GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)
(Deemed to be University)
VISAKHAPATNAM * HYDERABAD * BENGALURU

Accredited by NAAC with A^+ Grade

REGULATIONS AND SYLLABUS

OF

B.Sc. (Hons) Food Technology

(w.e.f. 2020-21 admitted batch)

B.Sc. (Hons.) FOOD TECHNOLOGY
REGULATIONS*

(W.e.f. 2020-21 admitted batch)

1.0 ADMISSIONS

Admissions into B.Sc. (Hons.) Food Technology program of GITAM (Deemed to be University) are governed by GITAM (Deemed to be University) admission regulations.

2.0 ELIGIBILITY CRITERIA

2.1 A pass in Intermediate or +2 with Physics, Chemistry, and Mathematics or Biology with a minimum aggregate of 50% marks or any other equivalent Examination approved by GITAM (Deemed to be University).

2.2 Admissions into B.Sc. (Hons.) FOOD TECHNOLOGY will be based on the marks obtained in intermediate or equivalent examination and the rule of reservation, wherever applicable.

3.0 CHOICE BASED CREDIT SYSTEM

Choice based credit system (CBCS) is introduced with effect from the admitted batch of 2020-21 based on UGC guidelines in order to promote:

- Student centered learning
- Cafeteria approach
- Inter-disciplinary learning.

Learning goals/objectives and outcomes are specified leading to what a student should be able to do at the end of the program.

4.0 STRUCTURE OF THE PROGRAMME

4.1 The program consists of:

(i) Ability enhancement compulsory core courses (AECC)
(ii) Core Courses (compulsory) (CC)
(iii) Discipline specific electives (DSE)
(iv) Generic electives (GE)
(v) Skill enhancement courses (SEC) are of general nature either related or unrelated to the discipline.
(vi) Practical Proficiency Courses (PPC): Laboratory work

4.2 Each course is assigned a certain number of credits depending upon the number of contact hours (lectures/tutorials/practical) per week.

4.3 In general, credits are assigned to the courses based on the following contact hours per week per semester.

- One credit for each lecture / tutorial hour.
- One credit for two hours of Practical per week.
- Eight credits for project

4.4 The curriculum of six semesters B.Sc. (Hons.) FOOD TECHNOLOGY program is designed to have a total of 142 credits for the award of B.Sc. (Hons.) FOOD TECHNOLOGY degree.

5.0 MEDIUM OF INSTRUCTION:

The medium of instruction (including examinations and project reports) shall be English.

6.0 REGISTRATION

Every student has to register himself/herself for each semester individually at the time specified by the Institute / University.

7.0 ATTENDANCE REQUIREMENTS

7.1 A student whose attendance is less than 75% in all the courses put together in any semester will not be permitted to attend the end - semester examination and he/she will not be allowed to register for subsequent semester of study. He /She have to repeat the semester along with his / her juniors.

7.2 However, the Vice Chancellor on the recommendation of the Principal/ Director of the University College / Institute may condone the shortage of attendance to the students whose attendance is between 66% and 74% on genuine medical grounds and on payment of prescribed fee.

8.0 EVALUATION

8.1 The assessment of the student's performance in a Theory course shall be based on two components: Continuous Evaluation (40 marks) and Semester-end examination (60 marks).

8.2 A student has to secure an aggregate of 40% in the course in the two components put together to be declared to have passed the course, subject to the condition that the candidate must have secured a minimum of 24 marks (i.e. 40%) in the theory component at the semester-end examination.

8.3 Practical/ Viva voce/ Seminar etc. course are completely assessed under Continuous Evaluation for a maximum of 100 marks, and a student has to obtain a minimum of 40% to secure Pass Grade. Details of Assessment Procedure are furnished below in Table 1.

Table 1: Assessment Procedure

S. No.	Component of assessment	Marks allotted	Type of Assessment	Scheme of Examination
1	Theory	40	Continuous evaluation	(i) Three mid semester examinations shall be conducted for 15 marks each. The performance in best two shall be taken into consideration. (ii) 5 marks are allocated for quiz. (iii) 5 marks are allocated for assignments.
		60	Semester-end examination	The semester-end examination shall be for a maximum of 60 marks.
	Total	100		
2	Practicals	100	Continuous evaluation	60 marks for performance, regularity, record/ and case study. Weightage for each component shall be announced at the beginning of the semester. 40 marks (30 marks for experiment(s) and 10 marks for practical Viva-voce.) for the test conducted at the end of the Semester conducted by the concerned lab Teacher.
	Total	100		
3	Project work	200	Project evaluation	150 marks for evaluation of the project work dissertation submitted by the candidate. 50 marks are allocated for the project Viva-Voce. The project work evaluation and the Viva-Voce shall be conducted by one external examiner outside the University and the internal examiner appointed by the Head of the Department.

9. RETOTALING & REVALUATION

9.1 Retotaling of the theory answer script of the semester-end examination is permitted on request by the student by paying the prescribed fee within one week after the announcement of the results.

9.2 Revaluation of the theory answer scripts of the semester-end examination is permitted on request by the student by paying the prescribed fee within one week after the announcement of the result.

10. PROVISION FOR ANSWER BOOK VERIFICATION & CHALLENGE EVALUATION:

10.1 If a student is not satisfied with his/her grade after revaluation, the student can apply for, answer book verification on payment of prescribed fee for each course within one week after announcement of revaluation results.

10.2 After verification, if a student is not satisfied with revaluation marks/grade awarded, he/she can apply for challenge valuation within one week after announcement of answer book verification result/ two weeks after the announcement of revaluation results, which will be valued by the two examiners i.e., one Internal and one External examiner in the presence of the student on payment of prescribed fee. The challenge valuation fee will be returned, if the student is succeeded in the appeal with a change for a better grade.

11. SUPPLEMENTARY EXAMINATIONS & SPECIAL EXAMINATIONS:

11.1 The odd semester supplementary examinations will be conducted on daily basis after conducting regular even semester examinations in April/May.

11.2 The even semester supplementary examinations will be conducted on daily basis after conducting regular odd semester examinations during November/December

11.3 A student who has completed his/her period of study and still has "F" grade in final semester courses is eligible to appear for Special Examination normally held during summer vacation.

12. PROMOTION TO THE NEXT YEAR OF STUDY

12.1 A student shall be promoted to the next academic year only if he/she completes the academic requirements of 60% of the credits till the previous academic year.

12.2 Whenever there is a change in syllabus or curriculum he/she has to continue the course with new regulations after detention as per the equivalency established by the BoS to continue his/her further studies.

13. BETTERMENT OF GRADES

13.1 A student who has secured only a pass or second class and desires to improve his/her class can appear for betterment examinations only in 'n' (where 'n' is no.of semesters of the program) theory courses of any semester of his/her

choice, conducted in summer vacation along with the Special Examinations.

13.2 Betterment of Grades is permitted 'only once', immediately after completion of the program of study.

14. REPEAT CONTINUOUS EVALUATION:

14.1 A student who has secured 'F' grade in a theory course shall have to reappear at the subsequent examination held in that course. A student who has secured 'F' grade can improve continuous evaluation marks upto a maximum of 50% by attending special instruction classes held during summer.

14.2 A student who has secured 'F' grade in a practical course shall have to attend Special Instruction classes held during summer.

14.3 A student who has secured 'F' grade in a combined (theory and practical) course shall have to reappear for theory component at the subsequent examination held in that course. A student who has secured 'F' grade can improve continuous evaluation marks upto a maximum of 50% by attending special instruction classes held during summer.

14.4 The RCE will be conducted during summer vacation for both odd and even semester students. Student can register a maximum of 4 courses. Biometric attendance of these RCE classes has to be maintained. The maximum marks in RCE be limited to 50% of Continuous Evaluation marks. The RCE marks are considered for the examination held after RCE except for final semester students.

14.5 RCE for the students who completed course work can be conducted during the academic semester. The student can register a maximum of 4 courses at a time in slot of 4 weeks. Additional 4 courses can be registered in the next slot.

14.6 A student is allowed to Special Instruction Classes (RCE) 'only once' per course.

15. 0 GRADING SYSTEM

15.1 Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester in each course. The letter grades and the corresponding grade points are as given in Table-2.

Table 2: Grades & Grade Points

Sl.No.	Grade	Grade Points	Absolute Marks
1	O (outstanding)	10	90 and above
2	A+ (Excellent)	9	80 to 89
3	A (Very Good)	8	70 to 79
4	B+ (Good)	7	60 to 69
5	B (Above Average)	6	50 to 59
6	C (Average)	5	45 to 49
7	P (Pass)	4	40 to 44
8	F (Fail)	0	Less than 40

9	Ab. (Absent)	0	-

15.2 "A student who earns a minimum of four grade points (P Grade) in a

Course is declared to have successfully completed the course, subject to securing an average GPA (average of all GPAs in all the semesters) of 5 at the end of the Program to declare pass in the program".

"Candidates who could not secure an average GPA of 5 at the end of the program shall be permitted to reappear for a course(s) of their choice to secure the same'.

16. GRADE POINT AVERAGE

16.1 A Grade Point Average (GPA) for the semester/trimester will be calculated according to the formula:

$$GPA = \frac{\Sigma [C \times G]}{\Sigma C}$$

Where

C = number of credits for the course,
G = grade points obtained by the student in the course.

16.2 To arrive at Cumulative Grade Point Average (CGPA), a similar formula is used considering the student's performance in all the courses taken, in all the semesters up to the particular point of time.

16.3 CGPA required for classification of class after the successful completion of the program is shown in Table 3.

Table 3: CGPA required for award of Class

Distinction	≥ 8.0*
First Class	≥ 7.0
Second Class	≥ 6.0
Pass	≥ 5.0

* In addition to the required CGPA of 8.0, the student must have necessarily passed all the courses of every semester in **first attempt**.

17 ELIGIBILITY FOR AWARD OF THE B.Sc. DEGREE

17. 1 Duration of the program: A student is ordinarily expected to complete B.Sc. program in six semesters of three years. However a student may complete the program in not more than five years including study period.

17.2 However the above regulation may be relaxed by the Vice Chancellor in individual cases for cogent and sufficient reasons.

17.3 A student shall be eligible for award of the B.Sc. Degree if he / she fulfills all the following conditions.

17.3.1 Registered and successfully completed all the courses and projects.

17.3.2 Successfully acquired the minimum required credits as specified in the curriculum corresponding to the branch of his/her study within the stipulated time.

17.3.3 Has no dues to the Institute, hostels, Libraries, NCC / NSS etc, and

17.3.4 No disciplinary action is pending against him / her.

17.4 The degree shall be awarded after approval by the Academic Council

18 Discretionary Power:

Notwithstanding anything contained in the above sections, the Vice Chancellor may review all exceptional cases, and give his decision, which will be final and binding.

BSc Food Technology (H)

Program Educational Objectives:

PEO 1. To mould the students for successful careers in the industry and institutions of food technology.

PEO 2. To make students competent in Food Science and allied areas.

PEO 3. To motivate the young food technologists through professional, ethical development and research

PEO 4. Enable the graduates for becoming entrepreneurs

PEO 5. To introduce the students to societal needs and global food security challenges.

Program Outcomes:

Students will be able to:

1. Gain knowledge of food science and nutrition fundamentals, know the properties and reactions of various food components, and select appropriate analytical methods when asked to quantitate.
2. Categorize the key pathogens and spoilage microorganisms in foods, and define the unit operations in food engineering applications to yield a healthier food product
3. Describe the basic principles and practices of food hygiene in food processing operations by following the food laws in food science and with the exploitation of food packaging materials.
4. Relate the principles of food technology in practical, real-world situations and problems.

Program Specific Outcomes:

1. Understand the composition of food, the role of each component and their interactions, their roles in food processing.
2. Will apply the knowledge of various spectrophotometric methods to quantify the desired compound in the given solutions.
3. Will be able to describe the importance of microbiology to food production and food safety.

4. Will be able to design food plant, identify the instruments required for processing by understanding principles followed by preservation techniques, and successful packaging method employment with good marketing skills.

Course Structure (Food Technology-Major)
Details of courses under B.Sc. (Honours)

COURSE	***CREDITS**
I. Core Course Theory (14 Papers)	14×4= 56
Core Course Practical (14 Papers)	14×2=28
II. Elective Course (8 Papers)	
A.1. Discipline Specific Elective **(3 Papers)**	4×3=12
A.2. Discipline Specific Elective Practical **(3 Papers)**	3×2=6
Project Work	6
B.1. Generic Elective/ Interdisciplinary **(4 Papers)**	4×4=16
B.2. Generic Elective Practical (**4 Papers)**	4×2=8
C. Skill Enhancement Elective Course **(2 Papers)**	2×2=4
III. Ability Enhancement Courses	
Ability Enhancement Compulsory (3 Papers of 2 credit each) English Communication Skills Environmental Science	3×2=6
Total credit	**142**

STRUCTURE OF B.Sc. (HONS.) FOOD TECHNOLOGY PROGRAM

SEMESTER-I

Course Code	Category	Title	Periods / week	Credits	Scheme of Evaluation		
					CE	SE	Total Marks
SFC 101	AECC	English for Communication – I	3	2	40	60	100
SFT 101	CC	Fundamentals of Food Technology	4	4	40	60	100
SFT 103	CC	Principles of Food Science	4	4	40	60	100
SFT 141 / 143	GE	Generic Elective-1	4	4	40	60	100
SFT 121	PPC	Fundamentals of Food Technology Practical	3	2	100	--	100
SFT 123	PPC	Principles of Food Science Practical	3	2	100	--	100
SFT 125 / 127	PPC	Generic Elective-1 Practical	3	2	100	--	100
Total			**24**	**20**			

SEMESTER-II

Course Code	Category	Title	Periods / week	Credits	Scheme of Evaluation		
					CE	SE	Total Marks
SFC 102	AECC	Environmental Science	3	2	40	60	100
SFT 102	CC	Technology of Food Preservation	4	4	40	60	100
SFT 104	CC	Food Processing Technology	4	4	40	60	100
SFT 142 / 144	GE	Generic Elective-2	4	4	40	60	100
SFT 122	PPC	Technology of Food Preservation Practical	3	2	100	--	100
SFT 124	PPC	Food Processing Technology Practical	3	2	100	--	100
SFT 126 / 128	PPC	Generic Elective-2 Practical	3	2	100	--	100
Total			**24**	**20**			

SEMESTER-III

Course Code	Category	Title	Periods / week	Credits	Scheme of Evaluation		
					CE	SE	Total Marks
SFC 203	AECC	English for Communication-II	3	2	40	60	100
SFT 201	CC	Food and Nutrition	4	4	40	60	100
SFT 203	CC	Technology of Fruits, Vegetables and Plantation Crops	4	4	40	60	100
SFT 205	CC	Technology of Animal Foods	4	4	40	60	100
SFT 241 / 243	GE	Generic Elective-3	4	4	40	60	100
SSE 283 / 293	SEC	Skill Enhancement Course-1	3	2	100	--	100
SFT 221	PPC	Food and Nutrition Practical	3	2	100	--	100
SFT 223	PPC	Technology of Fruits, Vegetables and Plantation Crops Practical	3	2	100	--	100
SFT 225	PPC	Technology of Dairy and Sea Food Practical	3	2	100	--	100
SFT 227 / 229	PPC	Generic Elective-3 Practical	3	2	100	--	100
Total			**34**	**28**			

SEMESTER-IV

Course Code	Category	Title	Periods/ week	Credits	Scheme of Evaluation		
					CE	SE	Total Marks
SFT 202	CC	Technology of Cereals, Pulses and Oilseeds	4	4	40	60	100
SFT 204	CC	Food Microbiology	4	4	40	60	100
SFT 206	CC	Technology of Meat, Poultry and Egg	4	4	40	60	100
SFT 242 / 244	GE	Generic Elective-4	4	4	40	60	100
SSE 288 / 290	SEC	Skill Enhancement Course-2	3	2	100	--	100
SFT 222	PPC	Technology of Cereals, Pulses and Oilseeds Practical	3	2	100	--	100
SFT 224	PPC	Food Microbiology Practical	3	2	100	--	100
SFT 226	PPC	Technology of Meat, Poultry and Egg Practical	3	2	100	--	100
SFT 228 / 230	PPC	Generic Elective-4 Practical	3	2	100	--	100
Total			**31**	**26**			

SEMESTER-V

Course Code	Category	Title	Periods / week	Credits	Scheme of Evaluation		
					CE	SE	Total Marks
SFT 301	CC	Food Engineering	4	4	40	60	100
SFT 303	CC	Biochemistry	4	4	40	60	100
SFT 341 / 343 / 345	DSE	Discipline Specific Elective-1	4	4	40	60	100
SFT 341 / 343 / 345	DSE	Discipline Specific Elective-2	4	4	40	60	100
SFT 321	PPC	Food Engineering Practical	3	2	100	--	100
SFT 323	PPC	Biochemistry Practical	3	2	100	--	100
SFT 325 / 327 / 329	PPC	Discipline Specific Elective-1 Practical	3	2	100	--	100
SFT 325 / 327 / 329	PPC	Discipline Specific Elective-2 Practical	3	2	100	--	100
Total			**28**	**24**			

SEMESTER-VI

Course Code	Category	Title	Periods / week	Credits	Scheme of Evaluation		
					CE	SE	Total Marks
SFT 302	CC	Food Chemistry	4	4	40	60	100
SFT 304	CC	Food Quality and Sensory Evaluation	4	4	40	60	100
SFT 342 / 344	DSE	Discipline Specific Elective-3	4	4	40	60	100
SFT 322	PPC	Food Chemistry Practical	3	2	100	--	100
SFT 324	PPC	Food Quality and Sensory Evaluation Practical	3	2	100	--	100
SFT 326 / 328	PPC	Discipline Specific Elective-3 Practical	3	2	100	--	100
SFT 330	PPC	Discipline Specific elective-4 (Project Work)	7	6	200	--	200
Total			**28**	**24**			

GENERIC ELECTIVES (GE)

GE-1 (One paper and corresponding lab to be selected)

SFT 141	Introductory Microbiology
SFT 143	Microbes in sustainable agriculture and development

SFT 125	Introductory Microbiology Practical
SFT 127	Microbes in sustainable agriculture and development Practical

GE-2 (One paper and corresponding lab to be selected)

SFT 142	Applied Physiology
SFT 144	Beverage technology
SFT 126	Applied Physiology Practical
SFT 128	Beverage technology Practical

GE-3 (One paper and corresponding lab to be selected)

SFT 241	Molecular Biology
SFT 243	Technology of Spices
SFT 227	Molecular Biology Practical
SFT 229	Technology of Spices Practical

GE-4 (One paper and corresponding lab to be selected)

SFT 242	Genetic Engineering and Biotechnology
SFT 244	Functional Foods and Nutraceuticals
SFT 228	Genetic Engineering and Biotechnology Practical
SFT 230	Functional Foods and Nutraceuticals Practical

DISCIPLINE SPECIFIC ELECTIVES (DSE)

DSE-1 & 2 (Two papers and corresponding labs to be selected)

SFT 341	Food Packaging
SFT 343	Fermentation Technology
SFT 345	Clinical Nutrition
SFT 325	Food Packaging Practical
SFT 327	Fermentation Technology Practical
SFT 329	Clinical Nutrition Practical

DSE-3 (One paper and corresponding lab to be selected)

SFT 342	Instrumentation for Food Analysis
SFT 344	Food Safety and Hygiene
SFT 326	Instrumentation for Food Analysis Practical
SFT 328	Food Safety and Hygiene Practical

DSC-4 SFT 330 Project Work (Compulsory)

SKILL ENHANCEMENT ELECTIVES (SEC)

SEC-1 (One paper to be selected)

SSE 283	Bioethics and Biosafety
SSE 293	Mathematics for Life Sciences

SEC-2 (One paper to be selected)

SSE 288	Entrepreneurship development
SSE 290	Probability and Statistics

Type of Course	No. of courses		Credits	
	Theory	Lab/Tutorial	Theory	Lab/Tutorial
Ability Enhancement Compulsory Courses	03	--	06	--
Core courses	14	14	56	28
Discipline Specific Electives	03	05	12	12
Generic Electives	04	04	16	08
Skill enhancement Courses	02	--	04	--
TOTAL	26	23	94	48

TOTAL CREDITS: 142 (Theory: 94 and Lab: 48)

B.Sc. (H) FOOD TECHNOLOGY I SEMESTER

SFC 101: ENGLISH FOR COMMUNICATION– I

Hours per week: 3 End Examination: 60 Marks

Credits: 2 Sessionals: 40 Marks

Preamble:

This course has been designed to enrich students' listening, speaking, reading and writing, abilities so they can pursue their personal, academic and career goals through the acquisition and improvement of English language skills. Students engage with the text while reinforcing what is learnt.

Course Objectives:

- To develop right pronunciation
- To enable students to use English in day-to-day communication
- To facilitate the use of language without grammatical errors
- To expose them to prose and poetry and enable them to learn language through simple literature.
- To build advanced vocabulary
- To improve reading skills

UNIT- I

The eyes are not here – Ruskin Bond

Pronunciation: Consonants, **Grammar:** Nouns, **Vocabulary:** Roots forms of words**, Spelling:** Correcting wrong spelling, **Punctuation:** Capitalisation,

Conversation and Role Play: Introducing oneself in formal or social contexts,

Learning Outcomes:

By the end of the course, the student will be able to

- Develop creative communication skills
- Understand and use consonant sounds in phonemic language
- Use correct spelling and capitalization.
- Introduce oneself in the appropriate diction, style and tone.

UNIT- II

Work Brings Solace – APJ Abdul Kalam

Pronunciation: Monophthongs **Grammar:** Pronouns,

Vocabulary: Prefixes & Suffixes, **Spelling:** using 'un' and 'dis' to complete antonyms**, Punctuation:** Capitalization,

Conversation and Role Play: starting a conversation/controlling a conversation**,**

Learning Outcomes:

By the end of the course, the student will be able to

- Perceive the content in the academic text and recognize the organization and purpose of reading a text.
- Determine the meaning of words using roots, *prefixes, and suffixes*.
- Engage in discussion on everyday topics
- Open and keep *conversations* going.
- Interrupt and end *conversations* appropriately

UNIT –III

Bangle Sellers – Sarojini Naidu

Pronunciation: Diphthongs **Grammar:** Helping verbs & auxiliary verbs, **Vocabulary:** Homophones, Homographs, Homonyms **Punctuation:** comma & full stop,

Conversation: Describing one's college and course of study, **Writing:** Paragraph writing/ Descriptive Writing,

Learning Outcomes:

By the end of the course, the student will be able to

- Comprehend and interpret poetic diction
- Define '*diphthong*'; recognize and identify *diphthongs* in speech and text
- Demonstrate the use of homophones, homographs, and homonyms in writing.
- Recognize and use comma and *full stop* in appropriate places in the text.
- Speak about his/her course of study and describe the college he/she is studying in with the right diction and tone.
- *Construct a paragraph* on familiar and academic topics using a topic sentence

UNIT -IV

The Merchant of Venice (Extract) – William Shakespeare

Pronunciation: varied pronunciation of some letters of the alphabet**Grammar:** Main verbs & Tenses,

Vocabulary: Collocations, **Punctuation:** Question mark and Exclamation mark,

Conversation: Leaving a message and taking an appointment

Learning Outcomes:

By the end of the course, the student will be able to

- appreciate the varied uses of language in Shakespearean Play
- Use present, past and future tenses with appropriate time markers.
- Be aware of the different types of collocations and use them appropriately
- Recognize and use question mark and *exclamation mark* in appropriate places in the text.
- Leave a message and take an appointment in a professional manner

UNIT- V

Vocabulary building: Synonyms, Antonyms, One Word Substitutes, Phrasal Verbs, Idiomatic Expressions, Foreign Phrases

Learning Outcomes:

By the end of the course, the student will be able to:

- Demonstrate understanding of synonyms and antonyms in active learning
- Strengthen their vocabulary base in one word substitution
- Use phrasal verbs in their day to day communication
- Familiarize with commonly used idiomatic expressions and use them correctly
- Recognize frequently used foreign words and phrases related to areas of immediate relevance.

Course Outcomes:

By the end of the course, the student will be able to:

- Understand and use consonant sounds in phonemic language
- Demonstrate understanding of synonyms and antonyms in active learning
- Gain proficiency in English

Recommended Readings:

Text Books:

Part – 1 (English for Enhanced Competence (by Sumit Roy, A.Karunakar, A.Aruna Priya)

Supplementary Reading:

1. Communicative skills for Technical Students, M. Faratullah. Orient Longman
2. Rizvi,MAshraf. ***Effective Technical Communication.*** McGraw - Hill.

B.Sc. (H) FOOD TECHNOLOGY I SEMESTER

SFT 101: FUNDAMENTALS OF FOOD TECHNOLOGY (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

Food Technology deals with the techniques involved in production, processing, preservation, packaging, labeling, quality management, and distribution of food products. The course also involves techniques and processes that are used to transform raw materials into food. Extensive research goes behind making food items edible as well as nutritious. Food technology greatly contributes to the manufacturing and supply of safe, wholesome and nutritious food products.

Course Objectives:

- To understand the history and evolution of food processing.
- To study the structure, composition, nutritional quality and post harvest changes of various plant foods.
- To study the structure and composition of various animal foods.

Unit I

Introduction-historical evolution of food processing technology. Cereals and millets-Structure and composition, properties and nutritional attributes of rice, wheat, maize, barley, millet and oats, malting, gelatinization of starch, types of browning- Maillard & caramelization, rice- parboiling of rice- advantages and disadvantages.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Understand various advantages and disadvantages of parboiled rice
- Describe the structure and composition of various cereals and millets
- Understand the concepts of malting, gelatinization and browning

Unit II

Pulses- Structure and composition of pulses, toxic constituents in pulses, processing of pulses- soaking, germination, decortications, cooking and fermentation. Fats and Oils-classification of lipids, types of fatty acids - saturated fatty acids, unsaturated fatty acids, essential fatty acids, trans fatty acids. Refining of oils, types- steam refining, alkali refining, bleaching, steam deodorization, and hydrogenation. Rancidity –Types- hydrolytic and oxidative rancidity and its prevention.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Describe the structure and composition of various pulses
- Extend the concepts of classification of lipids and oil Refining
- Summarize different types rancidity

Unit III

Fruits and Vegetables-Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments, Dietary fibre. Post-harvest changes in fruits and vegetables – Climacteric rise, horticultural maturity, physiological maturity, physiological changes, physical changes, chemical changes, pathological changes during the storage of fruits and vegetables.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Discuss the general composition and Classification of fruits and vegetables
- Identify the sources of pigments
- Summarize different types of post harvest changes during the storage of fruits and vegetables

Unit IV

Compositional, Nutritional and Technological aspects of Animal foods. Flesh Foods-Meat - Definition of carcass, concept of red meat and white meat, composition of meat, marbling, post-mortem changes in meat- rigor mortis, tenderization of meat, ageing of meat. Fish - Classification of fish (fresh water and marine), aquaculture , - microbiological, physiological, biochemical.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Gain Knowledge on the post-mortem changes in meat

- Compare and contrast red meat and white meat
- Describe the basic concepts of composition, characteristics and spoilage of fish

Unit V

Poultry - Structure of hen's egg, composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality, difference between broiler and layers. Milk and Milk Products- Definition of milk, chemical composition of milk, its constituents, processing of milk, pasteurization, homogenization.An overview of types of market milk and milk products.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Illustrate the concepts of egg structure, composition and nutritive value
- Gain knowledge on types of market milk and milk products
- Compare and contrast broiler and layers

Course Outcomes:

By the end of the course, the student will be able to:

- Understand various advantages and disadvantages of parboiled rice
- Describe the structure and composition of various pulses
- Illustrate the concepts of egg structure, composition and nutritive value
- Gain Knowledge on the post-mortem changes in meat

B.Sc. (H) FOOD TECHNOLOGY I SEMESTER

SFT 121: FUNDAMENTALS OF FOOD TECHNOLOGY (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Study different types of browning reactions: enzymatic and non-enzymatic.
2. To study gelatinization behavior of various starches
3. To study the concept of gluten formation of various flours.
4. To study malting and germination.
5. To study dextrinization in foods.
6. Identification of pigments in fruits and vegetables and influence of pH on them.
7. Quality inspection of animal foods.

Recommended Readings:

1. Bawa. A.S, O.P Chauhan etal.Food Science. New India Publishing agency, 2013
2. Roday,S. Food Science, Oxford publication, 2011.
3. B. Srilakshmi, Food science, New Age Publishers,2002
4. Meyer, Food Chemistry, New Age,2004
5. De Sukumar., Outlines of Dairy Technology, Oxford University Press, 2007

Course Outcomes:

By the end of the practicals, the student will be able to

- List the concepts of conventional and modern food processing methods
- Understand various concepts of Compositional, Nutritional and Technological aspects of animal foods
- Identify various Post-harvest changes during storage of plant foods
- Evaluate the toxic constituents in pulses

B.Sc. (H) FOOD TECHNOLOGY I SEMESTER

SFT 103: PRINCIPLES OF FOOD SCIENCE (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

Food science is an application of the basic sciences and engineering to study the fundamental physical, chemical and biochemical nature of foods and the and the concepts underlying food processing. Food science involves many specializations such as food microbiology, food engineering, and food chemistry in an attempt to better understand food processes and ultimately improve food products for the general public.

Course Objectives:

- To impart basic knowledge of Food Dispersions
- To learn the basic concepts and applications of Sensory science
- To understand the importance of food sanitation
- To understand the role of food Packaging in protecting food

Unit I

Characteristics, sols, gels, pectin gels, colloidal sols, stabilization of colloidal system, emulsions, properties of emulsions, formation of emulsion, emulsifying agent, food foams, formation stability and destruction of foam, application of colloidal chemistry to food preparation.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Describe the characteristics of sols, gels, pectin gels, colloidal sols
- Discuss the basic concepts of emulsions and food foams
- Extend the concepts of colloidal chemistry to food preparation.

Unit II

Objectives, type of food panels, characteristics of panel member, layout of sensory evaluation laboratory, sensitivity tests, threshold value, paired comparison test, duo- trio test, triangle test,

hedonic scale, chemical dimension of basic tastes, Amoore's classification of odorous compounds. Sherman and Sczezniak classification of food texture. Food as a substrate for microorganism, factors affecting growth of microbes: pH, water activity, O-R potential, nutrient contents, inhibitory substance and biological structure.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Use sensory evaluation in food product development
- Outline various types of food panels
- Identify the conditions under which microbes can be inactivated, killed or made harmless

Unit III

Principles and applications, Hurdle effect in fermented foods, shelf stable products, intermediate moisture foods, application of hurdle technology. Minimal processing of foods with thermal methods and non-thermal methods-safety criteria in minimally processed foods-Minimal processing in practice-fruits and vegetables-seafood-effect on quality-Future developments.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Identify the principles and applications of preservation processes
- Extend the concept of Minimal processing of foods
- Appreciate the effect of processing upon various properties of foodstuffs

Unit IV

Principles, equipment and processing, effect on food.Waste water, hardness of water, break point chlorination, physical and chemical of impurities, BOD, COD, waste water treatment, milk plant sanitation, CIP system, sanitizers used in food industry.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Identify & select processing equipment and methods appropriate for waste water treatment
- Explain the need of sanitation and CIP system in food industry
- Outline the different types of sanitizers used in food industry

Unit V

Objectives of packaging, flexible packaging, properties of the following packaging materials-low density polyethylene, high density polyethylene, polypropylene, polyvinyl chloride, polyvinylidene chloride, ethylene vinyl alcohol, polystyrene, polyethylene terepthalate, nylon, ethylene vinyl acetate, ethylene acrylic acid, ethylene methacrylic acid, ionomers.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Explain the objectives of food packaging
- Explain the properties of various food packaging materials
- Identify and examine the method of packaging and packaging materials in shelf life extension of foods

Course Outcomes:

By the end of the course, the student will be able to:

- Describe the characteristics of sols, gels, pectin gels, colloidal sols
- Identify the conditions under which microbes can be inactivated, killed or made harmless
- Identify and examine the method of packaging and packaging materials in shelf life extension of foods

B.Sc. (H) FOOD TECHNOLOGY I SEMESTER

SFT 123: PRINCIPLES OF FOOD SCIENCE (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Estimation of reducing sugar by Fehling's procedure
2. Estimation of salt content in brine
3. Estimation of salt content in butter
4. Preparation of brix solution and checking by hand refractometer
5. Application of colloidal chemistry to food preparation
6. Demonstration of the Soxhlet method for determination of fat content
7. Determination of acidity of water
8. Determination of alkalinity/ hardness of water
9. Demonstration of the Kjeldahl's method for estimation of protein content

Recommended Readings:

1. Coles R, McDowell D and Kirwan MJ, Food Packaging Technology, CRC Press,2003
2. De S, Outlines of Dairy Technology, Oxford Publishers,1980
3. Deman JM, Principles of Food Chemistry, 2nd ed. Van Nostrand Reinhold, NY1990
4. Frazier WC and Westhoff DC, Food Microbiology, TMH Publication, New Delhi,2004
5. Jenkins WA and Harrington JP, Packaging Foods with Plastics, Technomic Publishing Company Inc., USA,1991
6. Manay NS and Shadaksharaswamy M, Food-Facts and Principles, New AgeInternational(P) Ltd. Publishers, New Delhi, 1987
7. Meyer LH, Food Chemistry, CBS Publication, New Delhi,1987
8. Potter NH, Food Science, CBS Publication, New Delhi,1998
9. Ramaswamy H and MarcottM,Food Processing Principles and Applications CRC Press, 2006
10. Ranganna S, Handbook of Analysis and Quality Control for Fruits and Vegetable Products, 2nded.
11. TMH Education Pvt. Ltd,1986

Course Outcomes:

By the end of the practicals, the student will be able to

- Differentiate between thermal methods and non-thermal methods of food processing
- Understand various application of colloidal chemistry to food preparation
- Classify the physical and chemical of impurities in waste water
- Evaluate the safety criteria in minimally processed foods

B.Sc. (H) FOOD TECHNOLOGY II SEMESTER

SFC 102: ENVIRONMENTAL SCIENCE (AECC)

Hours per week: 3 End Examination: 60 Marks

Credits: 2 Sessionals: 40 marks

Preamble:

Environmental science is an interdisciplinary subject that studies the interactions of the physical, chemical, biological, geographical and social components of the environment and also the relationships and effects of these components with the organisms in the environment.

Course Objectives:

- To learn the multidisciplinary nature of environmental studies
- To identify causes, effects and control measures of various environmental problems
- To understand the concept of Environmental Legislation
- To extend the role of information technology in environment and human health.

Unit I

The multidisciplinary nature of environmental studies – Definition - Scope and Importance, Need for Public awareness. Natural Resources: Classification – Renewable and Non Renewable Resources. Renewable Resources: Forest, Water and Energy Resources Non Renewable Resources: Mineral, Food and Land resources (Uses, reasons for over-utilization and effects)

Learning Outcomes:

By the end of this Unit, the student will be able to

- Understand the scope and Importance of environmental studies
- Examine the reasons for over-utilization and effects
- Explain the need for public awareness on environmental studies

Unit -II

Eco-system:, Producers, consumers and de-composers, Structure of Terrestrial Ecosystems (Forest Ecosystem, Grassland Ecosystem, and Desert Ecosystem) and Aquatic Ecosystems (Pond Ecosystem

and Ocean Ecosystem). Function of an ecosystem -food chains, food web and ecological pyramids - energy flow in the ecosystem.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Explain the structure of an Ecosystem
- Describe the Functions of an ecosystem
- Gain knowledge on ecological pyramids and energy flow in the ecosystem.

Unit -III

Environmental Pollution: Causes, effects and control measures of Air, Water, soil pollution, Thermal pollution and nuclear hazards and Municipal solid waste management.

Environmental problems: Global Environmental Problems, Green house effect, Ozone layer depletion, acid rains and Climate change. National Environmental Problems: Deforestation – Causes and Effects, Environmental Problems associated with dams, mining and environmental effects.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Outline the different types of pollution
- Aware of the basic concepts of Global Environmental Problems
- Illustrate the concepts of Municipal solid waste management

Unit -IV

Social Issues and the Environment: Environmental ethics, Issues and possible solutions. Waste land reclamation, Consumerism and waste products. Environmental Legislation: Environment Protection Act, Air Act, Water Act, Wildlife Protection act and The Biological Diversity Act. Disaster definition, Classification, Disaster Management: Explosion, Earth quake, Hazardous materials spill/release.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Describe the basic concepts of Environment Protection act
- Understand the importance of Disaster Management
- Describe the basic concepts of waste land reclamation

Unit -V

Human Population and the Environment: Population growth, variation among nations, Population explosion-Family welfare program. Environment and human health - human rights - value education, HIV/AIDS, Women and Child welfare, Role of information technology in environment and human health.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Understand the relation between Environment and human health
- Discuss the role of Population growth on Environment:
- Extend the concepts of information technology in solving environmental problems

Recommended Readings:

1. Text Book of Environmental studies for Undergraduate courses by ErachBharucha Published by Orient Black Swan. 2nd edition.
2. Environmental Science: A Global Concern by William P. Cunningham and Baraba Woodworth Saigo. Published by McGraw-Hill Science/Engineering/Math; 8th edition,.
3. A text book of Environmental Science by P. C. Joshi and Namita Joshi, Published by A.P.H. Publishing Corporation.
4. A text book of Environmental Science by Arvind Kumar, Published by A.P.H. Publishing Corporation
5. Environmental Science by S C Santra, Published by New Central Book Agency (NCBA); (5th Reprint).
6. Ecology & Environment by P. D. Sharma, Published by Rastogi Publications.

Course Outcomes:

By the end of the course, the student will be able to

- Able to develop and implement value education and awareness programs
- Able to suggest solutions for National Environmental Problems
- Identify the differences between renewable and non renewable resources

B.Sc. (H) FOOD TECHNOLOGYII SEMESTER

SFT102: TECHNOLOGY OF FOOD PRESERVATION (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

Food Preservation is defined as a method of maintaining foods at a desired level of properties for their maximum benefit for as long as possible. The subject lies in the core of food science and technology and it is the main purpose of food processing. Food preservation uses many techniques that range from too simple to highly sophisticated

Course Objectives:

- To study the importance and need of food preservation
- To introduce the basics of various food processing and preservation technologies.
- To introduce the concepts of novel food preservation methods
- To familiarize the pros and cons of various food preservation techniques

Unit 1

Principles of Food Preservation, microorganisms associated with foods- bacteria, yeast and mold, Importance of bacteria, yeast and molds in foods. Classification of microorganisms based on temperature, pH, water activity, nutrient and oxygen requirements, typical growth curve of microorganisms. Classification of food based on pH, definition of shelf life, perishable foods, semi perishable foods, and shelf stable foods.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Identify the important pathogens and spoilage microorganisms in foods
- Identify the conditions under which the important pathogens are commonly inactivated, killed or made harmless in foods.
- Know the principles involving in food preservation via various processes.

Unit II

Thermal Processing- Classification of thermal treatments, Mode of action, Commercial heat preservation, methods: Sterilization, commercial sterilization, Pasteurization and blanching- objectives, types. Pros and cons of high temperature preservation.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Classify various thermal treatments based on temperature
- Discuss the Pros and cons of high temperature preservation
- Suggest the best thermal treatment for processing different foods

Unit III

Freezing and Refrigeration: Introduction to cool storage, refrigeration, and freezing, principle of freezing, freezing curve, changes occurring during freezing, types of freezing- slow freezing, quick freezing, introduction to thawing, changes during thawing and its effect on food.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Differentiate Freezing from Refrigeration
- Draw and analyze freeze curve
- Discuss the changes during thawing

Unit IV

Drying and Dehydration - Definition, drying as a means of preservation, heat and mass transfer, factors affecting rate of drying, normal drying curve, types of driers used in the food industry. Evaporation – Definition, factors affecting evaporation, names of evaporators used in food industry.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Compare and contrast Drying and Dehydration
- Apply the concept of heat and mass transfer in dehydration
- Discuss various factors affecting evaporation

Unit V

Irradiation - Introduction, units of radiation, kinds of ionizing radiations used in food irradiation, mechanism of action, application and benefits of irradiation processing in food industry. Quality and safety of irradiated foods

Learning Outcomes:

By the end of this Unit, the student will be able to

- Analyze the Quality and safety of irradiated foods
- Categorize different kinds of ionizing radiations used in food irradiation
- Describe the mode of action of various radiations in food industry

Course Outcomes:

By the end of the course, the student will be able to:

- Identify the important pathogens and spoilage microorganisms in foods
- Discuss the Pros and cons of high temperature preservation
- Apply the concept of heat and mass transfer in dehydration

B.Sc. (H) FOOD TECHNOLOGYII SEMESTER

SFT122: TECHNOLOGY OF FOOD PRESERVATION (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Methods of Sampling.
2. Concept of shelf life of different foods
3. To study the concept of Asepsis and sterilization
4. Determination of pH of different foods using pH meter.
5. Study quality characteristics of foods preserved by drying/dehydration/freezing.
6. To perform pasteurization of fluids using different methods.
7. To perform blanching of different plant foods.

Recommended Readings:

1. Text Book on Food Storage and Preservation (2004) by Vijayakhader.
2. Food Science (2002) by B. Srilakshmi.
3. Food Processing and Preservation (2010) by B.SivaShakar.
4. Food Processing and Preservation (2007) by G. Subbalakshmi
5. Food preservation and processing (2007) by ManoranjanKalia

Course Outcomes:

By the end of the course, the student will be able to

- Compare conventional methods of food preservation with novel methods of food preservation(food irradiation, biosensors, microwave)
- Apply principles of food preservation to pilot scale production of processed food and evaluate variation in processing parameters on product properties
- Evaluate the effect of processing upon the nutritional properties of foodstuffs.

B.Sc. (H) FOOD TECHNOLOGY II SEMESTER

SFT 104: FOOD PROCESSING TECHNOLOGY (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

Food Processing Technology includes a set of physical, chemical or microbiological methods to transform raw ingredients into food and into marketable food products that can be easily prepared and served by the consumer. Food processing typically involves activities such as mincing and macerating, liquefaction, emulsification, and cooking, pickling, pasteurization, and many other kinds of preservation; and canning or other packaging.

Course Objectives:

- To impart basic knowledge of Cold Preservation and freezers
- To understand the concept of Dehydration and Irradiation
- To impart basic knowledge of Food Packaging
- List the pros and cons of Thermal Processing

Unit I

Food processing operations - Refrigeration and Freezing -Requirements of refrigerated storage - controlled low temperature, air circulation and humidity, changes in food during refrigerated storage, progressive freezing, changes during freezing, Freezing methods -direct and indirect, still air sharp freezer, blast freezer, fluidized freezer, plate freezer, spiral freezer and cryogenic freezing.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Differentiate between various low temperature processing methods
- List out the requirements of refrigeration
- Understand the working principle of various freezers

Unit II

Thermal Processing of Foods - Classification of thermal processes, Principles of thermal processing, commercial canning operations, Aseptic Processing, UHT. Irradiation and microwave heating- Principles, Dosage, Applications of Irradiation, Mechanism of microwave heating and applications.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Classify the thermal processes used in food industry
- Use microwave heating for processing foods
- Compare and contrast Irradiation and microwave heating

Unit III

Material handling-Elementary concept of material handling in food industry, equipment and functioning of belt conveyor, screw conveyor, bucket elevator and pneumatic conveyor.

Separation processes - Principles and methods of: distillation, extraction, washing, filtration, sedimentation, sieving and centrifugation

Learning Outcomes:

By the end of this Unit, the student will be able to

- Illustrate the concepts of material handling
- Discuss the role of different equipment in food industry
- Understand the working principle of various processing equipment

Unit IV

Technology of colloids in food - Characteristics, sols, gels, pectin gels, colloidal sols, stabilization of colloidal system, syneresis, emulsions, properties of emulsions, formation of emulsion, emulsifying agents, food foams, formation stability and destruction of foam, application of colloidal chemistry to food preparation.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Describe the Characteristics of sols, gels, pectin gels, colloidal sols

- Discuss the basic concepts of emulsions and food foams
- Extend the concepts of colloidal chemistry to food preparation.

Unit V

Food Additives - Introduction, need of food additives in food processing, Characteristics and classification of food additives, Chemical, technological and toxicological aspects. Contamination in Food- Physical, chemical (heavy metals, pesticide residues, antibiotics, veterinary drug residues, dioxins, environmental pollutants, radionuclides, solvent residues, chemicals) Natural toxins.Food Laws and Regulations- Codex, HACCP, ISO, FSSAI (2018), BIS.

Learning Outcomes:

By the end of this Unit, the student will be able to

- List out various contaminants and natural toxins in food
- Judge the role of need of food additives in food processing and preservation
- Discuss the basic concepts of Food Laws and Regulations.

Course Outcomes:

By the end of the course, the student will be able to:

- Differentiate between various low temperature processing methods
- List out various contaminants and natural toxins in food
- Discuss the role of different equipment in food industry

B.Sc. (H) FOOD TECHNOLOGY II SEMESTER

SFT 124: FOOD PROCESSING TECHNOLOGY (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Canning of foods
2. Preservation of food by the process of freezing
3. Drying of food using Tray dryer/other dryers.
4. Estimation of Chemical Oxygen Demand (Demonstration)
5. Preparation of brix solution and checking by hand refractometer 6 Analysis of water
6. Minimal Processing of food
7. Application of colloidal chemistry in food preparation

Recommended Readings:

1. Potter NH,1998, Food Science, CBS Publication, New Delhi
2. Ramaswamy H and Marcotte M,2009, Food Processing Principles and Applications CRC Press
3. Deman JM,2007, Principles of Food Chemistry, 3rd Ed.Springer
4. Manay NS and Shadaksharaswamy M,1987, Food-Facts and Principles, New Age International (P) Ltd. Publishers, New Delhi

Course Outcomes:

By the end of the practicals, the student will be able to

- Identify the differences between high and low temperature processing methods
- Differentiate contaminants from toxins
- Compare and analyze conventional and modern methods of food processing

B.Sc. (H) FOOD TECHNOLOGY III SEMESTER

SFC 203: ENGLISH FOR COMMUNICATION–II

Hours per week: 3 End Examination: 60 Marks

Credits: 2 Sessionals: 40 Marks

Preamble:

This course has been designed to help students acquire English language skills for professional development. The students will be exposed to aspects of English language through some very interesting texts. Each unit of the book carries a very extensive and relevant explanation on pronunciation, grammar, vocabulary, spelling, punctuation, spoken dialogues, writing and reading.

Course Objectives:

- To introduce students to Prosodic features for right speech
- To enable students to use English in day-to-day communication
- To build up their confidence in the usage of English
- To expose them to Group Discussion sessions
- To develop their written communicative competence
- To make them interview ready

UNIT- I

The Open Window : Saki (H.H.Munro)

Pronunciation: Syllabification**, Grammar:** Non-infinite verbs, **Vocabulary:** Simile & Metaphor**,**

Spelling: using 'ie' or 'ei', **Punctuation:** semi-colon, **Conversation:** Asking for advice/information,

Learning Outcomes:

By the end of the course, the student will be able to

- Improve their speaking ability in English both in terms of fluency and comprehensibility.
- Heighten their awareness of correct usage of English grammar in writing and speaking.
- Attain and enhance competence in the four modes of literacy: LSRW.
- Utilize phonetic dictionary symbols to continue to improve pronunciation.
- Punctuate quoted statements, sentences and questions correctly.

UNIT- II

The Voice of Humanity – Rabindranath Tagore

Pronunciation: Word Stress, **Grammar:** Adjectives, **Vocabulary:** Oxymoron & Hyperbole**,**

Spelling: using 'able' and 'ible', **Punctuation:** Colon & dash, **Group Discussion**

Learning Outcomes:

By the end of the course, the student will be able to

- To use newly acquired vocabulary in classroom activities.
- Develop independent learning strategies and study skills.
- Have the ability to communicate effectively with others.
- Understand the rules of word stress
- Acquire the skills needed for a G.D and participate efficiently

UNIT –III

If – Rudyard Kipling

Pronunciation: Sentence Stress**, Grammar:** Articles, **Vocabulary:** Portmanteau and loan words**,**

Spelling: using suffixes, **Punctuation:**Hyphen & dash, **Oral Presentation**

Learning Outcomes:

By the end of the course, the student will be able to

- Demonstrate command of the conventions of Standard English punctuation, and spelling when writing.
- Enable to discuss literary texts from various theoretical and critical perspectives.
- Formulate ideas and connections between literary concepts and themes.
- Establish a deeper appreciation of cultural diversity by introducing them to poetry.
- Acquire effective presentation skills

UNIT -IV

Riders to the Sea – JM Synge

Pronunciation – Intonation**, Grammar:** Adverbs, **Vocabulary:** Palindromes**, Spelling:** completing tables with nouns, verbs, adjectives, adverbs **Punctuation:** Inverted comma, **Conversation/Role play:** Appearing for a job interview/conducting a job interview

Learning Outcomes:

By the end of the course, the student will be able to

- Collaborate with peers for role-playing, story analysis, and presentation planning.
- Use comparative forms of high frequency adjectives and adverbs.
- Apply sentence mechanics and master spelling of high frequency words.
- Demonstrate increased understanding of English syntax and grammatical elements for effective writing.
- Understand and use intonation in spoken language.
- Develop the skills needed for attending an interview

UNIT- V

Academic Writing: Letter Writing, Paragraph Writing, Essay Writing, Resume Preparation, Dialogue Writing, Precis

Learning Outcomes:

By the end of the course, the student will be able to

- Develop outlines, clusters, lists, or other graphic organizers to organize ideas for writing
- Format various types of writing such summaries, personal letters, formal letters and narrative, descriptive, and expository paragraphs on a variety of topics
- Develop own creativity and enhance their writing skills
- Paraphrase text appropriately.
- Write effective introductions and conclusions for paragraphs.
- Prepare a persuasive resume

Course Outcomes:

By the end of the course, the student will be able to:

- To use newly acquired vocabulary in classroom activities.
- Prepare a persuasive resume
- Develop the skills needed for attending an interview

Recommended Readings:

Text Books:

Part – 2 (English for Enhanced Competence (by Sumit Roy, A.Karunakar, A.Aruna Priya)

Supplementary Reading:

1. Communicative skills for Technical Students, M. Faratullah. Orient Longman

2. Rizvi,MAshraf. ***Effective Technical Communication.*** McGraw - Hill.

B.Sc. (H) FOOD TECHNOLOGY III SEMESTER

SFT 201: FOOD AND NUTRITION (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

Food and nutrition are the way that we get fuel, providing energy for our bodies. We need to replace nutrients in our bodies with a new supply every day. A healthy diet includes a lot of natural foods. A sizeable portion of a healthy diet should consist of fruits and vegetables. Whole grains, such as whole wheat and brown rice, should also play a part in your diet. For adults, dairy products should be non-fat or low-fat. Protein can consist of lean meat and poultry, seafood, eggs, beans, legumes, and soy products such as tofu, as well as unsalted seeds and nuts.

Course Objectives:

- Understand the relationship between food, nutrition and health.
- Understand the functions of food.
- Learn about various food groups and balanced diet.
- Understand digestion, absorption and function of various nutrients and their sources.

Unit I

Functions of food-physiological, psychological and social, Concept of Balanced Diet, Food Groups-major nutrients, Food Pyramid, guidelines for good health. Food exchange list, basal metabolism, factors affecting BMR

Learning Outcomes:

By the end of this unit, the student will be able to

- Understand the relationship between nutrition and human well-being.
- Know and understand the functions, importance of all nutrients for different age groups and special groups

Unit II

Basic terms in study of food and nutrition- BMI, Nutritional Status, malnutrition, recommended daily allowances (RDA). Factors affecting RDA, uses of RDA. Relationship between food, nutrition and health.

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn about functions of foods, definition of nutrition, nutrients, adequate optimum and good nutrition, malnutrition. Food as a source of nutrients.
- Illustrate inter relationship between nutrition and health, visible symptoms of good health.

Unit III

Meal planning-Factors affecting meal planning for different groups of people. Methods of cooking- Dry, moist, frying and microwave cooking, Advantages, disadvantages and effect on foods. Nutritional labeling- Importance, global trends, codex guidelines, nutritional labelling in India, FSSAI guidelines.

Learning Outcomes:

By the end of this unit, the student will be able to

- Understand the planning of meal
- Know and understand the different methods of cooking.
- Learn about nutritional labelling and guidelines.

Unit IV

Classification, digestion, functions, dietary sources, Recommended Dietary Allowances, clinical manifestations of deficiency and excess and factors affecting absorption- Energy, lipids carbohydrates and proteins

Learning Outcomes:

By the end of this unit, the student will be able to

- Understand the details about dietary sources
- Learn clinical manifestations of macromolecules

Unit V

Classification, digestion, functions, dietary sources, RDA, clinical manifestations of deficiency and excess and factors affecting absorption: Fat soluble vitamins-A, D, E and K. Water soluble vitamins – thiamin, riboflavin, niacin, pyridoxine, folate, vitamin B12 and vitamin C. Minerals – calcium, iron, iodine, fluorine, copper and zinc

Learning Outcomes:

By the end of this unit, the student will be able to

- Understand the details about dietary sources
- Learn clinical manifestations of micromolecules

Course Outcomes:

By the end of the course, the student will be able to:

- Understand the relationship between nutrition and human well-being.
- Know and understand the different methods of cooking.
- Learn about functions of foods, definition of nutrition, nutrients, adequate optimum and good nutrition, and malnutrition.

B.Sc. (H) FOOD TECHNOLOGY III SEMESTER

SFT 221: FOOD AND NUTRITION (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 marks

1. Identification of food sources for various nutrients using food composition tables.
2. Record diet of self-using 24 hour dietary recall and its nutritional analysis.
3. Introduction to meal planning, concept of food exchange system.
4. Estimation of BMI and other nutritional status parameters.
5. Planning meals for adults of different activity levels for various income groups.
6. Survey of locally available foods and identifying the key nutrients
7. Estimation of BMI and other nutritional status parameters.
8. Formulation of weaning foods
9. Planning and preparation of diets for aged people

Recommended Readings:

1. Dietetics (2007) by B. Srilakshmi.
2. ICMR (2010). Nutrient Requirements and Recommended Dietary Allowances for Indians
3. Text Book of Human Nutrition (2010) by Bamji
4. Essentials of Human Nutrition (2007) by A.S.Truswell.
5. Nutrition & Dietetics 3rd editionSubhangini Joshi
6. Oxford Handbook of Nutrition and Dietetics (2012) Joan Webster
7. Srilakshmi (2007). Food Science, 4th Edition. New Age InternationalLtd
8. IFCT (2017) Indian Food Composition Tables

Course Outcomes:

By the end of the practicals, the student will be able to

- Understand various functions of foods
- Identify the nutritional requirements of various age groups
- Understand the problems associated with different age groups
- Understand the importance of breast feeding

B.Sc. (H) FOOD TECHNOLOGY III SEMESTER

SFT 203: TECHNOLOGY OF FRUITS, VEGETABLES AND PLANTATION CROPS (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

India has been bestowed with wide range of climate and physic-geographical conditions and as such is most suitable for growing various kinds of horticultural crops such as fruits, vegetables, flowers, nuts, spices and plantation crops. Fruits and vegetables are an important supplement to the human diet as they provide the essential minerals, vitamins and fiber required for maintaining health. India is now the second largest producer of fruits and vegetables in the world and is the leader in several horticultural crops.

Course Objectives

- To impart knowledge of different methods of fruits and vegetable processing.
- To learn about processing of various spices, tea, coffee and cocoa.

Unit I

Introduction: Importance of fruits and vegetable, history and need of preservation, reasons of spoilage, method of preservation (short &long term).Canning and bottling of fruits and vegetables: Selection of fruits and vegetables, process of canning, factors affecting the process- time and temperature, containers of packing, lacquering, syrups and brines for canning, spoilage in canned foods.

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn different methods for the preservation fruits and vegetables.
- Understand the detailed account on canning process and bottling.

Unit II

Fruits beverages: Introduction, Processing of fruit juices, preservation of fruit juices, processing of

squashes, cordials, nectars, concentrates and powder.Jams, jellies and marmalades: Jam: Constituents, selection of fruits, processing & technology, Jelly: Essential constituents (Role of pectin, ratio), Theory of jelly formation, Processing & technology, defects in jelly, Marmalade: Types, processing & technology, defects.

Learning Outcomes:

By the end of this unit, the student will be able to

- Understand the processing of fruits and vegetables in making different products like juices, jam and jellies and marmalade.
- Learn about the product technologies and the defects in the production of the products.

Unit III

Pickles, chutneys and sauces: processing, types, causes of spoilage pickling.Tomatoproducts: Selection of tomatoes, pulping& processing of tomato juice, tomato puree, paste, ketchup, sauce and soup.

Learning Outcomes:

By the end of this unit, the student will be able to

- Understand the processing of fruits and vegetables in making different products like pickle, chutney and sauces.
- Know tomato product technologies and the defects in the production puree, paste and ketchup.

Unit IV

Dehydration of foods and vegetables: Sun drying & mechanical dehydration, process variation for fruits and vegetables, packing and storage.

Learning Outcomes:

By the end of this unit, the student will be able to

- Understand the different methods of dehydration of fruits and vegetables.

Unit V

Spices: Processing and properties of major and minor spices, essential oils & oleoresins, adulteration.

Tea, coffee and cocoa: Processing and properties of tea leaves, coffee cherries, cocoa beans variety and products.

Learning Outcomes:

By the end of this unit, the student will be able to

- Understand the different methods of processing of spices and oil production.
- Learn about the different methods of processing of tea and tea leaves.
- Understand the different methods of processing of coffee and coffee beans.

Course Outcomes:

By the end of the course, the student will be able to

- Learn different methods for the preservation fruits and vegetables.
- Understand the processing of fruits and vegetables in making different products like juices, jam and jellies and marmalade.
- Understand the different methods of processing of spices and oil production.

B.Sc. (H) FOOD TECHNOLOGY III SEMESTER

SFT 223: TECHNOLOGY OF FRUITS, VEGETABLES AND PLANTATION CROPS (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Estimation of total soluble solids (TSS).
2. Estimation of pH and acidity of products.
3. Estimation of brix: acidity ratio
4. Estimation of ascorbic acid and effect of heat treatment on it.
5. To study the steps of can making process.
6. Preparation and evaluation of pectin products.
7. Adulteration of spices.
8. Dehydration of fruits and vegetables.
9. Rehydration of fruits and vegetables.

Recommended Readings:

1. Girdharilal, Siddappaa, G.S and Tandon, G.L.1998. Preservation of fruits & vegetables, ICAR, NewDelhi
2. W B Crusess.2004. Commercial Unit and Vegetable Products, W.V. Special Indian Edition, Pub: AgrobiosIndia
3. Manay, S. &Shadaksharaswami, M.2004. Foods: Facts and Principles, New AgePublishers
4. Ranganna S.1986. Handbook of analysis and quality control for fruits and vegetable products, Tata Mc Graw-Hill publishing company limited, Secondedition.
5. Srivastava, R.P. and Kumar, S. 2006 .Fruits and Vegetables Preservation- Principles and Practices.3rd Ed. International Book DistributingCo.

Course Outcomes

- To impart knowledge of different methods of fruits and vegetable processing.
- To understand the detailed account on canning process and bottling
- To detailed learning on the processing of fruits and vegetables in making different products

like juices, jam and jellies and marmalade

- To understand the processing of fruits and vegetables in making different products like pickle, chutney, sauces and the tomato product technologies.
- Understand the different methods of processing of spices, oil production, tea and coffee beans.

B.Sc. (H) FOOD TECHNOLOGY III SEMESTER

SFT 205: TECHNOLOGY OF DAIRY AND SEA FOOD (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

Dairy Technology deals with processing of milk and milk product. Dairy technology study involves processing, storage, packaging, distribution and transportation of dairy products by entailing the science of bacteriology, nutrition and biochemistry. Seafood Processing: Technology, Quality and Safety covers the whole range of current processes which are applied to seafood, as well as quality and safety aspects.

Course Objectives:

- To know the need and importance of dairy and fishery industry
- To know the compositional and technological aspects of milk and fish.
- To study processed milk and fish products

Unit I

Introduction: Status of fishery industry in India. Chilling and Freezing of fish: Relationship between chilling and storage life, MAP, general aspects of freezing, freezing systems (air blast freezing, plate or contact freezing spray or immersion freezing, freezing on board, onshore processing, changes in quality in chilled and frozen storage, thawing.

Learning Outcomes:

By the end of this unit, the student will be able to

- Understand about the status of fishery in India.
- Learn different storage options for the fishes.

Unit II

Fish Curing and Smoking: Drying and salting of fish, water activity and shelf-life, salting process, salting methods (brining, pickling, kench curing, gaspe curing), Preservation by smoking, smoke production, smoke components, quality, safety and nutritive value of smoked fish, processing and

equipment, examples of smoked and dried products.

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn about the processing of fish by curing agents, drying and salting.
- Understand other processing options of preserving fish by smoking.

Unit III

Canning of fish: Principles, classification, storage of canned fish, pre-process operations, post process operations, cannery operations for specific canned products. (Tuna, Mackerel, Sardine). Fishery by-products: Surimi- Introduction, processing, comparison of surimi and fish mince products. Fish protein concentrates (FPC), fish protein extracts (FPE), fish protein hydrolysis (FPH), Fermented fish: Flowchart of Indigenous products- Fish sauce and Paste.

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn about processing of fish by canning of different variety fishes.
- Understand about fish by-products processing and potential benefits.

Unit IV

Milk: Physical properties of milk, Composition of milk – Lactose, milk fat, protein and enzymes, Market milk industry and milk products: Systems of collection of milk Reception, Platform testing, Various stages of processing- Filtration, Clarification, Homogenization, Pasteurization. Receiving and storage of milk.

Learning Outcomes:

By the end of this unit, the student will be able to

- Understand about milk, its properties both physical and functional and composition.
- Learn about processing of milk and milk products.

Unit V

Milk products–Butter, ghee, flavored milk, yoghurt, dahi, shrikhand, ice-cream, condensed milk, milk powder, channa, paneer, cheese (cheddar). Dairy plant sanitization: Objectives, cleaning, washing-

bottle and can, tankers, silos-detergents and sanitizers.

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn about different milk products and its production.
- Understand about dairy sanitization and storage.

Course Outcomes:

By the end of the course, the student will be able to:

- Learn different storage options for the fishes.
- Understand about milk, its properties both physical and functional and composition.
- Learn about the processing methods of fish by curing agents, drying and salting.

B.Sc. (H) FOOD TECHNOLOGY III SEMESTER

SFT 225: TECHNOLOGY OF DAIRY AND SEA FOOD (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. To perform platform tests in milk (Acidity, COB, MBRT, specific gravity, SNF)
2. To estimate milk protein by Folin method.
3. To estimate milk fat by Gerber method.
4. Preparation of flavored milk/. Pasteurization of milk
5. To prepare casein and calculate its yield.
6. Quality evaluation offish/prawn.
7. Identification of different varieties of fish.
8. Subjective evaluation of Fresh Fish.
9. Cut out examination of canned fish (Sardine, Mackerel, Tuna)
10. Fish product formulation/canning.

Recommended Readings:

1. De Sukumar, Outlines of Dairy Technology, Oxford University Press,Oxford. 2007.
2. Hall GM, Fish Processing Technology, VCH Publishers Inc., NY,1992
3. Sen DP, Advances in Fish Processing Technology, Allied Publishers Pvt.Limited 2005
4. Shahidi F and Botta JR, Seafoods: Chemistry, Processing, Technology and Quality, Blackie Academic &Professional,London,1994
5. Webb and Johnson, Fundamentals of Dairy Chemistry, 3rd ed., CBS Publishers, New Delhi1988

Course Outcomes:

By the end of the practicals, the student will be able to

- Understand status and maintenance of fishery in India.
- Learn processing of fish by curing agents, drying, smoking and salting.
- Know about canning of fish and fish products.
- Learn production of different fish products.

- Understand milk properties and standard processing methods.
- Know different milk products and its importance

B.Sc. (H) FOOD TECHNOLOGY IV SEMESTER

SFT 202: TECHNOLOGY OF CEREALS, PULSES AND OILSEEDS (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

In order to prevent huge quantitative as well as qualitative losses of cereals, pulses, spices, and plantation crops, all steps of improved postharvest technology (PHT) must be carefully designed and implemented, beginning with harvesting and ending with consumption and utilization of their products and by-products. To derive optimal benefit from production techniques, the engineering principles and practice of harvesting and threshing and their effects on grain yield have been outlined in this paper.

Course Objectives

- To teach technology of milling of various cereals
- To impart technical knowhow of pulses and oilseeds refining

Unit I

Milling technology: Wheat-Types, milling, flour grade, flour treatments (bleaching, maturing), flour for various purposes, Products and By-products. Rice – Physicochemical properties, milling (mechanical & solvent extraction), parboiling, ageing of rice, utilization of byproducts. Corn–Milling (wet & dry), cornflakes, corn flour. Barley- Milling (pearl barley, barley flakes & flour) Oats–Milling (oatmeal, oat flour & oat flakes) Sorghum and millets – Traditional & commercial milling (dry &wet)

Learning Outcomes:

By the end of this unit, the student will be able to

- Know about the various processing steps of major cereals after harvesting.
- Learn about the production of different processed products and by-products.

Unit II

Pulse technology: Processing- Soaking, Germination, Decortication, Cooking and Fermentation. Changes during germination, Milling- decutilating and splitting (dry and wet milling). Antinutritional factors, Factors affecting cooking time.

Learning Outcomes:

By the end of this unit, the student will be able to

- Know about the various processing steps of major pulses after harvesting.
- Learn about the toxic constituents of pulses.

Unit III

Legume technology: Classification of legumes, chemical composition and nutritional value. Methods of dehulling-. Home, cottage and commercial scale. Modern techniques of dehulling. Milling of legumes: Dal milling principles, methods, equipments and effect on quality. Principle products, fermented products of legumes.

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn about the various processing steps and methods of major legumes after harvesting.
- Know about the production of different processed products and fermented products.

Unit IV

Technology of Oil seeds: Sources, Composition, Processing of oil seeds – Soya bean, coconut. Hydrogenation. Refining of fats & oils, bleaching, de-odourising, hydroxylation, Protein isolates, Sources of protein (defatted flour, protein concentrates and isolates), properties and uses, protein texturization, fibre spinning

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn about the various processing steps of major oil seeds after harvesting.
- Know about the production of different methods of old refining and protein products.

Unit V

Alcoholic beverages: classification- wine, beer, spirit, liqueurs, cocktails. Production- fermentation and distillation. Storage. Bar layout- physical layout of bar, Bar stock- alcohol & non alcohol beverages, Bar equipments

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn various production steps of major alcoholic beverages.
- Know about equipment used in production and storage of alcohol.

Course Outcomes:

By the end of the course, the student will be able to:

- Know about the various processing steps of major cereals after harvesting.
- Know about equipment used in production and storage of alcohol.
- Learn about the various processing steps and methods of major legumes after harvesting.

B.Sc. (H) FOOD TECHNOLOGY IV SEMESTER

SFT 222: TECHNOLOGY OF CEREALS, PULSES AND OILSEEDS (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Physical characteristics of Wheat.
2. Estimation of Gluten Content of flour.
3. Estimation of Pelenske Value of flour.
4. Estimation of Potassium Bromate in flour.
5. Fermenting power of yeast.
6. Physical Characteristics of Rice and paddy.
7. Cooking characteristics of rice.
8. Determination of sedimentation power of flour
9. Identification of different varieties of millets and cereals

Recommended Readings:

1. Kent, N.L. 2003. Technology of Cereal, 5th Ed. PergamonPress.
2. Chakraverty. 1988. Post-Harvest Technology of Cereals, Pulses and Oilseeds, revisedEd., Oxford & IBH Publishing Co. PvtLtd.
3. Marshall, Rice Science and Technology. 1994. Wadsworth Ed., Marcel Dekker,NewYork.
4. Manay, S. and Sharaswamy, M. 1987. Food Facts and Priniciples.Wiley EasternLimited

Course Outcomes:

By the end of the practicals, the student will be able to

- Learn about the various processing steps of major cereals and pulses after harvesting, the production of different processed products and by-products.
- The various processing steps of major legumes and oil seeds after harvesting, the production of different processed products and by-products.
- The various processing steps the production of different processed alcoholic beverages.

B.Sc. (H) FOOD TECHNOLOGY IV SEMESTER

SFT 204: FOOD MICROBIOLOGY (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

Food microbiology is the scientific study of microorganisms, both in food and used for the production of food. This includes microorganisms that contaminate food, as well as those used in its production; for example to produce yoghurt, cheese, beer and wine.

Course Objectives:

- To know the important genera of microorganisms associated with food and their characteristics.
- To understand the role of microbes in fermentation, spoilage and food borne diseases.

Unit I

Food microbiology- definition and importance, Microbial growth in food- intrinsic and extrinsic factors affecting the growth of microorganisms in food, bacterial growth curve. Beneficial role of microorganisms in food.Probiotics, prebiotics and synbiotics.

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn about the morphological characteristics important in food bacteriology
- Understand about the importance of microbiology and its relevance to everyday life.

Unit II

Microorganisms associated with food- Bacteria, molds, yeast, virus- General characteristics, structure, morphological characteristics, growth and cultural characteristics. Endospore - structure and significance in food microbiology

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn about general characteristics of bacteria, fungi and virus.
- Know procedures of identification of microorganisms

Unit III

Microbial food spoilage - **s**ources of microorganisms in foods, spoilage of different food groups- milk and dairy products, meat, poultry and sea foods, cereal and cereal products, fruits and vegetables and canned products.

Learning Outcomes:

By the end of this unit, the student will be able to

- Understand about spoilage. Contamination sources, types, effect of cereals, sugar, vegetables and fruits, meat, milk, canned foods.

Unit IV

Sterilization methods-physical and chemical. Pure culture techniques, methods of isolation. Enumeration of Microorganisms- qualitative and quantitative. Control of Microorganisms in Foods-Principle and methods. Preservation and maintenance of microbial cultures.

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn about sterilization methods, pure culture techniques, methods of isolation
- Understand about control of microorganisms in foods, and preservation and maintenance of microbial cultures.

UNIT V

Food infection and food intoxication. Food and water borne diseases by – *Salmonella, E. coli, Clostridium, Listeria, Shigella, Bacillus, Campylobacter, Vibrio*. Trends in Food Microbiology-rapid methods of detection, recent Advances

Learning Outcomes:

By the end of this unit, the student will be able to

- Understand about the sources of contamination of food, mycotoxins, toxin production and physiological action, sources of infection of food by pathogenic organisms.
- Learn about water, soil and air borne diseases.

Course Outcomes:

By the end of the course, the student will be able to:

- Learn about the morphological characteristics important in food bacteriology.
- Understand about the sources of contamination of food, mycotoxins, toxin production and physiological action, sources of infection of food by pathogenic organisms.
- Know procedures of identification of microorganisms

B.Sc. (H) FOOD TECHNOLOGY IV SEMESTER

SFT224: FOOD MICROBIOLOGY (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Introduction to the Basic Microbiology Laboratory Practices and equipment
2. Functioning and use of compound microscope
3. Cleaning and sterilization of glassware
4. Preparation and sterilization of nutrient broth
5. Cultivation and sub-culturing of microbes
6. Preparation of slant, stab and plates using nutrient agar
7. Morphological study of bacteria and fungi using permanent slides
8. Simple staining
9. Gram's staining
10. Standard Plate Count Method
11. Introduction of culture procuring and depositing centers, ATCC, DSMZ, and IMTECH

Recommended Readings:

1. Food Microbiology (4^{th}edition) by W. C Frazier.
2. Modern Food Microbiology (7^{th} edition) by J.M. Jay .
3. Food Microbiology (2006) by M.R. Adams.
4. Basic Food Microbiology (2004) by G.J. Banwart.
5. Food Microbiology (2007) by K.Vijaya Ramesh.
6. Fundamentals of Food Microbiology (5^{th}Edition) by B. Ray and A. Bhunia.

Course Outcomes:

By the end of the practicals, the student will be able to

- Learn about important pathogens and spoilage microorganisms in foods and the conditions under which they will grow, conditions under which the important pathogens are commonly inactivated, killed or made harmless in food, principles involving food preservation via fermentation processes

- Understand about the role and significance of microbial inactivation, adaptation and environmental factors (i.e., Aw, pH, temperature) on growth
- Know about the response of microorganisms in various environments, and conditions, including sanitation practices, under which the important pathogens and spoilage microorganisms are commonly inactivated, killed or made harmless in foods.

B.Sc. (H) FOOD TECHNOLOGY IV SEMESTER

SFT 206: TECHNOLOGY OF MEAT, POULTRY AND EGG (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

The principle interests of the extension program at this time are in the area of total utilization of flesh foods, particularly poultry and fish, animal welfare, and the sustainability of animal agriculture. Issues of animal welfare are also presented to challenge simplistic, often anthropomorphic assumptions, especially with respect to egg layers.

Course Objectives:

- To understand need and importance of livestock, egg and poultry industry
- To study structure, composition and nutritional quality of animal products.
- To study processing and preservation of animal foods.
- To understand technology behind preparation of various animal food products and by-product utilization.

Unit I

Introduction: Livestock and poultry population in India, Development of meat and poultry industry in India and its need in nation's economy, Glossary of live market terms for animals and birds.

Learning Outcomes:

By the end of this unit, the student will be able to

- Understand the sources and developments of meat and poultry industries in India.
- Know about the importance of theses in national economy.

Unit II

Meat quality: Effects of feed, breed and environment on production of meat animals and their quality. Meat Quality-color, flavor, texture, Water-Holding Capacity (WHC), Emulsification capacity of meat

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn about muscle structure, chemical composition and physico-chemical properties of meat muscle.
- Understand the procedure of Pre-slaughter operations of meat animals and poultry birds.

Unit III

Slaughter process: Slaughter, inspection and grading, Antemortem examination of meat animals, slaughter of buffalo, sheep/ goat, poultry, pig. A generic HACCP model, dressing of carcasses, post-mortem examination of meat.

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn about muscle structure, chemical composition and physico-chemical properties of meat muscle.
- Understand the procedure of Pre-slaughter operations of meat animals and poultry birds.
- Learn the procedure of slaughtering and dressing of meat animals; Study of post-mortem changes.

Unit IV

Preservation of meat: Refrigeration and freezing, thermal processing- canning of meat, retort pouch, dehydration, irradiation, and RTE meat products, meat curing. Sausages-processing, types and defects. By-products: Importance, classification and uses, Manufacture of Natural casings

Learning Outcomes:

By the end of this unit, the student will be able to

- Know about the preservation of meat by different methods
- Understand the processing, preparation of meat and poultry products.
- Learn about meat plant sanitation and safety By-products utilization of abattoir.

Unit V

Egg Industry: The egg industry, its techniques of working, General management, structure, composition and nutritive value of egg and its products. Preservation of eggs: Refrigeration and freezing, thermal processing, dehydration, coating. Quality identification of shell eggs- Factors

affecting egg quality and measures of egg quality.

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn about egg structure, composition, nutritive value and quality characteristics.
- Understand about evaluation of quality and grading of eggs;
- Know about the preservation of shell eggs and experiments in by-products utilization.

Course Outcomes:

By the end of the course, the student will be able to:

- Understand the sources and developments of meat and poultry industries in India.
- Learn about muscle structure, chemical composition and physico-chemical properties of meat muscle.
- Learn about egg structure, composition, nutritive value and quality characteristics.

B.Sc. (H) FOOD TECHNOLOGY IV SEMESTER

SFT 226: TECHNOLOGY OF MEAT, POULTRY AND EGG (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Estimation of moisture content of meat
2. Cutout analysis of canned meats/retort pouches
3. Estimation of protein content of meat
4. Analysis of frozen meat/meat emulsion products
5. To study shelf-life of eggs by different methods of preservation
6. Evaluation of eggs for quality parameters(market eggs,branded eggs)
7. To perform freezing of yolk/albumen
8. Meat/Egg product formulation

Recommended Readings:

1. Lawrie R A, Lawrie's Meat Science, 5th Ed, Woodhead Publisher, England, 1998
2. Parkhurst &Mountney, Poultry Meat and Egg Production, CBS Publication, New Delhi, 1997
3. Pearson & Gillet Processed Meats,3 Ed, CBS Publication, New Delhi, 1997
4. Shai Barbut,Poultry Products Processing,CRC Press 2005
5. Stadelman WJ, Owen J Cotterill Egg Science and Technology, 4th Ed. CBS Publication New Delhi, 2002

Course Outcomes:

By the end of the practicals, the student will be able to

- Understand about muscle structure, chemical composition and physico-chemical properties of meat muscle
- Know procedures of Slaughtering of animals and poultry, post-mortem inspection and grading of meat
- Learn about factors affecting post-mortem changes, properties and shelf life of meat

- Understand about processing and preservation of meat- mechanical deboning, aging or chilling, freezing, pickling, curing, cooking and smoking of meat.
- Understand about technology of manufacture of meat and poultry products.

B.Sc. (H) FOOD TECHNOLOGY V SEMESTER

SFT 301: FOOD ENGINEERING (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

The amalgamation of food technology with engineering operations has given birth to the discipline of food engineering. This course covers the basic principles, materials and energy balance concepts that prepare a solid ground for easy comprehension of the technology involved. This course also emphasizes about unit operations in food processing, distillation, and several other mechanical operations. The student also learns about food industry management, and the peripheral and integrated food engineering operations.

Course Objectives:

- To understand the principle of Unit operation
- To acquaint with fundamentals of food engineering and its process
- To understand the basics of designing of food plant and systems

Unit I

Concept of unit operation, units and dimensions, unit conversions, dimensional analysis, mass and energy balance, related numericals. Important considerations for designing of food plants, types of layout. Principle and equipments used in food industry.

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn about unit operations, mass energy balance
- Learn about the food plants designs, and layout types.
- Understand principles of different equipments used in food industry

Unit II

Liquid transport systems, properties of liquids, Newton's law of viscosity, principle of capillary tube and rotational viscometer, properties of Non-Newtonian fluids, flow characteristics, Reynolds number, Bernoulli's equation, concept of flow measurement devices, related basic numericals.

Learning Outcomes:

By the end of this unit, the student will be able to:

- Know about Newton's laws of viscosity
- Learn importance concepts of Non-Newtonian fluids, Bernoulli's equation, and Reynolds number
- Learn related basic numericals

Unit III

Concept and selection of a refrigerant, description of a refrigeration cycle, pressure enthalpy charts and tables, mathematical expressions useful in analysis of vapour compression refrigeration cycle, numericals based on VCR system, Freon 12 and R-717, superheating and sub cooling, freezing time calculation using Plank's Equation, frozen food storage, related basic numericals

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn about vapour-compression-refrigeration cycle
- Know about importance of selection of refrigerants.
- Perform freezing time calculations, methods of frozen food storage.

Unit IV

Systems for heating and cooling food products, thermal properties of food, modes of heat transfer, application of steady state heat transfer-estimation of conductive, convective, overall heat transfer coefficient and design of tubular heat exchanger. Related basic numericals, Fick's law of diffusion, membrane separation systems-electrodialysis system, reverse osmosis, membrane System, and ultrafiltration membrane system, membrane devices used for RO and UF: plate and frame, tubular, spiral wound and hollow fiber devices.

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn about conductive and convective heat transfer methods, and heat exchangers.
- Learn about membrane separation systems

Unit V

Properties of dry air, properties of water vapour, properties of air vapour mixture, psychrometric chart, related basic numericals, generation of steam, construction and functions of fire tube and water tube boilers, thermodynamics of phase change, steam tables, boiling point elevation, types of evaporations, design of single effect evaporators, basic drying process, moisture content on wet basis and dry basis, dehydration systems, dehydration system design, related basic numericals

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn about evaporators, types, and dehydration systems
- Understand about basic drying process
- Understand about properties of dry air, generation of steam, construction and functions of boilers

Course Outcomes:

By the end of this Course, the student will be able to:

- Learn about the design of food plant with the learned layout and hygiene concepts.
- Demonstrate the working of various equipments used in food industry
- Understand about the importance of refrigeration, and principles and applications of conduction, convection, and rheology.

B.Sc. (H) FOOD TECHNOLOGY V SEMESTER

SFT 321: FOOD ENGINEERING (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Plant layout design
2. Determination of drying characteristics
3. Determination of viscosity of Newtonian and non Newtonian fluids
4. Study of effect of temperature on viscosity
5. Screen analysis of food sample
6. Study of evaporation process
7. Freezing time calculation
8. Psychrometrics- use and application.

Recommended Readings:

1. Rao DG. 2010. Fundamentals of food engineering. PHI learning private ltd.
2. Singh RP and Heldman DR.1993, 2003, 2009.Introduction to food engineering. Academic press 2^{nd}, 3^{rd}, and 4^{th} edition.
3. Rao C G 2006 Essentials of food process engineering. B S publications
4. Fellow P. 1988 Food processing technology

Course Outcomes:

By the end of practicals, the student will be able to:

- Design plant layout for different food plants
- Perform drying characteristics
- Perform calculations for freezing time
- Measure the viscosity of Newtonian and non-Newtonian fluids

B.Sc. (H) FOOD TECHNOLOGY V SEMESTER

SFT 303: BIOCHEMISTRY – I (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

Food chemistry deals with the chemical processes and interactions of all biological and non-biological components of foods. The biological substances comprise items like poultry, lettuce, meat, milk and beer. It is parallel to biochemistry in its main components including water, carbohydrates, lipids, proteins and enzymes. Apart from this it also contains areas like vitamins, minerals, food additives, flavors, and colors. This subject also includes how products change under certain circumstances of food processing techniques and methods either to enhance or to prevent them from occurring.

Course Objectives:

- To understand the chemistry of foods - composition of food, role of each component and their interaction.
- To understand the functional aspects of food components and to study their role in food processing.

Unit I

Introduction to Food Chemistry – Definition, Composition of food. Water - Definition of water in food, Structure of water and ice, Types of water, Sorption phenomenon, Water activity and packaging, Water activity and shelf-life

Learning Outcomes:

By the end of this unit, the student will be able to

- Understand the concept of micro and macro elements which constitutes the food
- Identify different types of water in the food and its relation to food spoilage
- Differentiate various foods based on shelf life

Unit II

Lipids - Classification of lipids, Physical properties-melting point, softening point, specific gravity, refractive index, smoke, flash and fire point, turbidity point. Chemical properties-reichert-meissel value, polenske value, iodine value, peroxide value, saponification value. Effect of frying on fats, Changes in fats and oils- rancidity, lipolysis, flavor reversion, Auto-oxidation and its prevention, Technology of edible fats and oils- Refining, Hydrogenation and Interesterification, Fat Mimetics

Learning Outcomes:

By the end of this unit, the student will be able to

- Differentiate between various types of fats like saturated and unsaturated and essential fats
- Explain how lipids gets spoiled and how to prevent it
- Extend the concept of processing various types of fats and oils

Unit III

Proteins - classification and structure, Nature of food proteins (plant and animal proteins), Properties of proteins (electrophoresis, sedimentation, amphoterism and denaturation), Functional properties of proteins eg.organoleptic, solubility, viscosity, binding gelation / texturization, emulsification, foaming.

Learning Outcomes:

By the end of this unit, the student will be able to

- Differentiate the types of proteins present in plants and animals
- Compare physical and functional properties of proteins
- Use the concepts of emulsification, foaming, gelation etc. for preparing food varieties

Unit IV

Carbohydrates – Classification (mono, oligo and poly saccharides), Structure of important polysaccharides (starch, glycogen, cellulose, pectin, hemicellulose, gums), Chemical reactions of carbohydrates –oxidation, reduction, with acid & alkali, Modified celluloses and starches, resistant starch.

Learning Outcomes:

By the end of this unit, the student will be able to

- Understand the types of carbohydrates in food

- Differentiate between processed foods, cereals and whole grain food
- Formulate low and high carbohydrate diet

Unit V

Vitamins – Structure, Importance and Stability of Water soluble vitamins & Fat soluble vitamins

Flavour - Definition and basic tastes, Chemical structure and taste, Description of food flavours, Flavour enhancers

Learning Outcomes:

By the end of this unit, the student will be able to

- Compare and contrast the water soluble and fat soluble vitamins
- Illustrate the deficiency disorder caused by lack of vitamins
- Develop variety of food using different flavors and enhancers

Course Outcomes:

By the end of the course, the student will be able to:

- Understand the concept of micro and macro elements which constitutes the food
- Understand the types of carbohydrates in food
- Compare and contrast the water soluble and fat soluble vitamins

B.Sc. (H) FOOD TECHNOLOGY V SEMESTER

SFT 323: BIOCHEMISTRY – I (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Preparation of primary and secondary solutions
2. Estimation of moisture content
3. Determination of gelatinization temperature range (GTR) of different starches and effect of additives on GTR.
4. Determination of refractive index and specific gravity of fats and oils.
5. Determination of smoke point and percent fat absorption for different fat and oils.
6. Determination of percent free fatty acids
7. Estimation of saponification value
8. Estimation of reducing and non-reducing sugars using potassium ferricyanide method.

Recommended Readings:

1. Fennema, Owen R, Food Chemistry, 3rd Ed., Marcell Dekker, New York, 1996
2. Whitehurst and Law, Enzymes in Food Technology, CRC Press, Canada, 2002
3. Wong, Dominic WS, Food Enzymes, Chapman and Hall, New York, 1995
4. Potter,N.N.and Hotchkiss,J.H, Food Science, 5th Ed., Chapman & Hall,1995
5. DeMan, J.M., Principles of Food Chemistry, AVI, NewYork, 1980

Course Outcomes:

By the end of the practicals, the student will be able to

- Prepare different types of solutions
- Differentiate between fats and oils and their adulterations
- Compare and contrast non-reducing and reducing sugars

B.Sc. (H) FOOD TECHNOLOGY VI SEMESTER

SFT 302: FOOD CHEMISTRY (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

Food chemistry plays a key role in warranting that the food being processed is of high quality and safe for eating. Understanding food chemistry helps us develop proper ways of handling food and also develop good manufacturing practices. Chemical substances can play a significant role in food manufacture and safeguarding. Food additives can, for example, prolong the shelf life of foods or can make food more attractive, such as colors. Flavorings are used to make food tastier. Other chemicals can be used to fight diseases in farm animals or crops.

Course Objectives:

- To understand the chemistry of food components and their interactions.
- To know about the role of enzymes and various processing treatments in food industry.
- To understand the concept of new product development.

Unit I

Minerals - Major and minor minerals calcium, phosphorus, Sulphur, magnesium, sodium, potassium, chlorine; minor minerals - iron, Florine, zinc, copper, iodine, chromium, cobalt, Metal uptake in canned foods, Toxic metals.

Learning Outcomes:

By the end of this unit, the student will be able to

- Differentiate between trace elements and essential elements in food
- Understand the pros and cons of canned foods
- Illustrate the harmful effects of toxic metals in food

Unit II

Natural Food Pigments- Introduction and classification Food pigments (chlorophyll, carotenoids, anthocyanins and flavonoids, beet pigments, caramel). Browning Reactions In Food - Enzymatic browning, Non – Enzymatic browning, Maillard reaction, Caramelization reaction, Ascorbic acid oxidation

Learning Outcomes:

By the end of this unit, the student will be able to

- Illustrate the importance of food colors in maintain and improving the appearance
- Differentiate between natural and artificial colors and pigments
- Apply enzymatic and non-enzymatic reactions for refining the food quality

Unit III

Enzymes - Introduction, classification, General characteristics, Enzymes in food processing, Industrial Uses of Enzymes, Immobilized enzymes

Learning Outcomes:

By the end of this unit, the student will be able to

- Use immobilized enzymes for convenience, economy and stability of food in industries
- Understand that enzymes can be used to enhance the digestion of food and the delivery of nutrients to the blood even in a compromised digestive system
- Develop mechanisms to control the speed of chemical reactions in the food using enzymes

Unit IV

Physico-chemical and nutritional changes occurring during food processing treatments -Drying and dehydration, Irradiation, Freezing, Canning

Learning Outcomes:

By the end of this unit, the student will be able to

- Comprehend that by processing the food it is possible to maintain a nutritious and safe food supply for the millions of people.
- Reduce the loss and increase the food supply by improving the processing efficiency by enhancing the yield of usable product.

- Appreciate how processing changes some of the food chemicals making it safer to eat, easier to digest and taste better.

Unit V

New product development – Definition, Importance, Need of product development, Steps of product development- Product development tools, Reasons for failure.

Learning Outcomes:

By the end of this unit, the student will be able to

- Discuss the elements which can impact on consumers' preferences and demands.
- Understand that new products development is the life & blood of companies
- Determine how to best communicate their products' attributes to their target customers based on customer needs, competitive pressures, available communication channels and reasons for failure of the new product in the market.

Course Outcomes:

By the end of the course, the student will be able to:

- Differentiate between trace elements and essential elements in food
- Illustrate the importance of food colors in maintain and improving the appearance
- Use immobilized enzymes for convenience, economy and stability of food in industries
- Understand that new products development is the life and blood of companies

B.Sc. (H) FOOD TECHNOLOGY VI SEMESTER

SFT 322: FOOD CHEMISTRY (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Estimation of total ash
2. Estimation of minerals-demo
3. Determination of thermal inactivation time of enzymes in fruits and vegetables.
4. Estimation of iodine value
5. Estimation of peroxide value
6. Determination of carotenoids w.r.t flour pigments.
7. Extend of non-enzymatic browning by extraction methods.
8. Introduction of the concept of new product development

Recommended Readings:

1. DeMan, John M., Principles of Food Chemistry ,3rd Ed., Springer 1999
2. Desrosier, Norman W. and Desrosier.,JamesN.,The technology of food preservation , 4th Ed.,Westport, Conn. : AVI Pub. Co., 1977.
3. Fennema, Owen R, Food Chemistry, 3rd Ed., Marcell Dekker, New York, 1996
4. Fuller, Gordon W, New Product Development From Concept to Marketplace, CRC Press, 2004.
5. Whitehurst and Law, Enzymes in Food Technology, CRC Press, Canada, 2002

Course Outcomes:

By the end of the practicals, the student will be able to

- Understand the concepts of enzymatic and non-enzymatic browning in food and improve the food quality
- Apply various enzymes in industry for improving the digestion of food and extending the shelf life of a product by preventing certain enzymes
- Develop a new product

B.Sc. (H) FOOD TECHNOLOGY VI SEMESTER

SFT 304: FOOD QUALITY AND SENSORY EVALUATION (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

Food quality is the quality characteristics of food that is acceptable to consumers. This includes external factors as appearance (size, shape, colour, gloss, and consistency), texture, and flavor; factors such as federal grade standards and internal (chemical, physical, microbial). Sensory evaluation is a scientific discipline used to analyze reactions to stimuli perceived through the senses – Sight, Smell, Touch, Taste and Sound. Sensory Analysis is a vital tool for the Food Industry and can be used in a number of applications like new product development.

Course Objectives:

- To understand quality attributes like appearance, flavor prepare our bodies for digestion
- To identify different tastes of the food
- To Identify different odours and classifications
- To recognize the colour abnormalities

Unit I

Introduction to quality attributes of food - Appearance, flavour, textural factors and additional quality factors.

Learning Outcomes:

By the end of this unit, the student will be able to

- Realize that quality attributes like appearance, flavor prepare our bodies for digestion
- Recognize that tasting and smelling food can trigger the salivary glands and secretion of digestive juices.

Unit II

Gustation- Introduction and importance of gustation, Structure and physiology of taste organs- tongue, papillae, taste buds, salivary glands. Mechanism of taste perception, Chemical dimensions of basic tastes- sweet, salt, sour, bitter and umami, Factors affecting taste quality, reaction time, taste modification, absolute and recognition threshold, Taste measurement- Electronic Tongue, Taste abnormalities

Learning Outcomes:

By the end of this unit, the student will be able to

- Identify different tastes of the food
- Use electronic tongues for improving the taste perception
- Recognize abnormalities in taste of the food items

Unit III

Olfaction - Introduction, definition and importance of odour and flavor, Anatomy of nose, physiology of odour perception, Mechanism of odour perception, Theories of odour classification, chemical specificity of odour. Odour measurement techniques – historical perspective and emphasis on recent techniques- e- nose etc. Olfactory abnormalities

Learning Outcomes:

By the end of this unit, the student will be able to

- Identify different odours and classifications
- Measure chemical specificity of odour
- Recognize the olfactory abnormalities

Unit IV

Colour - Introduction and importance of colour, Dimensions of colour and attributes of colour; gloss etc. Perception of colour. Colour Measurement: Munsell colour system, CIE colour system, Hunter colour system. Colour abnormalities

Learning Outcomes:

By the end of this unit, the student will be able to

- Apprehend that food colors can maintain or improve the appearance of the food.
- Measure different colors

- Recognize the colour abnormalities

Unit V

Texture - Introduction, definition and importance of texture, Phases of oral processing, Texture perception, receptors involved in texture perception, Rheology of foods, Texture classification, Texture measurement – basic rheological models, forces involved in texture measurement and recent advances in texture evaluation. Application of texture measurement in cereals, fruits and vegetables, dairy, meat and meat products

Learning Outcomes:

By the end of this unit, the student will be able to

- Apprehend that food texture can determine the eating quality of foods and can have a strong influence on food intake and nutrition
- Understand how the texture of food can influence calorie perceptions, food choice, and consumption amount can help nudge consumers towards making healthier choices
- Apply texture measurements for various food products

Course Outcomes:

By the end of the course, the student will be able to:

- Recognize that tasting and smelling food can trigger the salivary glands and secretion of digestive juices
- Apprehend that food colors can maintain or improve the appearance of the food.
- Apprehend that food texture can determine the eating quality of foods and can have a strong influence on food intake and nutrition.

B.Sc. (H) FOOD TECHNOLOGY VI SEMESTER

SFT 324: FOOD QUALITY AND SENSORY EVALUATION (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Training of sensory panel.
2. To perform sensitivity tests for four basic tastes
3. To perform analytical and affective tests of sensory evaluation.
4. Recognition tests for various food flavors.
5. Sensory evaluation of milk and milk products.
6. Flavor defects in milk
7. Extraction of pigments from various fruits and vegetables and study the effect of temperature and pH
8. Texture evaluation of various food samples- cookies/ biscuits/ snack foods
9. Textural measurement of various food products using Texture Analyzer
10. Measurement of colour by using Tintometer/ Hunter Colour Lab etc.
11. Concept of electronic tongue and nose.

Recommended Readings:

1. Rao E. S. (2013). Food Quality Evaluation. Variety Books.
2. Pomeranz Y and Meloan CE (2002). Food Analysis – Theory and Practice, CBS Publishers and Distributors, New Delhi.
3. deMan J. (2007). Principles of Food Chemistry, 3rd ed., Springer.
4. Meilgard (1999). Sensory Evaluation Techniques, 3rd ed. CRC Press LLC, 1999.
5. Amerine, Pangborn & Roessler (1965). Principles of Sensory Evaluation of food, Academic Press, London.

Course Outcomes:

By the end of the practicals, the student will be able to

- Measure the color and texture of the food

- Extract various natural pigments from fruits and vegetables
- Perform sensory evaluation of different food items and recognize various food flavors

B.Sc. (H) FOOD TECHNOLOGY I SEMESTER

SFT 141: INTRODUCTORY MICROBIOLOGY (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

This course introduces the students to the basic concepts of microbiology, history and development of microbiology. Additionally, they learn about isolation, identification, and classification of microorganisms. The student is introduced to all the applied aspects of microbiology.

Course Objectives:

- To introduce the subject of microbiology by its history, microscopy, aseptic techniques, sterilization, isolation of bacteria, study of morphological characters, identifying and classification of bacteria.
- To know about the preservation of microbes, staining techniques, understanding nutritional types of bacteria.
- To perform the detailed study of some clinically important bacteria
- To introduce the concepts of immunology

Unit I

Development of microbiology, Spontaneous generation theory. Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming, Beijerinck, Winogradsky, Edward Jenner, Ivanowski. Germ theory of disease, golden era of microbiology.

Learning Outcomes:

By the end of this unit, the student will be able to

- Know about the contributions of eminent scientists to microbiology

Unit II

Classification: Whittaker's and Carl Woese's three kingdom classification systems and introduction to Bergey's manual. Prokaryotic and eukaryotic cell organization. Acellular microorganisms (Viruses, Viroids, Prions) and Cellular microorganisms (bacteria, algae, fungi and protozoa).

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn about classification of microorganisms and importance of Bergey's manual

Unit III

Bright Field Microscope, Dark Field Microscope, Phase Contrast Microscope, Fluorescence Microscope. Control of microorganisms-sterilization, disinfection, antisepsis, and sanitization.

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn about microscopy and types of microscopes
- Understand about the importance of sterilization of microorganisms

Unit IV

Medical microbiology and immunology: List of important human diseases and their causative agents of various human systems. Definitions of immunity (active/passive), primary and secondary immune response, antigen, antibody and their types

Learning Outcomes:

By the end of this unit, the student will be able to

- Know general characteristics and pathogenesis of important human diseases
- Learn about the concepts of immunology-importantly antibody, antigen and their types

Unit V

Environmental microbiology: Microbial interactions–mutualism, commensalism, antagonism, and parasitism. Microorganisms used as biopesticides, biofertilizers, biodegradation, and bioremediation. Fermentation- types, primary and secondary metabolites, fermenter design, and important industrial products.

Learning Outcomes:

By the end of this unit, the student will be able to

- Learn important concepts of environmental microbiology
- Learn exploitation of microorganisms in using them as Biopesticides, biodegradation, and bioremediation.

Course Outcomes:

By the end of the course, the student will be able to:

- Know about the contributions of eminent scientists to microbiology
- Know general characteristics and pathogenesis of important human diseases
- Learn about microscopy and types of microscopes

B.Sc. (H) FOOD TECHNOLOGY I SEMESTER

SFT 125: INTRODUCTORY MICROBIOLOGY (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Microbiology Laboratory Management and Biosafety.
2. To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter) used in the microbiology laboratory
3. Preparation of culture media for bacterial cultivation
4. Sterilization of medium using Autoclave and assessment for sterility
5. Sterilization of glassware using Hot Air Oven and assessment for sterility
6. Sterilization of heat sensitive material by filtration and assessment for sterility
7. Demonstration of presence of microflora in the environment by exposing nutrient agar plates to air.
8. Study of different shapes of bacteria using permanent slides
9. Study of Rhizopus, Penicillium, Aspergillus using permanent mounts
10. Study of Spirogyra and Chlamydomonas using permanent Mounts
11. Study of the following protozoans using permanent mounts/photographs: Amoeba, Entamoeba, Paramecium and Plasmodium

Recommended Readings:

1. Tortora GJ, Funke BR and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education
2. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms.14th edition. Pearson International Edition
3. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited
4. Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9th Edition. McGraw Hill International.

5. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T.Brown Publishers.
6. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company.
7. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). General Microbiology. 5th edition. McMillan.

Course Outcomes:

By the end of the practicals, the student will be able to

- Learn principle and applications of important instruments
- Learn preparation of culture media
- Learn sterilization of medium
- Learn isolation of bacteria from environment
- Understand the morphology of bacteria

B.Sc. (H) FOOD TECHNOLOGY II SEMESTER

SFT 143: MICROBES IN SUSTAINABLE AGRICULTURE AND DEVELOPMENT (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

The high cost of Chemical fertilizers, pesticides, herbicides, and the difficulties of meeting demand for them, and their harmful environmental legacy have encouraged scientists to develop alternative strategies to raise productivity, with microbes playing a central role in these efforts. For example, soil microbes are used as bioinoculants for supplying nutrients and/or stimulating plant growth. This course provides an overall-view about microbiology of -soil, -in greenhouse gases, -in biofertilizers and biofuels production and applications.

Course Objectives:

- To learn about soil microbiology, and mineralization
- To understand microbial activity in soil and green house gases
- To provide knowledge about biocontrol mechanisms, biofertilizers production ad role
- To understand the production of Biomanure, biogas, biofuels, and their applications

Unit I

Soil Microbiology - Soil as Microbial habitat, Soil profile and properties, Soil formation, Diversity and distribution of microorganisms in soil. Soil organic matter - Mineralization of cellulose, hemicelluloses, lignocelluloses, lignin and humus

Learning Outcomes:

By the end of the course, the student will be able to

- Learn soil microbiology-soil profile, soil formation
- Know about cellulose, hemicellulose, lignin and humus

Unit II

Microbial activity in soil and green house gases- Carbondioxide, methane, nitous oxide, nitric oxide – production and control

Learning Outcomes:

By the end of the course, the student will be able to

- Know about microbial activity in soil and green house gases
- Learn production and control of CO_2, CH_4 etc.

Unit III

Microbial Control of soil borne plant pathogens- Biocontrol mechanisms and ways, Microorganisms used as biocontrol agents against Microbial plant pathogens, Insects, Weeds

Learning Outcomes:

By the end of the course, the student will be able to

- Learn microbial control of soil borne plant pathogens
- Learn about usage of microorganisms against plant pathogens, insects, and weeds

Unit IV

Biofertilization, Phytostimulation, Bioinsecticides, Plant growth limiting compounds, biofertilizers – symbiotic (Bradyrhizobium, Rhizobium, Frankia), Non Symbiotic (Azospirillum, Azotobacter, Mycorrhizae, MHBs, Phosphate solubilizers, algae), Novel combination of microbes as biofertilizers, PGPRs

Learning Outcomes:

By the end of the course, the student will be able to

- Learn about Biofertilization, phytostimulation etc.
- Understand the production of Biofertilizers using microbes

Unit V

Secondary Agriculture Biotechnology- Biotech feed, Silage, Biomanure, biogas, biofuels – advantages and processing parameters. GM crops -Advantages, social and environmental aspects, Bt crops, golden rice, transgenic animals. GEAC.

Learning Outcomes:

By the end of the course, the student will be able to

- Learn about production of Biomanure, biogas, biofuels, and their applications
- Learn about GM crops, transgenic animals

Course Outcomes:

By the end of the course, the student will be able to:

- Learn soil microbiology-soil profile, soil formation
- Learn microbial control of soil borne plant pathogens
- Learn about production of Biomanure, biogas, biofuels, and their applications

B.Sc. (H) FOOD TECHNOLOGY II SEMESTER

SFT 127: MICROBES IN SUSTAINABLE AGRICULTURE AND DEVELOPMENT (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Study soil profile
2. Study microflora of different types of soils
3. Rhizobium as soil inoculants characteristics and field application
4. Azotobacter as soil inoculants characteristics and field applications
5. Design and functioning of a biogas plant
6. Isolation of cellulose degrading organisms

Recommended Readings:

1. Agrios GN. (2006). Plant Pathology. 5th edition. Academic press, San Diego,
2. Singh RS. (1998). Plant Diseases Management. 7th edition. Oxford & IBH, New Delhi.
3. Glick BR, Pasternak JJ, and Patten CL (2010) Molecular Biotechnology 4th edition, ASM Press,
4. Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA
5. Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, Academic Press
6. Barton LL & Northup DE (2011). Microbial Ecology. 1st edition, Wiley Blackwell, USA Campbell RE. (1983). Microbial Ecology. Blackwell Scientific Publication, Oxford, England. 7. Coyne MS. (2001). Soil Microbiology: An Exploratory Approach. Delmar Thomson Learning.
8. Altman A (1998). Agriculture Biotechnology, ist edition, Marcel decker Inc.
9. Mahendra K. Rai (2005). Hand book of Microbial biofertilizers, The Haworth Press, Inc. New York.
10. Reddy, S.M. et. al. (2002). Bioinoculants for sustainable agriculture and forestry, Scientific

Publishers.
11. Saleem F and Shakoori AR (2012) Development of Bioinsecticide, Lap Lambert Academic Publishing GmbH KG.

Course Outcomes:

By the end of the practicals, the student will be able to

- Know about soil profile, and microflora of soils
- Importance of Rhizobium and Azotobacter
- Design and functioning of a biogas plant
- Isolate cellulose degrading organisms

B.Sc. (H) FOOD TECHNOLOGY II SEMESTER

SFT 142: APPLIED PHYSIOLOGY (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

This course aims to provide an overview of fundamental human physiology. This course aims to explain about structure and functions of cells and organs in humans such as immune system, gastrointestinal system, renal system. Cardiovascular system, respiratory system, central nervous system and reproductive system.

Course Objectives:

- To provide a thorough knowledge regarding human physiology
- To provide a thorough understanding of structure and functions of cells in human body
- To provide good knowledge about various systems in human body such as Cardiovascular, respiratory, central nervous, gastrointestinal and renal systems
- To teach our students about significance of endocrinology and sensory organs

Unit I

Introduction to human physiology: Cell prokaryotic and eukaryotic cell, cell cycles- mitosis, meiosis, Tissues, Blood- composition of blood and their functions,

Learning Outcomes:

By the end of this Unit, the student will be able to:

- To learn cell functions and cell cycles
- To understand differences between prokaryotic and eukaryotic cell structures
- To know the composition of blood and its role in our body
- To understand the structure and functions of various tissues in our body

Unit II

Immune system- innate and adaptive immune system, humeral and cell mediated immunity Endocrinology- hormones, endocrine glands-pituitary, thyroid, adrenal gland. Structure and functions of Special senses- Vision, hearing, taste and smell

Learning Outcomes:

By the end of this Unit, the student will be able to Know

- To understand the immune system and cells functions and types of immune system
- To study the fundamental concepts of endocrinology- hormones and endocrine glands
- To learn the structure and functions of special sensory organs

Unit III

Physiology of Cardiovascular system: design of CVS, Cardiac cycle, hypertension. Physiology of respiratory system- Organs of respiratory system and mechanism of respiration, regulation of respiration

Learning Outcomes:

By the end of this Unit, the student will be able to:

- To learn the fundamental structural design of cardiovascular system, and hypertension
- To understand the physiology and mechanism of respiratory system

Unit IV

Physiology of Gastrointestinal system –Description of GIT, organs, hormones, enzymes involved in GIT, Utilization and Absorption of Carbohydrates, proteins, fats. Physiology of renal system, organs of urinary system, structure of nephron

Learning Outcomes:

By the end of this Unit, the student will be able to:

- To learn the physiology of gastrointestinal system
- To study the hormones and enzymes involved in gastrointestinal system,
- To understand the absorption of various nutrients in our regular diet
- To learn the physiology and functions or urinary system

Unit V

Structure and functions of Central Nervous System, nerve cell, Structure and organization of central and peripheral nervous system. Physiology of male and female reproductive system, growth and development during pregnancy

Learning Outcomes:

By the end of this Unit, the student will be able to:

- To learn the structure and functions of CNS
- To study organization of central and peripheral nervous system
- To understand the physiology of male and female reproductive system
- To learn the growth and development during pregnancy

Course Outcomes:

By the end of the course, the student will be able to:

- To understand the immune system and cells functions and types of immune system
- To learn cell functions and cell cycles
- To study organization of central and peripheral nervous system

B.Sc. (H) FOOD TECHNOLOGY II SEMESTER

SFT 126: APPLED PHYSIOLOGY (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Understanding the mitosis cell cycle by using onion root tips.
2. Understanding meiosis by demonstration of permanent slides.
3. Differential blood count.
4. Determination of Blood Types
5. Determination of Hemoglobin
6. Counting of blood cells with Hemocytometric Method.
7. Blood Pressure Measurement by Auscultatory Method.
8. Determining blood glucose level using Automated blood glucose meters (glucometers)
9. Rapid immunological assay determining human chorionic gonadotropin (hCG)- Pregnancy test.

Recommended Readings:

1. Principles of Anatomy and Physiology – Gerard J. Tortora,, Bryan H Derrickson, 15th Edition, Willy publishers

2. Principles of human physiology-Cindy L. Stanfield and William J. Germann, 6th Edition, Pearson Publishers

3. Essentials of Medical Physiology- K. Sembulingam, Prema Sembulingam, 6th Edition, Jaypee Publishers

Course Outcomes:

By the end of the practicals, the student will be able to

- Understand the importance of mitosis cell cycle and meiosis.
- Learn the practical on blood type, and Hb determination.
- Study the importance of knowing the blood glucose levels, and counting the blood cells.

B.Sc. (H) FOOD TECHNOLOGY II SEMESTER

SFT 144: BEVERAGE TECHNOLOGY (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

Beverages including alcoholic and nonalcoholic beverages are diverse group of commodities which range from the most innocuous and essential drink. The market for these products continues to show a remarkable potential for growth.

Course Objectives:

- To understand the difference between alcoholic and nonalcoholic beverages
- To provide students with the knowledge on basic raw materials and additives in beverage production
- To familiarize the technological phases of alcoholic and nonalcoholic beverages.
- To introduce the fundamentals of the science of sugar manufacturing

Unit I

Beverages: Functions, classification, nutritive value, health benefits, Role of water in beverages, Laboratory standards of water, water treatments in food industry – distillation, reverse osmosis, membrane filtration, deionization, ozonation, irradiation, activated charcoal, chemical treatment, technology and chemical constituents of bottled water

Learning Outcomes:

By the end of the course, the student will be able to

- Describe the laboratory standards of water
- Compare and contrast various water treatments
- Classify beverages
- Understand the technologies involved in making carbonated beverages and fruit beverages

Unit II

Fruit based beverages– fruit juice, fruit drink, cordials, fruit nectars, squash, concentrates, fruit punch, carbonated fruit beverages. Processing of Fruit based beverages. Carbonated non – alcoholic soft drinks- ingredients and manufacturing.

Learning Outcomes:

By the end of the course, the student will be able to

- Describe the processing of fruit based beverages
- Understand the technologies involved in making carbonated beverages
- Differentiate between various fruit beverages

Unit III

Alcoholic beverages: Starter cultures, Role of yeast, beer- raw materials, technology of brewing, Wine-technology of wine making, types of wine. Distilled spirits- whisky, rum, gin and brandy. Traditional alcoholic beverages: toddy, *chang*, *kaomak*, *takju*, *feni*and *madhuka.*

Learning Outcomes:

By the end of the course, the student will be able to

- Understand the concepts of wine and beer making
- Summarize different types traditional alcoholic beverages
- Gain Knowledge on distilled spirits
- Classify wines

Unit IV

Coffee: bean processing, blending, roasting, grinding, brewing. Caffeine – effect on health. Decaffeinated coffee: methods of decaffeination, Instant coffee processing. Tea- types of tea, chemical constituents, harvesting, processing and packaging. Instant tea processing.

Learning Outcomes:

By the end of the course, the student will be able to

- Gain knowledge on coffee and tea manufacturing
- Compare different types of tea
- Describe instant tea and instant coffee processing

Unit V

Role of sweeteners, types of sweeteners-Sucrose, invert sugar, High fructose corn syrup, high glucose corn syrup, honey. Artificial sweeteners- types, effect on health, Food adjuncts- types, sources, fortified beverages, Packaging, labeling and storage considerations of beverages,

Learning Outcomes:

By the end of the course, the student will be able to

- Describe the functions and types of sweeteners in beverages
- Gain knowledge on fortified beverages and food adjuncts
- Compare and contrast natural sweeteners from artificial sweeteners
- Describe the processing of honey, HFCS

Course Outcomes:

By the end of the course, the student will be able to:

- Describe the laboratory standards of water
- Describe the processing of fruit based beverages
- Describe the functions and types of sweeteners in beverages

B.Sc. (H) FOOD TECHNOLOGY II SEMESTER

SFT 128: BEVERAGE TECHNOLOGY (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Processing of fruit juices – Mango, pineapple
2. Preparation of fruit cordials- lemon and orange
3. Preparation of concentrates- Grape and tomato
4. Preparation of coffee by different methods and comparing
5. Preparation of appetizers - tomato and corn soup
6. Visit to local beverage industry
7. Study on locally available traditional alcoholic beverages

Recommended Readings:

1. Text book of Food Science and Technology (2001) by Vijayakhader
2. Srilakshmi (2007). Food Science, 4th Edition. New Age International Ltd.
3. Chemistry and Technology of Soft Drinks and Fruit Juices (2nd Edition) by P. R. Ashurst.
4. Beverages: technology, chemistry and microbiology (1994) by A. Varnam, J.M. Sutherland
5. Food and Beverage Packaging Technology,(2011)Richard Coles
6. Functional and Speciality Beverage Technology (2009) by P Paquin

Course Outcomes:

By the end of the practicals, the student will be able to

- Acquire knowledge on basic raw materials applied in the beverage production.
- Understand various technologies of beverage making
- Evaluate various methods of water treatments in food industry
- Describe the role and types of sweeteners and adjuncts in beverages

B.Sc. (H) FOOD TECHNOLOGY III SEMESTER

SFT 241: MOLECULAR BIOLOGY (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

This curse provides an overview about the molecular basis of biological activity between biomolecules in the various systems of a cell, including the interactions between DNA, RNA, proteins and their biosynthesis, as well as the regulation of these interactions. The student also learns about the important mechanisms and crucial factors involved in understanding the three complicated processes replication, transcription and translation.

Course Objectives:

- To provide knowledge about the organization of genetic material in prokaryotes and eukaryotes
- To provide knowledge about the structure of DNA and RNA
- To learn about the mechanisms and crucial factors involved in understanding the three complicated processes replication, transcription and translation.
- To focus on the important phenomenon of regulation of gene expression in prokaryotes and eukaryotes-

Unit I

Structures of DNA and RNA / Genetic Material - DNA structure, Salient features of double helix, Types of DNA, denaturation and renaturation, topoisomerases; Organization of DNA Prokaryotes, Viruses, Eukaryotes. RNA Structure

Learning Outcomes:

By the end of this Unit, the student will be able to

- Learn about structure of DNA and RNA
- To provide knowledge about the organization of genetic material in prokaryotes and eukaryotes

Unit II

Replication of DNA - Bidirectional and unidirectional replication, semi- conservative, semi-discontinuous replication Mechanism of DNA replication: Enzymes and proteins involved in DNA replication –DNA polymerases, DNA ligase, primase, telomerase – for replication of linear ends.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Gain knowledge on mechanism of replication of DNA in Prokaryotes, importantly proteins and enzymes involved to each role of subunit in the process.

Unit III

Transcription - Transcription: Definition, promoter - concept and strength of promoter. Transcriptional Machinery and Mechanism of transcription. Translation - Genetic code, Translational machinery, charging of tRNA, aminoacyl tRNA synthetases, Mechanisms of initiation, elongation and termination of polypeptides.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Understand the mechanism of transcription in prokaryotes and eukaryotes; and importantly transcription initiation factors and their roles in the process
- Know about the translation mechanism by studying initiation, elongation, and termination steps in protein synthesis-learn all the parameters involved with respect to translation mechanism.

Unit IV

Regulation of gene Expression - Principles of transcriptional regulation, regulation at initiation with examples from lac and trp operons. Mutations - Mutations and mutagenesis: Definition and types of Mutations; Physical and chemical mutagens; Uses of mutations, DNA repair mechanisms.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Understand the important regulations of gene expression in prokaryotes and eukaryotes

by studying different operons

- Understand mutations, use of mutations, and DNA repair mechanisms

Unit V

Microbiomics-Microbial diversity mapping and deciphering microbial community behavior through Microbiomics – the Gut Microbial Community and its relationship with health and disease; and microbial biofilms as examples system Exploiting the microbiome for health; Microbiomics in food preservation, detection and surveillance of diseases. The US Food and Drug Adminstration's (US FDA) "GenomeTrakr" Network.

Learning Outcomes:

By the end of this Unit, the student will be able to

- To study and understand the importance of microbiomics in microbial diversity mapping.
- To study and understand the importance of microbiomics in health and in food preservation.

Course Outcomes:

By the end of the course, the student will be able to:

- Learn about structure of DNA and RNA
- Gain knowledge on mechanism of replication of DNA in Prokaryotes, importantly proteins and enzymes involved to each role of subunit in the process.
- To study and understand the importance of microbiomics in microbial diversity mapping.

B.Sc. (H) FOOD TECHNOLOGY III SEMESTER
SFT 227: MOLECULAR BIOLOGY (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Study of different types of DNA and RNA using micrographs and model / schematic representations
2. Study of semi-conservative replication of DNA through micrographs / schematic representations
3. Estimation of salmon sperm / calf thymus DNA using colorimeter (diphenylamine reagent) or UV spectrophotometer (A260 measurement)
4. Resolution and visualization of DNA by Agarose Gel Electrophoresis.
5. Resolution and visualization of proteins by Polyacrylamide Gel Electrophoresis (SDS-PAGE).
6. Study the effect of chemical (HNO_2) and physical (UV) mutagens on bacterial cells.
7. Study survival curve of bacteria after exposure to ultraviolet (UV) light
8. Demonstration of Bacterial Transformation and calculation of transformation efficiency.

Recommended Readings:

1. Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008) Molecular Biology of the Gene, 6th edition, Cold Spring Harbour Lab. Press, Pearson Publication
2. Becker WM, Kleinsmith LJ, Hardin J and Bertoni GP (2009) The World of the Cell, 7th edition, Pearson Benjamin Cummings Publishing, San Francisco
3. De Robertis EDP and De Robertis EMF (2006) Cell and Molecular Biology, 8th edition. Lippincott Williams and Wilkins, Philadelphia
4. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons. Inc.
5. Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition, Cold Spring Harbour Laboratory press.
6. Krebs J, Goldstein E, Kilpatrick S (2013). Lewin's Essential Genes, 3rd Ed., Jones and Bartlett Learning

7. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India
8. Klug WS, Cummings MR, Spencer, C, Palladino, M (2011). Concepts of Genetics, 10th Ed., Benjamin Cummings
9. Maloy SR, Cronan JE and Friefelder D (2004) Microbial Genetics 2nd EDITION., Jones and Barlett Publishers 10. Russell PJ. (2009). i Genetics- A Molecular Approach. 3rd Ed, Benjamin Cummings

Course Outcomes:

By the end of the practicals, the student will be able to

- Know types of DNA and RNA, and semi-conservative replication of DNA
- Perform DNA estimation-an important parameter in rDNA technology studies
- Run Agarose gel electrophoresis of DNA, know the size and purity of DNA
- Perform transformation and tell transformation efficiency

B.Sc. (H) FOOD TECHNOLOGY II SEMESTER

SFT 243: TECHNOLOGY OF SPICES (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

Spices are woven into the history of nations. Most of the spices are native of our country and hence India is known as the Land of Spices. Spices impart aroma, color and taste to food preparations. Most of the spices have potential medicinal values. Spices and spice products are also indirectly used as flavoring or coloring agents or as preservatives in many pharmaceutical preparations.

Course Objectives:

- To introduce students to the world of plants and their products with an emphasis on the creative use of spices in enhancing the aroma and taste of many dishes.
- Understand the history of herbs, spices, and medicinal plants.
- Understand the important role of herbs and spices in human history
- Familiarize about the value added products of spices

Unit I

Spices - Definition, Composition, classification. Spice production in India, role of spices in cookery, spice processing technology. Post processing treatment- steam sterilization, irradiation, and chemical fumigation. Nutritive value of spices. Application in food systems

Learning Outcomes:

By the end of the course, the student will be able to

- Familiarize with classification, nutritive value and composition of spices
- Describe role of spices in cookery
- Understand the concepts of spices processing

Unit II

Major spices –pepper, cardamom, chillies, ginger, turmeric composition, production, processing, uses, health benefits, active spice constituents. Minor spices –Asafoetida, ajwain, aniseed, bay leaves, caraway cinnamon, clove, coriander, cumin, fenugreek, garlic, nutmeg, mace, kokam, saffron- uses and active spice constituents.

Learning Outcomes:

By the end of the course, the student will be able to:

- Differentiate between major and minor spices
- Understand the technologies involved in spice processing
- Gain knowledge on uses and active spice constituents.

Unit III

Benefits of value added products. Primary and secondary functions of spices. Role of biotechnology in improvement of spice crops. Adulteration of spices. Economic uses of spices.

Learning Outcomes:

By the end of the course the student will be able to

- Discuss various value added products of spices.
- Differentiate between the primary and secondary functions of spices
- Discuss the role of biotechnology in improvement of spice crops

Unit IV

Technology of manufacturing spice extractives - oleoresins and oils, advantages and applications of spice extractives**.** Spice contaminants- harmful effects, preventive measures, decontamination techniques, sterilization of spices. Spoilage of spices-factors affecting spice spoilage, Preservation of spices.

Learning Outcomes:

By the end of the course, the student will be able to

- Describe various methods for manufacturing spice extracts
- Gain knowledge on spice contaminants
- Identify methods of preservation of spices

Unit V

Packaging and storage of spices- packaging requirements, types and characteristics of packaging materials, labeling considerations of spice and spice products, storage stability. Quality control of spices, spice specific tests. Storage requirements of spice and spice products. Spice board of India.

Learning Outcomes:

By the end of the course, the student will be able to

- Explain the need of proper packaging for spices
- Summarize different types of packaging materials suitable for spices
- Apply the concept of Quality control in spice processing

Course Outcomes:

By the end of the course, the student will be able to:

- Describe role of spices in cookery
- Describe various methods for manufacturing spice extracts
- Apply the concept of Quality control in spice processing

B.Sc. (H) FOOD TECHNOLOGY II SEMESTER

SFT 229: TECHNOLOGY OF SPICES (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Testing for adulterants in spices
2. Processing of some spices
3. Extraction of various spices
4. Investigating the antimicrobial activity of various spices
5. Visit to commercial crop production and research centers
6. Value addition of spices

Recommended Readings:

1. Handbook of Herbs and Spices (2006)Volume 3 by K. V. Peter
2. Chemistry of Spices (2008) by V. A. Parthasarathy
3. Handbook on Spices &Condiments (Cultivation, Processing and Extraction) 2010 by H. Panda
4. The Complete Book on Spices & Condiments (2006) 2nd edition by NIIR Board
5. Cultivation of Spice Crops (2005) by Azhar Ali Farooqi

Course Outcomes:

By the end of the practicals, the student will be able to

- Understand the importance of spices and herbs in cooking
- List the value added products of various spices
- Summarize various applications of spices
- Differentiate major and minor spices

B.Sc. (H) FOOD TECHNOLOGY IV SEMESTER

SFT 242: GENETIC ENGINEERING AND BIOTECHNOLOGY (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

This curse provides an overview about the molecular cloning-from given the DNA template to protein synthesis using rDNA technology techniques.

Course Objectives:

- To get an overall idea given the DNA template to protein synthesis using molecular cloning and rDNA technology techniques.
- To learn about the important methods to know the success of the molecular biology and rDNA technology like sequencing etc

Unit I

Introduction to genetic engineering and biotechnology, restriction modification systems: mode of action, applications of type II restriction enzymes in genetic engineering, DNA modifying enzymes and their applications: DNA polymerases. terminal deoxynucleotidyl transferase, kinases and phosphatases, and DNA ligases cloning: use of linkers and adaptors, transformation of DNA electroporation, methods of dna, rna and protein analysis

Learning Outcomes:

By the end of the course, the student will be able to

- Get overall view about the production of recombinant protein-given the DNA template using the molecular cloning-rDNA technology techniques
- Learn about the importance of restriction enzymes, DNA ligases, transformation, and selection of positive clones.

Unit II

Vectors: Cloning Vectors: Definition and Properties Plasmid vectors: pBR and pUC series Bacteriophage lambda and M13 based vectors Cosmids, BACs, YACs Expression vectors: E.coli

lac and T7 promoter-based vectors, yeast YIp, YEp and YCp vectors, Baculovirus based vectors, mammalian SV40-based expression vectors

Learning Outcomes:

By the end of the course, the student will be able to

- Learn about the importance of cloning vectors in molecular cloning

Unit III

DNA Amplification and DNA sequencing: Basics of PCR, RT-PCR, Real-Time PCR Genomic and cDNA libraries: Preparation and uses, Genome sequencing Sanger's method of DNA Sequencing: traditional and automated sequencing

Learning Outcomes:

By the end of the course, the student will be able to

- Get an overall view about the importance of sequencing and procedures of sequencing methods.
- Learn about important techniques like PCR etc. and its usage in rDNA technology

Unit IV

Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viralmediated delivery, Agrobacterium - mediated delivery Products of recombinant DNA technology: Products of human therapeutic interest - insulin, hGH, antisense molecules. Bt transgenic - cotton, brinjal, flavo savo tomato, Gene therapy, recombinant vaccine, protein engineering

Learning Outcomes:

By the end of the course, the student will be able to

- Get an overall view about the importance of different gene delivery methods.
- Learn about transgenics and protein engineering

Unit V

Introduction to Indian Patent Law. World Trade Organization and its related intellectual property provisions. Intellectual/Industrial property and its legal protection in research, design and development. Patenting in Biotechnology, economic, ethical and depository considerations.

Learning Outcomes:

By the end of the course, the student will be able to

- Understand Indian Patent Law, rules and regulations
- Learn Intellectual Property and its legal protection in research, design and development

Course Outcomes:

By the end of the course, the student will be able to:

- Learn about the importance of cloning vectors in molecular cloning
- Get an overall view about the importance of sequencing and procedures of sequencing methods.
- Understand Indian Patent Law, rules and regulations

B.Sc. (H) FOOD TECHNOLOGY IV SEMESTER

SFT 228: GENETIC ENGINEERING AND BIOTECHNOLOGY

(PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Isolation of Plasmid DNA from E.coli
2. Digestion of DNA using restriction enzymes and analysis by agarose gel electrophoresis
3. Ligation of DNA fragments
4. Interpretation of sequencing gel electropherograms
5. Designing of primers for DNA amplification
6. Amplification of DNA by PCR
7. Demonstration of Southern blotting

Recommended Readings:

1. Brown TA. (2010). Gene Cloning and DNA Analysis. 6th edition. Blackwell Publishing, Oxford, U.K.
2. Clark DP and Pazdernik NJ. (2009). Biotechnology: Applying the Genetic Revolution. Elsevier Academic Press, USA
3. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
4. Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press
5. Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education

Course Outcomes:

By the end of the practicals, the student will be able to

- Isolate plasmid DNA, understand about the restrictions digestions, ligation, transformation, and screening of positive clones
- Interpret sequencing results and able to set up PCR cycles for amplification of DNA

B.Sc. (H) FOOD TECHNOLOGY IV SEMESTER

SFT 244: FUNCTIONAL FOODS AND NUTRACEUTICALS (THEORY)

Hours per week: 3 End Examination: 60 Marks

Credits: 2 Sessionals: 40 Marks

Preamble:

Functional food or medicinal food is any fresh or processed food claimed to have a health-promoting and/or disease-preventing property beyond the basic nutritional function of supplying nutrients. This is an emerging field in food science, in which such foods are usually accompanied by health claims for marketing purposes. Functional foods are sometimes called nutraceuticals, a portmanteau of nutrition and pharmaceutical, and can include food that has been genetically modified. Fermented foods with live cultures are often also considered to be functional foods with probiotic benefits.

Course Objectives:

- To develop comprehensive understanding of different nutraceuticals and functional foods
- To understand the potential of various functional foods in promoting human health

Unit I

Functional foods and Nutraceuticals -Definitions, sources, Health benefits, bioactive components of functional foods. Development of functional foods, challenges and safety considerations, Future trends of functional foods. Dietary supplements and fortified foods- need, health benefits adverse effects.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Know about health benefits and adverse effects of Functional foods and Nutraceuticals
- Learn about development of functional foods, challenges and safety considerations

Unit II

Functional foods of animal origin: Diary products, sea foods, egg, Functional foods of plant origin: fruits, vegetables, nuts, spices, cereals, and beverages. Probiotics, prebiotics and synbiotics as functional foods, Effects of probiotics on health.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Learn about probiotics, prebiotics and synbiotics effects on health
- Know about functional foods of animal origin and plant origin

Unit III

Types of functional foods**:** whole foods, enriched foods, enhanced foods, fortified foods, modified foods. Market of functional foods, Challenges for Functional food delivery, Factors affecting consumer interest.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Understand types and challenges of functional foods
- Know about factors affecting consumer interest.

Unit IV

Diet and disease relationship – nutrition and health claims, Food component – approved health claims, labeling considerations for functional ingredients, Permissible and impermissible functional claims, Role of biotechnology in the development of functional foods.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Understand nutritional benefits functional foods
- Know about diet and disease relationship and health claims

Unit V

Nutraceutical compounds – Phytochemicals, phytosterols and other bioactive compounds, peptides and proteins, carbohydrates, prebiotics, probiotics and synbiotics, lipids, vitamins and minerals; their sources and role in promoting human health.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Know about phytochemicals, phytosterols and other bioactive compounds role in promoting human health
- Understand about sources of Nutraceutical compounds

Course Outcomes:

By the end of the course, the student will be able to

- Develop comprehensive understanding of different nutraceuticals and functional foods.
- Understand and acquire knowledge about the potential of various functional foods in promoting human health

B.Sc. (H) FOOD TECHNOLOGY IV SEMESTER

SFT 230: FUNCTIONAL FOODS AND NUTRACEUTICALS (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Estimation of fats, Proteins and carbohydrates
2. Estimation of Iodine in fortified foods.
3. Estimation of carotenoids in vegetables/fruits.
4. Estimation of polyphenols in plant products.
5. Determination of antioxidant property in Vitamin C rich food products.
6. Estimation of Anthocyanin pigments in fruits and vegetables.
7. In vitro model for testing the survival of bacteria from commercial probiotic supplements.
8. Market survey for nutraceuticals rich in ready to eat food products and raw foods (cereals/pulses, fruits and vegetables).

Recommended Readings:

1. Text Book of Human Nutrition (2010) by Bamji
2. Handbook of Nutraceuticals and Functional Foods, Second Edition Robert E C Wildman
3. Functional Foods and Nutraceuticals 2012 Rotimi E. Aluko
4. Functional Foods: Principles and Technology (2009) Mingro Guo CRC
5. Functional Foods: Designer Foods, Pharma foods, Nutraceuticals I. Goldberg

Course Outcomes:

By the end of the practicals, the student will be able to:

- To perform the estimations of carbohydrates, proteins, and fats and their importance in quantifying them
- To perform the estimations of polyphenols, carotenoids, iodine, Vitamin C and their importance in quantifying them

B.Sc. (H) FOOD TECHNOLOGY V SEMESTER

SFT 341: FOOD PACKAGING (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

This course informs the student brief idea about food preservation processes and techniques, product quality and shelf life, and the in-depth knowledge about logistical packaging, packaging materials, machinery and processes, necessary for a wide range of packaging presentations. The course also teaches food packaging innovation have a thorough technical understanding of the requirements of a product for protection and preservation, together with a broad appreciation of the multi-dimensional role of packaging.

Course Objectives:

• To impart comprehensive overview of the scientific and technical aspects of food packaging.

• To instill knowledge on packaging machinery, systems, testing and regulations of packaging.

Unit I

Packaging functions and Requirements, printing of packages. Barcodes and other marking, Labeling Laws. Paper and paper-based materials, corrugated fiber board (CFB).Plastics, formation- molding, types of plastics, biodegradable plastics, edible packaging, environmental concerns.

Learning Outcomes:

By the end of this Unit, the student will be able to:

- Understand the idea of food packaging, importance of printings and barcoding
- Understand the packaging products-paper and plastics
- Learn the Labelling and related Laws, importance of labelling of nutrient information

Unit II

Metal packaging- Metals: Tinplate, tinning process, components of tinplate, tin free can (TFC) types of can, metallic films, lacquers Glass: Composition, Properties, Methods of bottle making, and types of closures.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Understand about food packaging materials such as metal packaging materials manufacture and types, and importance of metal cans
- Understand about food packaging materials such as glass packaging materials manufacture and types, and importance

Unit III

Package design for fresh horticultural produce and animal foods, dry and moisture sensitive foods, frozen foods, fats and oils, thermally processed foods and beverages.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Learn about appropriate suitable packaging designs for various foods

Unit IV

Testing Procedures for Packaging Materials- thickness, tensile strength, puncture resistance, bursting strength, seal strength, water vapor permeability, CO_2 permeability, oxygen permeability, grease resistance, Testing Procedures for Packaged Foods - Compatibility and shelf life studies, evaluation of transport worthiness of filled packages.Food Packaging Laws and Regulations.

Learning Outcomes:

By the end of this Unit, the student will be able to:

- Understand testing (variety of methods to know the quality of packaging material) and regulatory aspects of food packaging.
- Know about food packaging laws and regulations

Unit V

Bottling machines, Cartoning systems, Seal and Shrink packaging machine; Form, Fill and Sealing machine (FFS).Vacuum, Controlled and Modified atmosphere packaging systems; Aseptic packaging systems; Retort packaging, Active and Intelligent packaging systems.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Understand the principle and working of different packaging machinery and systems
- Importance of smart packaging that deals active and intelligent packaging systems

Course Outcomes:

By the end of the course, the student will be able to:

- Understand the idea of food packaging, importance of printings and barcoding
- Learn about appropriate suitable packaging designs for various foods
- Understand the principle and working of different packaging machinery and systems

B.Sc. (H) FOOD TECHNOLOGY V SEMESTER

SFT 325: FOOD PACKAGING (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Testing of physical/mechanical properties of food packaging material.
2. Testing of thermal shock resistance of glass.
3. Gas/Vacuum packaging of foods and shelf life studies.
4. Determination of Water Vapor Transmission rate of Packaging Material.
5. Edible packaging of Food Samples.
6. Study of Sorption Isotherm for Food Package Design.
7. Packaged food cut-out analysis.
8. To study the operation of FFS machine.

Recommended Readings:

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

Course Outcomes:

By the end of the practicals, the student will be able to

- Understand the physical and mechanical properties of food packaging materials
- Preparation of edible packaging of food samples
- Understand the principle and working of different packaging machinery and systems
- Importance of smart packaging that deals active and intelligent packaging systems

B.Sc. (H) FOOD TECHNOLOGY V SEMESTER

SFT 343: FERMENTATION TECHNOLOGY (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

Fermentation is a metabolic process that produces chemical changes in organic substrates through the action of enzymes. Industrial fermentation is the intentional use of fermentation by microorganisms such as bacteria and fungi to make products useful to humans. Fermentation technology is a valuable tool for future economic development. Fermented products have applications as food as well as in general industry.

Course Objectives:

- To impart comprehensive overview of the scientific and technical aspects of fermentation technology
- To instill knowledge on regulated methodology in fermentation and process of production

Unit I

Introduction to fermentation processes, microorganisms used in food fermentation. Isolation, primary and secondary screening methods. Preservation and strain improvement methods

Learning Outcomes:

By the end of this Unit, the student will be able to

- Know about microorganisms used in food fermentation
- Summarize the screening methods
- Gain knowledge on preservation and strain improvement methods.

Unit II

Design of fermentor, types of fermentors: maintenance of aseptic conditions, instrumentation control, physical and chemical environment sensors, control of various physical parameters; fermentation economics.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Summarize the types of fermentors
- Gain knowledge on fermentation economics
- Describe the design of fermentor

Unit III

Industrial media formulation; substrates for fermentation – carbon and nitrogen sources; antifoams; sterilization; inoculums development, Types of fermentations- batch, continuous, dual or multiple fermentations. Solid state, surface, submerged fermentations, scale up.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Discuss various carbon and nitrogen sources
- Compare and contrast different types of fermentations
- Gain knowledge on industrial media formulation

Unit IV

Industrial production: Industrial production of enzymes, proteolytic enzymes, pectinases, amylases, organic acids – acetic acid, lactic and citric acid. Production of vitamins (Vitamin B2, Vitamin B12), Baker's yeast, yoghurt.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Gain knowledge on industrial production of enzymes
- Gain knowledge on industrial production of vitamins
- Gain knowledge on industrial production of organic acids

Unit V

Immobilization technology. Downstream processing- solid-liquid separation, Release of intracellular products, concentration, recovery and purification. Computer applications in fermentation technology.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Illustrate the immobilization technology
- Summarize downstream processing
- Discuss on the applications of computers in fermentation technology

Course Outcomes:

By the end of the course, the student will be able to:

- Know about microorganisms used in food fermentation
- Gain knowledge on industrial production of enzymes, vitamins, organic acids
- Discuss on the applications of computers in fermentation technology

B.Sc. (H) FOOD TECHNOLOGY V SEMESTER

SFT 327: FERMENTATION TECHNOLOGY (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Design of fermentor
2. Screening for amylase production.
3. Screening for organic acid production by crowded plate technique
4. Screening of antibiotic producing microorganisms.
5. Isolation of yeasts from grapes.
6. Production of Wine
7. Production and estimation of Ethanol

Recommended Readings:

1. Industrial Microbiology (1984) by A.H. Patel.
2. Prescott and Dunn's Industrial Microbiology (2004) by G. Reed.
3. Solid State Fermentation in Biotechnology (2009) by Ashok Pandey.
4. Industrial Microbiology (2002) by Waites.
5. Biotechnology: A Text Book of Industrial Microbiology (1991) by Cruger and Cruger.
6. Principles of Fermentation Technology (2008) by Stanbury.
7. Microbial Technology: Microbial Processes (2009) by H. J. Peppler.

Course Outcomes:

By the end of the practicals, the student will be able to

- Get an overview on the technical concepts of fermentation
- Identify the role and need of computers in fermentation technology
- Gain knowledge on industrial production of various products
- Compare and contrast different types of fermentations

B.Sc. (H) FOOD TECHNOLOGY V SEMESTER

SFT 345: CLINICAL NUTRITION (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

Food is the basic necessity of life. Nutrition is the scientific study of food and its relation to health. Therapeutic nutrition refers to the use of food and the nutrients it contains to prevent or treat a disease or condition. Therapeutic nutrition brings awareness about the main etiological factors responsible for various ailments of the present day generation.

Course Objectives:

- To provide an overview of fundamental knowledge in food and nutrition.
- To introduce students to clinical dietary and nutritional principles
- To translate basic concepts of medical nutrition therapy for the different diseases into practical menu planning application
- To familiarize the concept of lifestyle changes

Unit I

Therapeutic diet-Principles of diet therapy. Factors to be considered during meal planning. Therapeutic modification of normal diet, assessment of patient needs, special feeding methods-tube feeding, parenteral feeding. Nutrition counseling, Risk factors of different nutritional and metabolic disorders.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Know about the status of nutraceuticals and functional food market
- Understand types of nutraceutical compounds and their health benefits

Unit II

Dietary management- Diabetes mellitus – etiology, prevalence, risk factors, symptoms, classification, diagnosis, complications, insulin. Obesity- etiology, types, theories, assessment,

risk factors, complications, dietary and non- dietary treatment. Underweight- etiology, dietary modifications.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Learn about dietary management for Diabetes mellitus, Obesity, Underweight
- Understand complications, diagnosis of various health risk factors

Unit III

Anatomy and functions of gastro intestinal tract, common gastro intestinal disorders – dyspepsia, diarrhoea, peptic ulcers, constipation- etiology symptoms and dietary treatment. Structure and functions of liver. Liver disorders - hepatitis, cirrhosis and hepatic coma- etiology, symptoms, diagnosis and dietary management

Learning Outcomes:

By the end of this Unit, the student will be able to

- Learn anatomy and functions of gastro intestinal tract, common gastro intestinal disorders
- Understand diagnosis and dietary management for Gastro intestinal and liver disorders.

Unit IV

Cardiovascular system components, Anatomy and functions of heart, cardiovascular diseases: etiology, prevalence, modifiable and non-modifiable risk factors, symptoms, diagnosis, medications, Dietary management in atherosclerosis, hypertension, myocardial infarction.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Learn about anatomy and functions of heart
- Know about cardiovascular diseases and its dietary management

Unit V

Anatomy and functions of kidneys- symptoms, etiology, diagnosis Dietary management of kidney and urinary tract: Nephritis, renal calculi. Etiology, symptoms and dietary management – Anaemia, Inborn errors of metabolism- phenylketonuria, galactosemia, Lactose intolerance.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Learn about anatomy and functions of kidney
- Understand about renal diseases and its dietary management

Course Outcomes:

By the end of the course, the student will be able to:

- Know about the status of nutraceuticals and functional food market
- Learn about dietary management for Diabetes mellitus, Obesity, Underweight
- Learn anatomy and functions of gastro intestinal tract, common gastro intestinal disorders

B.Sc. (H) FOOD TECHNOLOGY V SEMESTER

SFT 329: CLINICAL NUTRITION (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Formulating diet for preschool going children (2-5 years).
2. Planning high protein diets
3. Planning low fat and low caloric diets.
4. Planning and preparation of high fibre diets.
5. Planning diet for diabetic mellitus
6. Planning diet for cardio vascular disease
7. Planning diet for anemia
8. Formulation of antioxidant rich foods

Recommended Readings:

1. Dietetics (2007) by B. Srilakshmi.
2. Nutrition and Diet Therapy (2005) by S.R.Williams.
3. Text Book of Human Nutrition (2010) by Bamji
4. Essentials of Human Nutrition (2007) by A.S.Truswell.
5. Advancing Dietitics and Clinical Nutrition (2011) by A. Payne and H.M.Barker.

Course Outcomes:

By the end of the practicals, the student will be able to

- Describe different methods of feeding in relation to the health status
- Identify risk factors associated with various illnesses
- Develop a day diet plan that addresses client's disease incorporating the client's cultural preferences
- Describe the current prevalence of various diseases
- Understand the physiological role physical activity plays in the various diseases

B.Sc. (H) FOOD TECHNOLOGY VI SEMESTER

SFT 342: INSTRUMENTATION FOR FOOD ANALYSIS (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

This paper gives student an idea about principles and procedures in performing different chromatographic techniques like in purifying the proteins to homogeneity, testing the purity levels by different electrophoretic techniques, and quantitating the same by spectrophotometric methods. This paper also gives you brief idea about the different radioactive methods for measurement of radioactivity, electrochemical methods in determining the pH of the solution, and about importance of biosensors. This course also helps to quantitate the scientific data, importance of statistics and application of various statistical methods, importantly, standard deviation, correlation, and regression related to bioanalytical techniques.

Course Objectives:

- To understand the detailed principles, procedures and applications of various chromatographic techniques for example in learning the purification of proteins by using ion exchange and affinity chromatography, and molecular weight determination by size exclusion chromatography.
- To learn the principles, procedures and applications of various electrophoretic techniques, importantly knowing the difference between SDS and native PAGE, and isoelectric focussing.
- To study the principles, procedures and applications of various spectrophotometric methods especially in quantitation of desired compound in the given solutions.
- To know the principles, procedures and applications of radioactive methods for measurement of radioactivity, electrochemical methods, and biosensors.
- To focus on the usage of different statistical methods learned with respect to bioanalytical techniques perspectives.

Unit I

Principles and applications of chromatographic techniques: paper chromatography, thin layer chromatography, gel filtration, ion-exchange chromatography, affinity chromatography, gas chromatography, high performance liquid chromatography, fast protein liquid chromatography.

Learning Outcomes:

By the end of this Unit, the student will be able to:

- Understand the detailed principles, procedures and applications of various chromatographic techniques.
- Learn the basics of isolation of proteins to the purification of the proteins to homogeneity, and especially with the usage of high end chromatography columns, and purification procedures.
- Know the prerequisites for making recombinant protein for ease in purification of proteins with tags such as his-tag etc.
- Identify carbohydrates and amino acids by techniques like paper and thin layer chromatography

Unit II

Principles and concepts of electrophoretic techniques: native polyacrylamide gel electrophoresis (PAGE), sodium dodecyl sulphate-PAGE, agarose gel electrophoresis, capillary electrophoresis, isoelectric focusing and two dimensional, pulse field and diagonal electrophoresis.

Learning Outcomes:

By the end of this Unit, the student will be able to:

- Understand the principles, components, and applications of various electrophoretic techniques.
- Know the difference between SDS-PAGE and native PAGE techniques with respect to proteins
- Learn the importance of agarose gel electrophoresis with respect to molecular biology techniques like PCR and molecular cloning
- Visualize the purity of proteins those are purified to homogeneity using various chromatography columns.

Unit III

Principles and applications of UV-visible, infrared, fluorescence spectroscopy, AAS, ESR, NMR. Principles and applications of preparative and analytical ultracentrifuges.

Learning Outcomes:

By the end of this Unit, the student will be able to:

- Know the principles, components, and applications of various spectrometry techniques.
- Learn the utilization of UV-visible to know the concentrations of the solutions.

Unit IV

FTIR, XRF, Differential Scanning Calorimetry, XRD, SEM, TEM, water activity meter, textural analyzer, biosensors, nitrogen analyzers

Learning Outcomes:

By the end of this Unit, the student will be able to:

- Understand the importance of techniques such as XRD for retrieving the structure of the protein with high resolution.
- Understand the principles of Differential scanning calorimetry, SEM, TEM etc.
- Gain knowledge on various biosensors and their applications in many industries

Unit V

Detection and measurement of radioactivity. Radioactive and non-radioactive tracer techniques and their applications in the field of biological sciences. Principles of electrochemical techniques –operation and applications of pH, oxygen, ion-selective and gas sensing electrodes.

Learning Outcomes:

By the end of this Unit, the student will be able to:

- Gain knowledge on various radioactive and stable isotopes, tracer techniques, and about biosensors and their applications in many industries.
- Know the instruments used for measurement of radioactivity
- Learn the working of pH electrode etc.

Course Outcomes:

By the end of the course, the student will be able to:

- Understand the detailed principles, procedures and applications of various chromatographic techniques.
- Understand the principles, components, and applications of various electrophoretic techniques.
- Know the principles, components, and applications of various spectrometry techniques.
- Understand the importance of techniques such as XRD for retrieving the structure of the protein with high resolution.

B.Sc. (H) FOOD TECHNOLOGY VI SEMESTER

SFT 326: INSTRUMENTATION FOR FOOD ANALYSIS (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Separation and identification of sugars using paper chromatography
2. Separation and identification of sugars using thin layer chromatography
3. Separation and identification of amino acids using paper chromatography
4. Estimation of DNA concentration by Diphenylamine method
5. Estimation of RNA concentration by Orcinol method
6. Separation of proteins by SDS-PAGE

Recommended Readings:

1. Principles and Techniques of Biochemistry and Molecular Biology (7th edition) by K. Wilson and J. Walker.
2. A Biologists guide to Principles and Techniques of Practical Biochemistry (3rd edition) by B.D.Williams.
3. Biophysical Chemistry: Principles and Techniques (2010) by Upadhyay, Upadhyay and Nath.

Course Outcomes:

By the end of the practicals, the student will be able to

1. Learn to separation and identify proteins and amino acids by paper and thin layer chromatography
2. Know the concentrations of DNA and RNA
3. Separate and check for the quality of proteins by SDS-PAGE.

B.Sc. (H) FOOD TECHNOLOGY IV SEMESTER

SFT 344: FOOD SAFETY AND HYGEINE (THEORY)

Hours per week: 4 End Examination: 60 Marks

Credits: 4 Sessionals: 40 Marks

Preamble:

Food hygiene are the conditions and measures necessary to ensure the safety of food from production to consumption. Food can become contaminated at any point during slaughtering or harvesting, processing, storage, distribution, transportation and preparation. The term 'food hygiene' refers particularly to the practices that prevent microbial contamination of food at all points along the chain from farm to table. Food hygiene and safety issues are not separate from human health concerns or from community health issues. Good food hygiene practices can protect the community from foodborne illness.

Course Objectives:

- To describe the public health importance and aims of food hygiene.
- To define the essential functions of food
- To outline the principle aspects of a food control system and explain why food control is important.

Unit I

Introduction to Food Safety – Definition, Types of hazards, biological, chemical, physical hazards, Factors affecting Food Safety, Importance of Safe Foods, Food Hazards of Physical and Chemical Origin – Introduction, Physical Hazards with common examples, Chemical Hazards (naturally occurring ,environmental and intentionally, added), Packaging material as a threat, Impact on health, Control measures

Learning Outcomes:

By the end of this unit, the student will be able to

- Prevent food spoilage, i.e. changes that make food unfit for consumption due to microbial or chemical contamination.
- Inform and educate people about simple and practical methods of keeping food safe to protect themselves against foodborne diseases.

- Protect food from adulteration (intentional contamination).
- Differentiate unsafe food, misbranded food, adulterated food, wholesome food and uncontaminated food

Unit II

Food Hazards of Biological Origin – Introduction, Indicator Organisms, Food borne pathogens: bacteria, viruses and eukaryotes, Seafood and Shell fish poisoning, Mycotoxins. Management of hazards – Need, Control of parameters, Temperature control, Food storage

Learning Outcomes:

By the end of this unit, the student will be able to

- Identify whether food is safe for consumption using indicator organisms
- Differentiate between fungal, algal and microbial toxins
- Manage hazards which occur during processing and storage

Unit III

Hygiene and Sanitation in Food Service Establishments – Introduction, Sources of contamination, Control methods using physical and chemical agents, Waste Disposal, Pest and Rodent Control, Personnel Hygiene

Learning Outcomes:

By the end of this unit, the student will be able to

- Identify various sources of contamination
- Prevent contamination of food using physical and chemical agents
- Learn how to dispose the waste safely and make money out of waste

Unit IV

Food Safety Management Tools - Basic concept, Prerequisites- GHPs ,GMPs, HACCP, ISO series, TQM - concept and need for quality, components of TQM, Kaizen, Risk Analysis, Accreditation and Auditing

Learning Outcomes:

By the end of this unit, the student will be able to

- Illustrate important safety tools like HACCP that will help food industries to handle, store, and sell safe food to customers while ensuring compliance with the necessary standards
- Understand practices and procedures to actively control risks and hazards throughout the food process and ensure regulatory compliance.

Unit V

Microbiological criteria - Microbiological standards and limits (for processed food, water), Sampling, Basic steps in detection of food borne pathogens, Water Analysis Food laws and Standards - Indian Food Regulatory Regime, Global Scenario, Recent concerns - New and Emerging Pathogens, Genetically modified foods\Transgenics, Organic foods, Newer approaches to food safety.

Learning Outcomes:

By the end of this unit, the student will be able to

- Understand the advantages of genetically modified foods, that GMO plants can be resistant to specific pesticides and herbicides while becoming adaptive to changing environmental conditions.
- Illustrate that crop yields become more consistent and productive, allowing more people to be fed.

Course Outcomes:

By the end of the course, the student will be able to:

- Prevent food spoilage, i.e. changes that make food unfit for consumption due to microbial or chemical contamination.
- Learn how to dispose the waste safely and make money out of waste
- Understand practices and procedures to actively control risks and hazards throughout the food process and ensure regulatory compliance.

B.Sc. (H) FOOD TECHNOLOGY VI SEMESTER

SFT 328: FOOD SAFETY AND HYGEINE (PRACTICAL)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

1. Preparation of different types of media (complex, differential and selective)
2. Enumeration of aerial microflora using PDA
3. Identification of Molds by lactophenol blue staining
4. Negative Staining
5. Microbiological Examination of food
6. Bacteriological Analysis of Water by MPN method
7. Assessment of surface sanitation by swab and rinse method
8. Assessment of personal hygiene

Recommended Readings:

1. Lawley, R., Curtis L. and Davis,J. The Food Safety Hazard Guidebook , RSC publishing, 2004
2. De Vries. Food Safety and Toxicity, CRC, New York, 1997
3. Marriott, Norman G. Principles of Food Sanitation, AVI, New York, 1985
4. Forsythe, S J. Microbiology of Safe Food, Blackwell Science, Oxford, 2000Forsythe,S.J.The Microbiology of Safe Food , second edition, Willey- Blackwell,U.K.,2010
5. Mortimore S.and Wallace C.HACCP,A practical approach, Chapman and Hill,London,1995
6. Blackburn CDW and Mc Clure P.J.Food borne pathogens. Hazards, risk analysis & control.CRC Press, Washington,U.S.A, 2005.

Course Outcomes:

By the end of the practicals, the student will be able to

- Culture different bacteria, molds and yeast using various types of media
- Identify different types of microorganisms using staining techniques
- Understand the importance of personal hygiene

B.Sc. (H) FOOD TECHNOLOGY III SEMESTER

SSE 283: BIOETHICS AND BIOSAFETY (THEORY)

Hours per week: 4

Credits: 4 Sessionals: 100 Marks

Preamble:

Bioethics is the study of the ethical issues emerging from advances in biology and medicine. Bioethics are concerned with the ethical questions that arise in the relationships among life sciences, biotechnology, medicine and medical ethics, politics, law, and philosophy. Intellectual property refers to creations of the mind: inventions; literary and artistic works; and symbols, names and images used. Intellectual property is divided into two categories: Industrial Property includes patents for inventions, trademarks, industrial designs and geographical indications.

Course Objectives:

- To create a stable research environment to encourage investigation, analysis and studying the bioethical principles, values, concepts, social and juridical implications.
- To gain knowledge on the human rights contained in the Universal Declaration on Bioethics
- To create awareness on protection of the rights of IP owners to enable them to reap the rewards of their creativity.

Unit I

Introduction to Indian Patent Law. World Trade Organization and its related intellectual property provisions. Intellectual/Industrial property and its legal protection in research, design and development. Patenting in Biotechnology, economic, ethical and depository considerations.

Learning Outcomes:

By the end of the course, the student will be able to

- Understand Indian Patent Law, rules and regulations
- Learn Intellectual Property and its legal protection in research, design and development

Unit II

Entrepreneurship: Selection of a product, line, design and development processes, economics on material and energy requirement, stock the product and release the same for making etc. The basic regulations of excise: Demand for a given product, feasibility of its production under given constraints of raw material, energy input, financial situations export potential etc.

Learning Outcomes:

By the end of the course, the student will be able to

- Learn and understand all the prerequisites for Entrepreneurship
- Learn basic regulations of excise

Unit III

Bioethics – Necessity of Bioethics, different paradigms of Bioethics – National & International. Ethical issues against the molecular technologies.

Learning Outcomes:

By the end of the course, the student will be able to

- Understand the concepts of Bioethics
- Gain awareness on national and international ethical issues

Unit IV

Biosafety– Introduction to biosafety and health hazards concerning biotechnology. Introduction to the concept of containment level and Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).

Learning Outcomes:

By the end of the course, the student will be able to

- Grasp the biosafety regulations to be followed in India
- Apprehend the guidelines to be followed for conducting research in biology

Unit V

Forensic science: e.g. solving violent crimes such as murder and rape; solving claims of paternity and theft etc. using various methods of DNA finger printing.

Health: e.g. development of non-toxic therapeutic agents, recombinant live vaccines, gene therapy, diagnostics, monoclonal in E.coli, human genome project.

Learning Outcomes:

By the end of the course, the student will be able to

- Learn techniques to perform forensic science
- Learn about development of non-toxic therapeutic agents, recombinant live vaccines

Course Outcomes:

By the end of the course, the student will be able to:

- Understand Indian Patent Law, rules and regulations
- Understand the concepts of Bioethics
- Learn techniques to perform forensic science

B.Sc. (H) FOOD TECHNOLOGY III SEMESTER

SSE 293: MATHEMATICS FOR LIFE SCIENCES (THEORY)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

Preamble:

This course enables the students understand the importance of mathematics in the field of life sciences. The student will get idea on trigonometry, differentiation, and integration and knowledge acquired by reading them can be exploited to understand the important equations, derivations related to food technology applications for example in the fields of food engineering.

Course Objectives:

- To develop comprehensive understanding of mathematical measurements of standards and limitations
- To understand the Differentiation of a function with respect to another function

Unit I

Trigonometry: Measurement of angles, Trigonometric ratios, Trigonometric identities, Trigonometric ratios of compound angles.

Learning Outcomes

- Learn about measurement of angles, Trigonometric identities, and Trigonometric ratios of compound angles

Unit II

Trigonometry: Trigonometric ratios of multiple and Sub-multiple angles, Transformations, Inverse trigonometric functions (Definitions only), Hyperbolic Functions (Definitions only).

Learning Outcomes:

By the end of this Unit, the student will be able to

- Understand about trigonometric ratios of multiple and Sub-multiple angles Hyperbolic Functions

Unit III

Limits and Continuity: Limit of a function, Standard Limits, Indeterminate forms, Continuity of a function

Learning Outcomes:

By the end of this Unit, the student will be able to

- Know limit of a function, and continuity of a function

Unit IV

Differentiation: Derivability of a function, Derivatives from first principles, Derivatives of trigonometric functions, Product rule, Quotient rule, Derivative of Inverse function and Inverse trigonometric functions, Derivative of Hyperbolic and Inverse Hyperbolic functions, Derivatives of functions defined by means of a parameter, Differentiation of a function with respect to another function, Implicit differentiation, Logarithmic differentiation, Transformation.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Learn derivatives of functions defined by means of a parameter
- Know about differentiation of a function with respect to another function
- Understand about logarithmic differentiation

Unit V

Integration: Definition, Methods of integration- Integration by substitution, Integration by parts, Integration of rational function of the form $\frac{1}{ax^2+bx+c}$

Learning Outcomes:

By the end of this Unit, the student will be able to

- Learn integration of rational function

Recommended Readings:

- "New Intermediate Mathematics Volume I for Junior Intermediate" by V. Venkateswara Rao, N. Krishna Murthy, B.V.S.S. Sarma; S. Chand & Company Ltd.
- "New Intermediate Mathematics Volume II for Senior Intermediate" by V. Venkateswara Rao, N. Krishna Murthy, B.V.S.S. Sarma ; S.Chand & Company Ltd.

Course Outcomes:

By the end of the course, the student will be able to

- Acquire necessary knowledge on the important mathematics equations
- Develop the ability of using the formulas learned in the fields of food technology.

B.Sc. (H) FOOD TECHNOLOGY IV SEMESTER

SSE 288: ENTERPRENEURSHIP DEVELOPMENT

Hours per week: 3

Credits: 2 Sessionals:100 Marks

Preamble:

Entrepreneurship has been described as the capacity and willingness to develop, organize and manage a business venture along with any of its risks in order to make a profit. Entrepreneurs play a key role in any economy. They have the skills and initiative necessary to anticipate current and future needs and bring good new ideas to market.

Course Objectives:

- To acquire necessary knowledge and skills for organizing and carrying out entrepreneurial activities,
- To develop the ability of analyzing and understanding business situations
- To develop knowledge necessary to plan entrepreneurial activities
- To understand how new products are developed and readied for launch
- To understand the role of Design Thinking in developing new ideas and products

Unit I

Meaning, Need and Importance of Entrepreneurship, Promotion of entrepreneurship, Factors influencing entrepreneurship, Features of a successful Entrepreneurship.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Understand the need and importance of Entrepreneurship
- Analyze various factors influencing entrepreneurship

Unit II

Forms of Business Organization, Project Identification, Selection of the product, Project formulation, Assessment of project feasibility.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Identify project and select product as per project
- Assess project feasibility
- Gain knowledge on project formulation

Unit III

What is Business Model Design? Different types of Business Models; Consumer Value Propositions, Revenue Models, Operating Models; What is Go-to-Market Strategy and how is it executed?

Learning Outcomes:

By the end of the unit, the student will be able to:

- Understand how business model design is done and how to tailor a particular model to the type of product or service being sold or provided
- How to develop a Revenue Model in order to ensure the financial viability of a start-up business
- What are the approaches to be used to launch a successful "Got-To-Market" campaign

Unit IV

Meaning and Importance, Marketing-mix, product management – Product line, Product mix, stages of product life cycle, marketing Research and Importance of survey, Physical Distribution and Stock Management.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Gain knowledge on marketing-mix and product management
- Identify the importance of marketing research and importance of survey
- Understand the concepts of Physical Distribution and Stock Management

Unit V

Meaning of International business, Selection of a product, Selection of a market for international business, Export financing, Institutional support for exports.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Select a market for international business
- Gain knowledge on Export financing
- Identify the need for institutional support for exports

Recommended Readings:

1. Holt DH. Entrepreneurship: New Venture Creation.
2. Kaplan JM Patterns of Entrepreneurship.
3. Gupta CB, Khanka SS. Entrepreneurship and Small Business Management
4. Vasant Desai (2012) Fundamentals of Entrepreneurship and Small Business Management,
5. Vasant Desai (2011) The Dynamics of Entrepreneurial Development and Management,
6. D. David and S Erickson (1987) Principles of Agri Business Management

Course Outcomes:

By the end of the course, the student will be able to

- Acquire necessary knowledge and skills for organizing and carrying out entrepreneurial activities
- Develop the ability of analyzing and understanding business situations
- Develop knowledge necessary to plan entrepreneurial activities

B.Sc. (H) FOOD TECHNOLOGY IV SEMESTER

SSE 290: PROBABILITY AND STATISTICS (THEORY)

Hours per week: 3

Credits: 2 Sessionals: 100 Marks

Preamble:

This course enables the students to understand the importance of probability in combination with statistics in the field of life sciences. The student will get idea on importance of collecting data, analyzing the data, understanding the error in the obtained data, giving/submitting the data to be significant or non-significant and knowledge acquired by reading them can be exploited to understand the importance of providing the scientific data with perfection, this could be useful in the fields of food technology.

Course Objectives:

- To impart comprehensive overview of Statistics
- To instill knowledge on Probability, Correlation and regression
- To study Sampling of variables

Unit I

Statistics: collection of data, classification of data, graphical representation of data, measures of central tendency-mean, median and mode; measures of dispersion-range, mean deviation, standard deviation and variance

Learning Outcomes:

By the end of this Unit, the student will be able to

- Gain knowledge on collection of data, classification of data
- Understand measures of dispersion-range, mean deviation, and standard deviation

Unit II

Probability: Definition, Addition theorem, Multiplication theorem, Conditional probability, Bayee's theorem (definitions only, no proofs). Theoretical distributions: Random variables,

Mean and variance, Binomial distribution, Poisson distribution, Normal distribution (simple problems on the above topics).

Learning Outcomes:

By the end of this Unit, the student will be able to

- Gain knowledge on using Probability in sample testing
- Understand about binomial distribution, Poisson distribution, Normal distribution

Unit III

Correlation and regression, rank correlation, curve fitting, method of least squares- fitting of other curves straight line, parabola, $y = ax^b$, $y = ae^{bx}$

Learning Outcomes:

By the end of this Unit, the student will be able to

- Know the importance of Correlation and regression
- Understand the application of curve fitting, method of least squares

Unit IV

Sampling: objectives of sampling, sampling distribution, testing of hypothesis, null hypothesis, level of significance, Test of significance for large samples, comparison of large samples. Test of significance of means of two large samples.

Learning Outcomes:

By the end of this Unit, the student will be able to

- Learn objectives of sampling and sampling distribution
- Understand the test of significance for large samples

Unit V

Sampling of variables – small samples, students 't' distribution, properties of t-distribution. Significance test of sample mean, significance test of difference between sample means. Chi – square test – properties of Chi square distribution – 'F' distribution, ANOVA (one way classification)

Learning Outcomes:

By the end of this Unit, the student will be able to

- Gain knowledge on Sampling of variables
- Know about significance test of difference between sample means.
- Learn about Chi –square test – properties of Chi square distribution, ‘F’ distribution, and ANOVA

Recommended Readings:

- Engineering Maths by Dr. B. S. Grewal, Khanna Publications
- Engineering Mathematics by B. V. Ramana, Third Edition, Tata Mc.Graw Hill
- S. C. Gupta and V. K. Kapoor, S. Chand and Company Ltd.
- Fundamentals of Biostatistics, Khan and Khanum UKAAZ Publications.

Course Outcomes:

By the end of the course, the student will be able to

- Acquire necessary knowledge on the statistics and probability
- Develop the ability of using the formulas learned in the fields of food technology.