Course Curricula
For
Undergraduate Programme

in

Food Nutrition and Dietetics

UG- Certificate in Food Nutrition & Dietetics
UG- Diploma in Food Nutrition & Dietetics
B.Sc. Food Nutrition and Dietetics (Hons.)

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INTRODUCTION

Food Nutrition and Dietetics is a linking discipline between agricultural food production system and human health management system. It deals with the science which manages normal nutrition and health situations of the entire population of the country. The Food Nutrition and Dietetics programme has come under the umbrella of ICAR in the 5th Deans' Committee report, and the programme is currently running in 6 agriculture universities, namely, MPUA&T, Udaipur; PAU, Ludhiana; CAU, Tura; TNAU, Madurai; AAU, Assam and SDAU, Gujarat. This programme was taken up by the ICAR because improvement in food production has not improved the nutrition situation among Indians. In order to meet global nutrition targets by 2030, India needs a food distribution system, nutrition education, nutritional intervention and a continuous programme monitoring team. However, there is dearth of nutritionists and dieticians in country. It has been estimated by research that India lacks around 2.5 lakh dieticians. Hon. Prime Minister is keenly observing the nutrition situation of population and has taken out several programmes like Prime Ministers Overarching Scheme for Holistic Nutrition (POSHAN Abhiyan).

To meet out the gap Govt. of India via, Gazette notification The National Commission For Allied And Healthcare Professions Act, 2021 has identified nutritionists as "healthcare professionals", it includes a scientist, therapist or other professional who studies, advises, researches, supervises or provides preventive, curative, rehabilitative, therapeutic or promotional health services and who has obtained any qualification of degree under this Act, the duration of which shall not be less than three thousand six hundred hours spread over a period of three years to six years divided into specific semesters. Nutrition Science Professional is a person who follows a scientific process to assess, plan and implement programmes to enhance the impact of food and nutrition on health, promotes good health, prevent and treat disease to optimize the health of individuals, groups, communities and populations with training in nutritional science, food science, food quality and safety, normal & therapeutic dietetics. It includes Dietician, Clinical Dietician, Food Service Dietician, Public Health Nutritionist, Sports Nutritionist, Food Scientist, Food Safety and Quality Analyst. Keeping this in mind, this course has been developed and revised as per NEP, 2020.

The present report is an outcome of the valuable suggestions and recommendations of VI Deans' Committee members after having multistage in-depth deliberations and discussions in virtual meetings and personal communications with the Deans and faculty members. Restructuring process followed consultations with Deans of Home Science/ Community Science colleges, Heads of department of Foods and Nutrition, senior faculty members of food and nutrition, meetings with stake holders like students, industry partners, government officials, dieticians etc. After several rounds of consultations, the contents of restructured course curricula have been developed. Restructuring of Undergraduate programmes in Food Nutrition and Dietetics has been carried out as per National Education Policy- 2020 guidelines to build among students' strong foundation of knowledge with increased practical exposure and skilling to build competence and confidence for the application of the gained knowledge.

Curriculum content is modified in a way to have core essentials and space is made for critical thinking based, inquiry-based, discovery-based, discussion-based, and analysis and problem solving based more holistic learning. Approach of programme is for holistic development i.e. learning how to learn, to inculcate character and creating holistic and well-rounded individuals. Emphasis has been given on basic skill enhancement courses, exposure visits and case studies, industry attachments, flexibility in choice of courses via electives offered in fourth year and also through online courses along with provision of advanced skill development through project work or experiential learning, etc., with amalgamation of multiple exit and entry options as per NEP-2020.

HIGHLIGHTS

- The whole course program of 4 years B.Sc. Food Nutrition and Dietetics (Hons.) will be of 175 credit hours, which will have 167 credits offered by the parent university and 10 credit hours of online courses taken by the student as per his/ her choice.
- After the admission of students in the university, the students will register for the Foundation programme of 3 weeks' duration in the 1st semester. The course will include discussions on operational framework of academic process in university, sessions from alumni, business leaders, University academic & research managers and classes on personality development (instilling life and social skills, social awareness, ethics and values, team work, leadership, etc.) and communication skills.
- Steps will be taken to identify the strength and weakness of students (with remedial measures) and diverse potentialities and to enhance cultural Integration of students from different backgrounds. It will also create a platform for students to learn from each other's life experiences.
- The students will have to do common courses under following categories like Multi-Disciplinary Courses, Value Added Courses, Ability Enhancement Course, NSS/NCC etc.
- The first year of the course is dedicated for skill development in Food, Nutrition and Dietetics areas with few introductory courses. The Skill enhancement course (SEC) of 8 credit hours will be offered during Sem.1 and 2 of first year with flexibility to students as per NEP 2020 guidelines. After satisfactory completion of 40 credits of courses in two semesters and subsequent satisfactory completion of 10 credits (10 weeks) of industry/ institute training/ internship, the student will become eligible for the award of UG-Certificate in Food Nutrition and Dietetics on exit. The students continuing the study further, would not have to attend the internship after 1st year.
- An institution (university or college) may work independently or in partnership with capable organizations/ companies/ NGOs/ progressive entrepreneurs for running various skill enhancement courses. In such cases, while the parent institution will control admission process, develop the content, delivery module of the program and monitor the learning and skill development by students, the evaluation can be done jointly by the collaborating partners.
- The second year has been designed with the basic courses as well as fundamental courses in food science, human nutrition and normal dietetics with adequate theory and practical components, enabling the student to get acquainted with the basic principles and applications in the discipline. Students will be studying 4 credits of SEC in second year also. After satisfactory completion of the courses of 2nd year (total 80 credits for the two years) and subsequent satisfactory completion of 10 credits (10 weeks) of industry/ institute training/ internship, the

student will become eligible for the award of UG-Diploma in Food Nutrition and Dietetics on exit. The students continuing the study further, would not have to attend the internship after 2nd year.

- University/HEI may offer courses in any area as identified by it, based on institutional expertise/capabilities/resources.
- Skill Enhancement Courses' (SEC)list as suggested by UGC, is given in item4 listed under 3.1.12 are suggestive. Any of these courses can be considered for inclusion under SEC category.
- The third-year courses have been designed to impart specialized knowledge to the students in the major disciplines i.e. Food Science, Nutrition science and Dietetics and Hospitality management. Students may opt courses from one or more options. The students, from other disciplines, who wish to take minor package from Food Nutrition and Dietetics may opt any one elective module given after Sem VIII, and take desired no of credits in consultation with faculty mentor who will ensure that basic courses are included in the package.
- There won't be exit option after third year as it is a professional course.
- During the fifth and sixth semester, i.e. third year, the students will have educational tour/ industry visit of 10-12 days duration, which is gradial and shall count for 2 credits in the programme.
- During the 5th semester, the students will have a study tour/ industry visit of 10-12 days duration, which will be counted as 2 credits (Non-gradial).
- Students shall have elective courses in VII and VIII Semester for the award of degree i.e. B.Sc. Food Nutrition and Dietetics (Hons).
- For Hons degree programme students shall take 20 credits of elective from major group in VII Sem.
- In the fourth year of the course, for further strengthening of the knowledge and skill, and for developing confidence of the students to take up either nutrition counselling, therapeutic counselling for patients, R&D in industry, research, employment or entrepreneurship, provision of internship, in-plant training and project has been kept in addition to the basket of elective courses. The student will have the option to choose the model in consultation with a faculty mentor. Each student will be attached to a mentor from the College/ University.
- In-plant training may be conducted in split manner in more than one industry/ organization/ institute.
- There will be adequate choice of electives/ specialization for the students, in the 4th year. The Universities will have flexibility to include more courses as Electives depending on specific needs and situational variations. The objective is to enable the student to acquire deeper understanding in any particular field.

- In order to inculcate the moral and experiential habits in students, research methodology and ethics were also added besides Students Rural and Entrepreneurial Awareness Development Yojana (Student-READY).
- The core and elective courses can also be modified maximum up to 30% with approval from competent authority of the University.
- The students will take 10 credits of online courses either from MOOC/Swayam/ NPTEL/ mooKIT/ edX/ Coursera or any other portal accepted by the University during the third and fourth year as a partial requirement for the B.Sc. Food Nutrition and Dietetics (Hons.) or B.Sc. Food Nutrition and Dietetics (Hons. With Research) programme.
- The online courses may relate with the main discipline or from any other discipline like social science, psychology, anthropology, economics, business management, agriculture, veterinary, language/humanity, music, etc. The objective is to allow the students to groom their passion or strengthen their knowledge and competency in any field beyond prescribed courses.
- These online courses will be non-gradial as separate certificates would be issued by institutes offering the courses. However, the university/ institute will keep a record of such courses registered and completed by each student and will indicate the title of the (successfully completed) courses in final transcript issued to the student.
- After satisfactory completion of fourth year course requirements of 167 credits and MOOC or open access courses of 10 credits, the student will become eligible for the award of Degree in BSc. Food Nutrition and Dietetics (Hons).
- Minimum credits for minor is 32 as per UGC guidelines under "Curriculum and credit framework for undergraduate programmes 2022". Minor stream courses can be from the 1st, 2nd or 3rd year or above level and 50% of the total credits from minors must be secured in the relevant subject/discipline and another 50% of the total credits from a minor can be earned from any discipline as per students' choice.
- MOOCS, SWAYAM, student will make his/her own planning and execution under intimation to the Dean/ authority. Students can also select any of the listed courses given under 3.1.12 depending upon the regional priority and infrastructural facility in the concerned university/HEI.
- At each stage of exit (UG-certificate/ UG-Diploma/ B.Sc. FND (Hons.), the students are expected to acquire competency and confidence to get jobs, to face the real challenges in varied jobs and research, as well as to start their own consultancy/ enterprise.
- The social skills acquired by the students will also make the students more empathetic towards the society and social issues.
- It is recommended that each HEI appoints a Coordinator for INTERNSHIP PROGRAMME. The coordinator must plan / monitor internship programme implementation in the university, as

per detailed guidelines prescribed by UGC. Read more details of guidelines in UGC notification on Internship, 2023.

Entry and Exit Options

The entry and exit options for the UG programmes in Community Science are shown in the Fig.-1

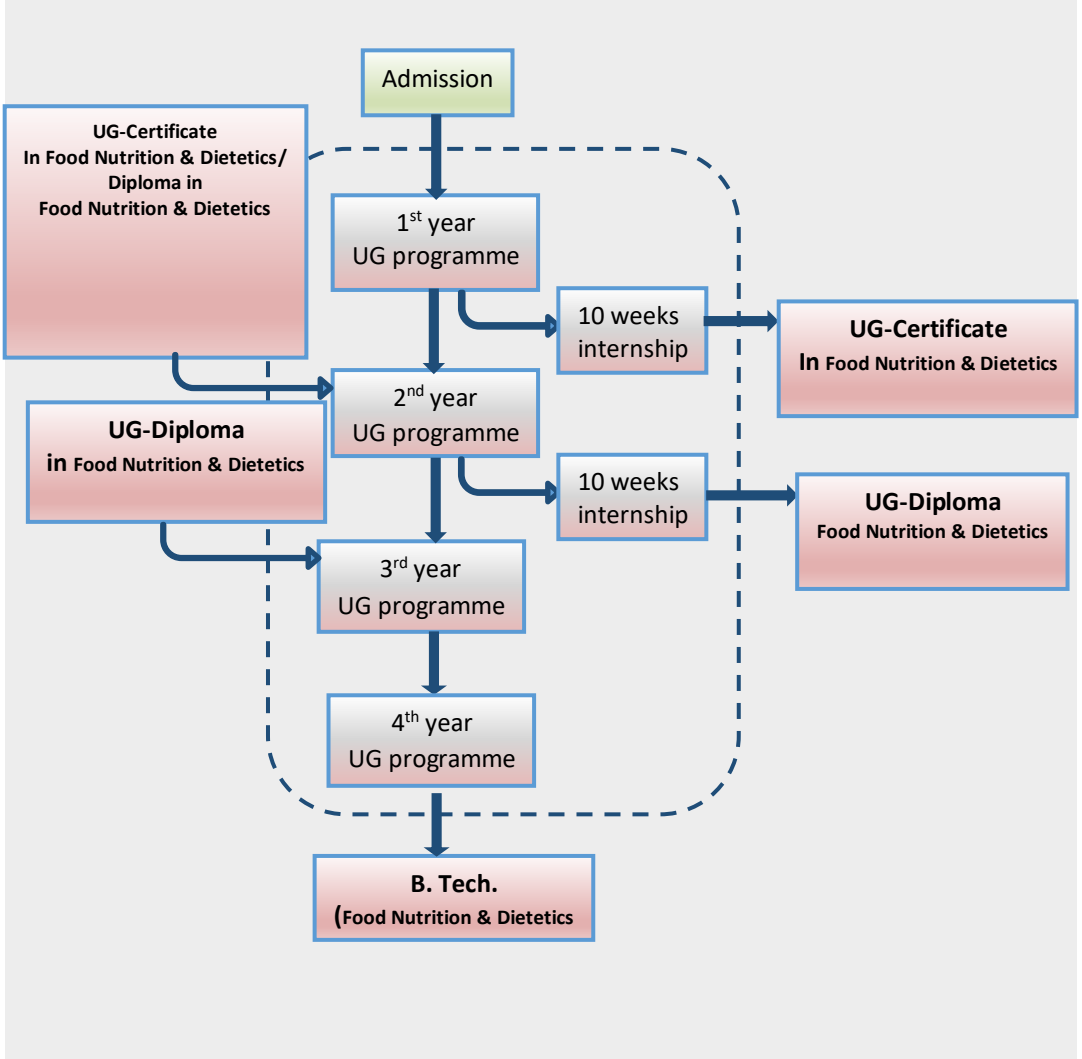

Fig.-1 Entry and Exit options for the UG programmes in Food Nutrition & Dietetics

Exit options

- **UG-Certificate in Community science** (Exit after first year and completion of 10 weeks' internship)
- **UG-Diploma in Community Science** (Exit after second year and completion of 10 weeks' internship)

- **B.Sc. (Hons.) Community Science** (On successful completion of four-year degree requirements)

Admission Eligibility: +2 Science with Biology or Mathematics as one subject/Agriculture

ACADEMIC PROGRAMME

Semester wise course distribution

Sl. No.	Course Title	Credit Hours	Total Credit hours
First Year			
I semester			
	Deeksharambh (Foundation Course of 2 weeks)	2(0+2) Non-gradial	**22 (9+13)**
2.	Introduction to Food Science and Nutrition	3(3+0)	
3.	Principles and Practices of Food Preparation	2(1+1)	
4.	Indian Cuisinology	2(0+2)	
5.	Nutritional Status Assessment	3(2+1)	
6.	Convenience and Health Food Formulation	2(0+2)	
7.	Farming based Livelihood Systems	3 (2+1)	
8.	Skill Enhancement Courses (SEC-I)*	2(0+2)	
9.	Skill Enhancement Courses (SEC-II)*	2(0+2)	
10.	Communication Skill	2(1+1)	
11.	NSS-I/ NCC-I	1 (0+1)	
II semester			
1.	Bakery Science and Technology	3(2+1)	**21 (10+11)**
2.	Nutritional Programme Surveillance	3(1+2)	
3.	Food Preservation and Storage	2(0+2)	
4.	Personality Development	2(1+1)	
5.	Entrepreneurship Development and Business Management	3(2+1)	
6.	Environmental Studies	3(2+1)	
7.	Skill Enhancement Courses(SEC-III)*	2(0+2)	
8.	Skill Enhancement Courses(SEC-IV)*	2(0+2)	
9.	NSS-II/NCC-II	1(0+1)	
Post- Semester II (Only for exit option for UG-Certificate)			
1.	Internship**(10 weeks)	**10(0+10)***	
Second Year			
III semester			
1.	Principles of Human Nutrition	4(4+0)	**22 (15+7)**
2.	Fundamentals of Food Science	2(1+1)	
3.	Community Nutrition & Education	3(2+1)	
4.	Human Physiology	3(2+1)	
5.	Economics & Food Business Management	2(2+0)	
6.	Food Psychology	2(2+0)	
7.	Skill Enhancement Courses (SEC-V)*	2(0+2)	
8.	Physical Education, First Aid and Yoga	2(0+2)	
9.	Food Nutrition and Agriculture	2(2+0)	
Semester IV			
1.	Normal Nutrition & Meal Planning	3(2+1)	**20 (13+7)**
2.	Public Health Nutrition	3(2+1)	
3.	Nutritional Biochemistry	3(3+0)	
4.	Food Standards & Quality Control	3(2+1)	
5.	Skill Enhancement Courses(SEC-VI)*	2(0+2)	

6.	Agriculture Marketing and Trade	3(2+1)	
7.	Agriculture Informatics	3(2+1)	
Post- IV Semester Internship (Only for exit option for award of UG- Diploma)			
	Internship*** (10 weeks)	**10(0+10) ***	
Third Year			
V semester			
1.	Therapeutic Nutrition	4(3+1)	**20 (13+7)**
2.	Food Analysis	3(2+1)	
3.	Current Food Processing Technologies	3(2+1)	
4.	Statistical Methods	3(2+1)	
5.	Diet & Nutrition Counselling	2(0+2)	
6.	Nutraceuticals and Health Foods	2(2+0)	
7.	Introduction to Clinical Nutrition	3(2+1)	
8.	Educational Tour (10-12 days)	2(0+2) Non-gradial	
VI semester			
1.	Food and Nutrition Security	2(1+1)	**21(13+8)**
2.	Nutrition, Body Composition & Physical Fitness	3(2+1)	
3.	Food Microbiology	3(2+1)	
4.	Milk Processing and Technology	3(2+1)	
5.	Cereals & Millets: Processing & Technology	3(2+1)	
6.	Sustainable Nutrition	3(2+1)	
7.	Hospitality Management	2(1+1)	
8.	Food Hygiene and Sanitation	2(1+1)	
Fourth Year			
VII semester			
Major/minor	Elective courses	20	**20**
VIII semester			
	Student READY **Option A (Any Two)** I. In-Plant Training (10 weeks) **** II. Student Project***** III. Hands on Training **Option B** Internship******	 10(0+10) 10(0+10) 10(0+10) 20(0+20)	**20**

*From the basket of available SEC modules

**Mandatory requirement for UG-Certificate.

. *** Mandatory requirement for UG-Diploma.

**** In plant training / attachment with Industry/ Research Institute (May be conducted in split manner in more than one industry/ institution/ organization).

***** The student project will be R & D based/ field study based/ entrepreneurship based (incubation/ experiential learning)

****** The internship can be taken in service Industry (e.g. Hospital or Hotel) OR in Production Industry (e.g. Food/ nutraceuticals Industry) OR in Food Quality and Analysis Laboratories

Department/ section wise course breakup

	Course Title	Credits	Total
Foundation courses			
	Deeksharambh (Foundation Course of 2 weeks)	0+2 (NG)*	4(0+4) *Credits not included in the total
	Physical Education, First Aid and Yoga Practices	0+2 (NG)* Non-gradial	
Common Courses			
Multidisciplinary courses (MDC) **9 credits**	Farming based livelihood systems	3 (2+1)	21 (12 + 09)
	Entrepreneurship Development & Business Management	3(2+1)	
	Agriculture Marketing and Trade	3(2+1)	
Value Added courses(VAC) **(6 credits)**	Environmental Studies and Disaster Management	3 (2+1)	
	Agriculture Informatics	3(2+1)	
Ability Enhancement Courses (AEC) **8 credits**	NSS-I/ NCC – I	2 (0+2)	
	Communication Skills	2(1+1)	
	Personality Development	2(1+1)	
Nutrition and Dietetics			
Core courses	Nutritional Status Assessment	3(2+1)	50(34+16)
	Nutritional Programme Surveillance	3(1+2)	
	Principles of Human Nutrition	4(4+0)	
	Community Nutrition & Education	3(2+1)	
	Human Physiology*	3(2+1)	
	Normal Nutrition & Meal Planning	3(2+1)	
	Public Health Nutrition	3(2+1)	
	Nutritional Biochemistry	3(3+0)	
	Therapeutic Nutrition	4(3+1)	
	Diet & Nutrition Counselling	3(0+3)	
	Nutraceuticals and Health Foods	2(2+0)	

	Course Title	Credits	Total
	Introduction to Clinical Nutrition	3(2+1)	
	Food Nutrition and Agriculture	2(2+0)	
	Food and Nutrition Security	2(1+1)	
	Nutrition, Body Composition & Physical Fitness	3(2+1)	
	Sustainable Nutrition	3(2+1)	
	Statistical Methods*	3(2+1)	
Skill Enhancement Courses under SEC Modules	Assessment of clinical signs and symptoms	2(0+2)	08(0+8)
	Development of nutritional educational material	2(0+2)	
	Web designing and multimedia production	2(0+2)	
	Development of audio-visual aid	2(0+2)	
Food Science			
Core courses	Introduction to Food Science and Nutrition	3(3+0)	52(21+14)
	Principles and Practices of Food Preparation	2(1+1)	
	Convenience and Health Food Formulation	2(0+2)	
	Bakery Science and Technology	3(2+1)	
	Food Preservation and Storage	2(0+2)	
	Fundamentals of Food Science	2(1+1)	
	Food Standards & Quality Control	3(2+1)	
	Food Analysis	3(2+1)	
	Current Food Processing Technologies	3(2+1)	
	Food Microbiology	3(2+1)	
	Milk Processing and Technology	3(2+1)	
	Statistical Methods*	3(2+1)	
	Cereals & Millets: Processing & Technology	3(2+1)	

	Course Title	Credits	Total
Skill Enhancement Courses under SEC Modules	Jam jelly preparation	2(0+2)	18(0+18)
	Cake making	2(0+2)	
	Indian traditional sweets	2(0+2)	
	Cake decoration and icing	2(0+2)	
	Pickle preparation	2(0+2)	
	Candy making	2(0+2)	
	Savory Snack preparation	2(0+2)	
	Ready to eat snacks	2(0+2)	
	Sugar processing and confectionary	2(0+2)	
Institutional Food Service and Hospitality Management			
Core courses	Indian Cuisinology	2(0+2)	18(12+6)
	Food Psychology	3(2+1)	
	Food Service Facilities and Management	2(2+0)	
	Economics & Food Business Management*	2(2+0)	
	Hospitality Management	3(2+1)	
	Food Hygiene and Sanitation	3(2+1)	
	Statistical Methods*	3(2+1)	
Skill Enhancement Courses under SEC modules	Hygiene management in food service units	2(0+2)	10(0+10)
	Quality control in food processing units	2(0+2)	
	Development of project proposals	2(0+2)	
	Laboratory analysis	2(0+2)	
	Practical skills in Writing and Speaking	2(0+2)	

- In addition, there are courses/ credits for internship, in plant training, project, online courses; as per the specific programme.
- *Basic Supporting Courses

Summary of credit distributions

Type of courses		**Credits**
Skill Enhancement Courses (SEC)	**:**	12
Core courses (major & minor/s)	**:**	112
Common courses (MDC+VAC+AEC)	**:**	23
Elective courses	**:**	20
**MOOCS/SWAYAM	**:**	10 non-gradial
Total	**:**	**167+10****

Food Nutrition and Dietetics is a multi-disciplinary subject and have perfect amalgamation of many disciplines. Hence, choice of skill based & Elective courses will be offered to student from basket of Skill Enhancement Course modules to develop required skill competency in both first year and second year for UG Certificate in Community Science or Diploma in Community Science at the first exit or second exit, respectively. The online learning through digital environment like MOOC/SWAYAM, courses will further complement and open new avenues to pursue the passion of the student within the whole span of four years of the degree program.

Table-1: Credits Allocation Scheme of UG Food Nutrition and Dietetics

Sem-ester	Core Courses (Major+ Minor)	Multi-Disciplinary Course (MDC)	Value Added Course (VAC)	Ability Enhancement Course (AEC)	Skill Enhancement Course (SEC)	Internship/ Project/ Student READY	Total Credits	Non-Gradial	Internship	Online Courses/ MOOC
I	12	3[2]		1[3] + 2[4]	4	-	22	2[1]		
II	08	3[5]	3[6]	1[3] + 2[7]	4	-	21	-	10[12]	
III	18	----		2[8]	2	-	22			
IV	12	3[9]	3[10]	----	2	-	20	-	10[13]	**10**
V	21	-	-	-	-	-	21	2[11]		
VI	21	-	-	-	-	-	21	-		
VII	20*	-	-	-	-	-	20	-		
VIII	-	-	-	-	-	20	20	-		
Total	**112**	**9**	**6**	**8**	**12**	**20**	**167**	**4**		**10**

Note: The credit hours mentioned in the table includes both theory and practicals.

[1]Deeksharambh (Induction-cum-Foundation Course) of 2 credits (2 weeks duration).
[2]Farming based Livelihood systems
[3]NCC/NSS
[4]Communication Skills
[5]Entrepreneurship Development and Business Management
[6]Environmental Studies and Disaster Management
[7]Personality Development
[8]Physical Education, First Aid and Yoga Practices
[9]Agriculture Marketing & Trade
[10]Agriculture Informatics
[11]Study tour (10-14 days).
[12]Only for those opting for an exit with UG-Certificate
[13]Only for those opting for an exit with UG-Diploma

DETAILED SYLLABI

Semester I

S. No.	Course Title	Credit Hours
1.	Deeksharambh (Foundation Course of 2 weeks)	2(0+2) Non-gradial
2.	Introduction to Food Science and Nutrition	3(3+0)
3.	Principles and Practices of Food Preparation	2(1+1)
4.	Indian Cuisinology	2(0+2)
5.	Nutritional Status Assessment	3(2+1)
6.	Convenience and Health Food Formulation	2(0+2)
7.	Farming based Livelihood Systems	3 (2+1)
8.	Skill Enhancement Courses(SEC-I)*	2(0+2)
9.	Skill Enhancement Courses(SEC-II)*	2(0+2)
10.	Communication Skill	2(1+1)
11.	NSS-I/ NCC-I	1 (0+1)
	Total	**22 (9+13)**

Deeksharambh (Induction-cum-Foundation Programme) 0+2 (NG)

The activities to be taken under "Deeksharambh" shall aim at creating a platform for students to

1. Help for cultural Integration of students from different backgrounds,
2. Know about the operational framework of academic process in university
3. Instilling life and social skills,
4. Social Awareness, Ethics and Values, Team Work, Leadership, Creativity, etc.
5. Identify the traditional values and indigenous cultures along with diverse potentialities both in indigenous and developed scenario.

The details of activities will be decided by the parent universities. The structure shall include, but not restricted to:

i. Discussions on operational framework of academic process in university, as well as interactions with academic & research managers of the University
ii. Interaction with alumni, business leaders, perspective employers, outstanding achievers in related fields, and people with inspiring life experiences
iii. Group activities to identify the strength and weakness of students (with expert advice for their improvement) as well as to create a platform for students to learn from each other's life experiences
iv. Activities to enhance cultural Integration of students from different backgrounds.

v. Field visits to related fields/ establishments
vi. Sessions on personality development (instilling life and social skills, social awareness, ethics and values, team work, leadership, etc.) and communication skills

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Introduction to Food Science and Nutrition 3(3+0)

Objectives

- To make student understand basic nutrients, their functions, requirements and availability in different food groups.
- Understanding of the changes that occur in foods during preparation, processing and preservation.
- Understanding the nutritive value of different foods and methods of preserving them during cooking.

Theory

Introduction and overview of basic principles of nutrition. Relationship of nutrition to health, growth and human welfare. Definitions of terms used in nutrition - recommended dietary allowances, balanced diet, health, functional foods, phytochemicals, nutraceuticals, dietary supplements, food groups. Concepts of food science (definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems etc.). Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavors, colors, miscellaneous bioactive compounds, important reactions). Food microbiology (bacteria, yeast, molds, spoilage of fresh and processed foods, production of fermented foods). Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.). Food and nutrition, malnutrition (over and under nutrition), nutritional disorders. Energy metabolism (carbohydrate, fat, proteins). Balanced/modified diets. Menu planning. New trends in food science and nutrition.

Suggested Reading

- Khader V (2003) Food, Nutrition and Health. Kalyani Publishers, Ludhiana
- Sehgal S. and Raghuvanshi RS. (2007). Textbook of Community Nutrition Directorate of Information and Publications of Agriculture, Indian Council of Agricultural Research, New Delhi.
- Gopalan, C, Rama Sastri, B V and Balasubramanian, S C (2011). Nutritive value of Indian Foods. National Institute of Nutrition, ICMR, Hyderabad.
- Gurtherie H A (1989) Introductory Nutrition. Times Mirror, St. Louis
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- Potter, N. 2005. Food Science, CBS Publishers and Distributors, Delhi
- Srilakshmi. B. 2015. Nutrition Science. New Age International Pvt. Ltd. New Delhi.

Principles and Practices of Food Preparation 2(1+1)

Objective

Upon completion of the course, assignments, readings, and laboratory activities, the student will be able to:

- Understand effect of heat transfer on texture, flavour, taste and appearance of food.
- Demonstrate correct use of small equipment and appliances;
- Identify and apply scientific principles of food selection and preparation, prepare and handle food using safe, sanitary practices; in order to retain Nutritive value and produce quality food products;
- Demonstrate and understand ingredient substitution for recipe and describe characteristic properties of quality food products;

Theory

Kitchen attire and equipment, cooking of food, heat and heat transfer cooking methods, effect of cooking on food and their nutritive value, basics of culinary practice, thickening and binding agents, basic flavoring stocks essence and glazes sauces soups garnishes, basics of cookery of various food - cereals, pulses, egg, fish, meat and poultry, principles and practice of boiling, steaming, frying, stewing, roasting, baking, grilling and combined methods of cookery

Practical

Kitchen Equipment - Identification, Description, Uses & handling. Market survey to assess the types and availability of processed products. Identification and Selection of Ingredients. Preparation of cereal products and pulse products- boiling and steaming, puffing. roasting methods. Basic dry heat cooking methods. Basic medium fat cooking – Roasting, grilling, frying. Milk cookery – pudding, custard and ice creams. Preparation of Vegetable- Boiled vegetables and Glazed vegetables. Preparation of Vegetable- Fried vegetables and Stewed vegetables. Egg cookery - Boiled (Soft & Hard), Fried, Poaches, Scrambled, Omelets. Preparation of Simple Salads: Potato salad, Beet root salad, green salad, Fruit salad, Preparation of baked products. Cold desserts - Caramel Custard, Bread and Butter Pudding, Soufflé – Lemon / Pineapple, Mousse (Chocolate Coffee Apricot Pudding HOT desserts - Steamed Pudding. Preparation of meat & products. Preparation of Continental Stock: White stock, brown stock, chicken stock and emergency stock. Preparation of confectionery products - fudge, fondant, candies, toffees and chocolates, Identification of meat cuts of lamb, Curing of meat – sugar, salt and nitrite, Cost reporting system – daily, monthly and for special managerial decisions. Visit to kitchen equipment stores

Suggested Reading

- Brown, A. (2018). Understanding Food: Principles and Preparation. Wadsworth Publishing Co Inc.
- Chambers, M. D. (2009). Principles of food preparation; a manual for students of home economics. Boston cooking-school magazine Company, 1914.
- Sethi, M. (2007). Catering Management – An Integrated Approach. New Age International (P) Limited Publishers, New Delhi.
- The BC Cook Articulation Committee (2015). Basic Kitchen and Food Service Management. BC campus, British Columbia.

Indian Cuisinology 2(0+2)

Objectives

- This course will impart a hands-on, skill oriented intense curriculum on Indian Cuisine and Culture.
- The programme will examine the central place of cuisine in Indian culture and society.
- This course uses practical experiences in cooking to understand the importance of cuisine in cultural practices.

Practical

Exploring Indian regional cuisines - North India, North East, South India, Western and Eastern India. Familiarization and identification of Indian herbs and spices. Preparation of dry/wet masalas, pastes and curries/gravies. Preparation of common recipes and meals of North, South, East, West and central zones of the country. Preparation of Mughlai cuisines. Preparation of food according to festivals in India. Preparation of non-alcoholic Indian beverages. Use of modern crockery/cutlery for presentation. Special meals during fasting. Street foods of India – Exploration and preparation.

Suggested Reading

- Achaya K T (1998) Indian Food: A Historical Companion. Oxford University Press, USA.
- Pant P (2007). Cuisines – Incredible India. Wisdom Tree, India.
- O'Brien C (2012) Food Guide to India. Penguin India.
- Mehta N (2013) Cookbook of Regional Cuisines of India. Snab Publishers, India.
- Shukla S (2022) Plant-Based India: Nourishing Recipes Rooted in Tradition. The Experiment.
- Richard E. Martland., Derek A. Eelsy. (1998). Text book of basic cookery, Fundamental recipes and variations.
- https://www.unigoa.ac.in/uploads/syllabus/bsc-culinary-arts_syllabus_33020210830.055146.pdf
- https://www.uou.ac.in/sites/default/files/syllabus/BHM-401T.pdf

Nutritional Status Assessment 3(2+1)

Objectives

- This course covers the basic concepts of malnutrition, describes how nutritional status is assessed, and identifies the most commonly used nutrition indicators.
- It also explains the criteria to consider when selecting the indicators in specific contexts and situations.

Theory

Major Nutritional Problems–Global & India. Nutritional Status assessment – Direct & Indirect method, Anthropometric & Body composition methodology (indexes and references), Biochemical Methods of Nutritional Assessment, Clinical nutrition methodology, Dietary Assessment methods. Nutrition Intervention programmes & policies, Sustainable Nutrition Goals, Mental Health & well-being. Rapid assessment methods.

Practical

Assessment of nutritional status of community using dietary surveys, clinical, surveys, anthropometric measurements-Data collection, tabulation, data analysis (indexes and references), interpretation and report writing. Target group selection from pediatrics, adults, elderly, pregnant and lactating women, tabulation, interpretation and report writing of their tested biomarkers.

Suggested Reading

- Sehgal S. and Raghuvanshi RS. (2007). Textbook of community nutrition Directorate of Information and Publications of Agriculture, Indian Council of Agricultural Research, New Delhi.
- Latham. M.C. (1997). Human nutrition in the developing world. Food and Agricultural Organization of United Nations.
- Dahiya, S., Boora, P. and Rani, V. (2013). A manual on Community Nutrition, Department of Foods and Nutrition, published under ICAR Assistance scheme.
- Bamji, S.M., Rao, N.P. and Reddy, V. (1996). Textbook of human nutrition. Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
- Flamino Fidanza .1991. Nutritional Status Assessment, Springer Science Business Media.
- Beghan I, Cap M, Dajardan B (1988) A guide to Nutritional Status Assessment WHO Geneva.
- Raghuvanshi, R. S., Mittal, M. 2014. Food Nutrition and Diet Therapy. India: Westville Publishing House New Delhi.

Convenience and Health Food Formulation 2(0+2)

Objectives

- Imparting understanding of convenience foods among students
- Nutritional and health benefits of various healthy food recipes and convenience foods

Practical

Importance and need for convenience foods. Usefulness and types of convenience foods. FSSAI standards on health food formulations. Health foods-definition, classification and types. Food safety and quality control issues in product development. Packaging of convenience foods. Needs for effective marketing of convenience and health foods. Market survey of convenience and health foods. Cereal based traditional convenience foods and snacks. Convenience foods of millets. Ready to eat breakfast cereals. Pasta products. Legume/pulse based traditional convenience foods and snacks. Extruded products. Milk based products and mixes. Vegetable and fruit-based convenience foods. Food adjuncts (Pickles, chutneys, papad/vadi etc. Soup mixes. Fried products.

Suggested Reading

- Khatkar, B.S. (2007) Food Science and Technology. Daya Publishing House, Delhi.
- Pant P (2006) Indian Fast Food. Roli Books Pvt Limited.
- Shukla S (2022) Plant-Based India: Nourishing Recipes Rooted in Tradition. The Experiment.
- Arya, S.S. (1990) Grain based snack and convenience foods. Indian Food Packer, Sept –Oct, page: 17-34

- Shiby. V.K., Sinija, V.R. and Mishra, H.N. (2007) Ready to eat health foods: A promising concept. Indian food Industry. Nov-Dec.pg.47-53.
- Chattopadhyay, P.K. (2007) Cereal Food Technology. Published by National Institute of Industrial Research. Pg 137-139.
- Selves, J. and Devipriya, J. (2010) Health foods as Soya bean. Beverages and Food World Feb Pg-64.
- Chaughan G.S., N. S. Verma and G.S. Bains, 1985. Effect of extrusion processing on the nutritional quality of protein in rice – legume blends. Die Nahrung.
- Guy R. Extrusion Cooking, Technologies and Applications. Wood head Publishing Limited, Abington, and Cambridge.
- Fast R.B. and Caldwell E.F. (2000). Breakfast Cereals and How they are made. American Association of Cereal Chemists., St. Paul, Minnesota.

Farming based Livelihood Systems 3 (2+1)

Objectives

i)To make the students aware about farming based livelihood systems in agriculture

ii)To disseminate the knowledge and skill how farming based systems can be a source of livelihood

Theory

Status of agriculture in India and different states, Income of farmers and rural people in India, Livelihood- Definition, concept and livelihood pattern in urban & rural areas, Different indicators to study livelihood systems. Agricultural livelihood systems (ALS) : Meaning, approach, approaches and framework , Definition of farming systems and farming based livelihood systems Prevalent Farming systems in India contributing to livelihood. Types of traditional & modern farming systems. Components of farming system/ farming based livelihood systems- Crops and cropping systems, Livestock, (Dairy, Piggery, Goatry, Poultry, Duckry etc.), Horticultural crops, Agro--forestry systems, Aqua culture Duck/Poultry cum Fish, Dairy cum Fish, Piggery cum Fish etc., Small, medium and large enterprises including value chains and secondary enterprises as livelihood components for farmers, Factors affecting integration of various enterprises of farming for livelihood. Feasibility of different farming systems for different agro-climatic zones, Commercial farming based livelihood models by NABARD, ICAR and other organizations across the country, Case studies on different livelihood enterprises associated with the farming. Risk & success factors in farming based livelihood systems, Schemes & programmes by Central & State Government, Public & Private organizations involved in promotion of farming based livelihood opportunities. Role of farming based livelihood enterprises in 21st Century in view of circular economy, green economy, climate change, digitalization & changing life style.

Practical

Survey of farming systems and agricultural based livelihood enterprises, Study of components of important farming based livelihood models/ systems in different agro-climatic zones, Study of production and profitability of crop based, livestock based, processing based and integrated farming based livelihood models, Field visit of innovative farming system models. Visit of Agri-based enterprises & their functional aspects for integration of production, processing & distribution sectors and Study of agri-enterprises involved

in industry and service sectors (Value Chain Models), Learning about concept of project formulation on farming based livelihood systems along with cost & profit analysis, Case study of Start-Ups in agri-sectors.

Suggested Readings

1. Dixon, J. and A. Gulliver with D. Gibbon. (2001). Farming Systems and Poverty: Improving Farmers' Livelihoods in a ChangingWorld. FAO & World Bank, Rome, Italy & Washington, DC, USA

2. Ashley, C.; Carney, D. (1999). Sustainable Livelihoods: Lessons from Early Experience; Department for International Development: London, UK,; Volume 7. [Google Scholar]

3. Reddy, S.R. 2016. Farming System and Sustainable Agriculture, Kalyani Publishers, New Delhi.

4. Panwar et al. 2020. Integrated Farming System models for Agricultural Diversification, Enhanced Income and employment, Indian Council of Agricultural Research, New Delhi.

5. Singh, J.P., et al. 2015. Region Specific Integrated Farming System Models, ICAR-Indian Institute of Farming Systems Research, Modipuram.

6. Walia, S. S. and U. S. Walia, 2020. Farming System and Sustainable Agriculture, Scientific Publishers, Jodhpur, Rajasthan.

7. Livelihood Improvement of Underprivileged Farming Community: Some Experiences from Vaishali, Samastipur, Darbhanga and Munger Districts of Bihar by B. P. Bhatt, Abhay Kumar, P.K. Thakur, Amitava Dey Ujjwal Kumar, Sanjeev Kumar, B.K. Jha, Lokendra Kumar, K. N. Pathak, A. Hassan , S. K. Singh, K. K. Singh and K. M. Singh ICAR Research Complex for Eastern Region ICAR Parisar, P.O. Bihar Veterinary College, Patna - 800 014, Bihar

8. Carloni, A (2001) Global Farming Systems Study: Challenges and Priorities to 2030 – Regional Analysis: Sub-Saharan Africa, Consultation Document, FAO, Rome, Italy

9. Evenson, R.E. (2000). Agricultural Producitivity and Production in Developing Countries'. In FAO, The State of Food and Agriculture, FAO, Rome, Italy

10. Agarwal, A. & Narain, S. (1989). Towards Green Villages: A strategy for Environmentally, Sound and Participatory Rural Development, Center for Science and Environment, New Delhi, India

- Indian Dietetic Association. (n.d.). Retrieved from https://idaindia.com/
- National Institute of Nutrition. (n.d.). Retrieved from https://www.nin.res.in/

Skill Enhancement Courses (SEC)

Objective

To enable the students to acquire basic skills in Food, Nutrition and Dietetics so that in case they exit with UG-certificate, they can be properly engaged or they can start their own enterprise. These are taken from the basket of available SEC modules.

Communication Skill 2(1+1)

Objectives:

To acquire competence in oral, written and non-verbal communication, develop strong personal and professional communication and demonstrate positive group communication

Theory

Communication Process: The magic of effective communication; Building self-esteem and overcoming fears; Concept, nature and significance of communication process; Meaning, types and models of communication; Verbal and non-verbal communication; Linguistic and non-linguistic barriers to communication and reasons behind communication gap/ miscommunication.

Basic Communication Skills: Listening, Speaking, Reading and Writing Skills; Precis writing/Abstracting/Summarizing; Style of technical communication Curriculum vitae/resume writing; Innovative methods to enhance vocabulary, analogy questions.

Structural and Functional Grammar: Sentence structure, modifiers, connecting words and verbals; phrases and clauses; Case: subjective case, possessive case; objective case; Correct usage of nouns, pronouns and antecedents, adjectives, adverbs and articles; Agreement of verb with the subject: tense, mood, voice; Writing effective sentences; Basic sentence faults;

Practical

Listening and note taking; Writing skills: precis writing, summarizing and abstracting; Reading and comprehension (written and oral) of general and technical articles; Micro-presentations and Impromptu Presentations: Feedback on presentations; Stage manners: grooming, body language, voice modulation, speed; Group discussions; Public speaking exercises; vocabulary building exercises; Interview Techniques; organization of events.

Suggested readings

1. Allport, G W, 1937, Personality: A Psychological Interpretation. Holt, New York.
2. Brown Michele & Gyles Brandreth, 1994, How to Interview and be Interviewed. Sheldon Press, London.
3. Carnegie Dale, 1997, The Quick and Easy Way to Effective Speaking. Pocket Books, New York.
4. Francis Peter S J, 2012, Soft Skills and Professional Communication. Tata McGraw Hill, New Delhi .
5. Kumar S and Pushpa Lata, 2011, Communication Skills. Oxford University Press.
6. Neuliep James W, 2003, Intercultural Communication A Contextual Approach. Houghton Mifflin Co Boston.
7. Pease, Allan, 1998, Body Language. Sudha Publications, Delhi.
8. Raman M and Singh P, 2000, Business Communication. Oxford University Press.
9. Seely J, 2013, Oxford Guide to Effective Writing and Speaking. Oxford University Press.
10. Thomson A J and Martinet A V, 1977, A Practical English Grammar. Oxford University

NCC- I 1(0+1)

Objective

1. To develop qualities of character, courage, comradeship, discipline, leadership, secular outlook, spirit of adventure and sportsmanship and the ideals of selfless service among the youth to make them useful citizen.

2. To create a human resource of organized trained and motivated youth to provide leadership in all walks of life including the Armed Forces and be always available for the service of the nation.

Practical/ Awareness activities

- Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline.
- Drill- aim, general words of command, attention, stands at ease, stand easy and turning.
- Sizing, numbering, forming in three ranks, open and close order march, and dressing.
- Saluting at the halt, getting on parade, dismissing, and falling out.
- Marching, length of pace, and time of marching in quick/slow time and halt. Side pace, pace forward and to the rear. Turning on the march and wheeling. Saluting on the march.
- Marking time, forward march, and halt. Changing step, formation of squad and squad drill.
- Command and control, organization, badges of rank, honors, and awards
- Nation Building- cultural heritage, religions, traditions, and customs of India. National integration. Values and ethics, perception, communication, motivation, decision making, discipline and duties of good citizens. Leadership traits, types of leadership. Character/personality development. Civil defense organization, types of emergencies, firefighting, protection. Maintenance of essential services, disaster management, aid during development projects.
- Basics of social service, weaker sections of society and their needs, NGO's and their contribution, contribution of youth towards social welfare and family planning.
- Structure and function of human body, diet and exercise, hygiene and sanitation. Preventable diseases including AIDS, safe blood donation, first aid, physical and mental health. Adventure activities. Basic principles of ecology, environmental conservation, pollution and its control.

NSS- I 1(0+1)

Objective

Evoking social consciousness among students through various activities viz., working together, constructive, and creative social work, to be skilful in executing democratic leadership, developing skill in programme, to be able to seek self-employment, reducing gap between educated and uneducated, increasing awareness and desire to help sections of society.

Practical/ Awareness activities

- Orientation: history, objectives, principles, symbol, badge; regular programs under NSS
- Organizational structure of NSS, Code of conduct for NSS volunteers, points to be considered by NSS volunteers' awareness about health.
- NSS program activities. Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, analyzing guiding financial patterns of scheme, youth program/ schemes of GOI, coordination with different agencies and maintenance of diary. Understanding youth. Definition, profile, categories, issues and challenges of youth; and opportunities for youth who is agent of the social change.

- Community mobilization. Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of mobilization involving youth-adult partnership. Social harmony and national integration
- Indian history and culture, role of youth in nation building, conflict resolution and peace- building. Volunteerism and *shramdaan*. Indian tradition of volunteerism, its need, importance, motivation, and constraints; shaman as part of volunteerism
- Citizenship, constitution, and human rights. Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights and rights to information. Family and society. Concept of family, community (PRIs and other community-based organizations) and society

Semester II

S. No.	Course Title	Credit Hours
1.	Bakery Science and Technology	3(2+1)
2.	Nutritional Programme Surveillance	3(1+2)
3.	Food Preservation and Storage	2(0+2)
4.	Personality Development	2(1+1)
5.	Entrepreneurship Development and Business Management	3(2+1)
6.	Environmental Studies & Disaster Management	3(2+1)
7.	Skill Enhancement Courses (SEC-III)*	2(0+2)
8.	Skill Enhancement Courses (SEC-IV)*	2(0+2)
9.	NSS-II/NCC-II	1(0+1)
		21 (10+11)

*From the basket of available SEC modules

Bakery Science and Technology 3(2+1)

Objectives

- The aim of the course is to understand the process of different products, how their ingredients play a role in preparation of breads, cakes, biscuits, etc., their quality testing and how to modify products with desirable nutritional requirements.
- The course provides individuals with key knowledge of packaging, labeling, food safety and food laws that can be applied directly in existing products and also in development of new products of bakery.

Theory

Introduction to baking science. Basic materials used in bakery and confectionery, selection, properties and functions. Flours- constituents, functions and characteristics of good flour and tests. Different types of flour mixtures used bakery, egg structure, composition and its functions in bakery. Different types of fats and oils used in bakery and their functions. Sugars and functions and types of sugars used in bakery and

confectionery, Salt and its functions in bakery and their functions, Yeast and types of yeast used in bakery and their functions. Improvers, leavening agents and emulsifiers used in bakery and their functions. Tools, equipment and techniques used in bakery.

Practical

Bakery unit: importance of sanitation and personal hygiene. Use of different bakery equipment microwave baking, balancing the formula for bakery products , demonstration on standard method of making different types of biscuits, salt, coconut and fruit biscuits Demonstration on standard method of making different types of cookies, preparation of different types of cookies, plain sponge cake, chocolate cake, pineapple upside down cake, walnut cake, madeira cake, fruit / plum cake, carrot cake, Demonstration on standard method of making of pastries, pastries, icings and cake decoration.

Suggested Reading

- Ashok Kumar Y. 2012. Textbook of Bakery and Confectionery. PHI Learning, India.
- Scott D. 2020. Bread Baking for Beginners: A Simple essential guide to kneading and baking bread.
- Mathuravalli S M D. 2022. Handbook of bakery and Confectionary. CRC Press.
- Bakers Handbook on Practical Baking, 1994. US Wheat Associates, New Delhi
- NIIR Board of consultants and Engineers. 2014. The complete technology book on bakery products (Baking Science with formulation and production). NIIR Project consultancy services, New Delhi.

Nutritional Programme Surveillance 3(1+2)

Objective

This course will enable the students to-

- Understand the concept of nutritional status and its relationship to health.
- Know aims, objectives, methods used for assessment of nutritional status.
- Identify the factors responsible for the malnutrition.

Theory

Nutrition monitoring and surveillance – definition, introduction, need and significance. Principles of a food and nutrition surveillance system and implementation steps. Nutrition surveillance in developed and underdeveloped countries. Setting up food and nutrition surveillance system activities -strengthening a food and nutrition surveillance system. Nutritional programmes – implementation, monitoring and evaluation. Concept of E-surveillance on the Nutritional situation in the country. Elements of the nutritional assessment - individual and population assessment - measuring malnutrition. Sampling of population. Supervision, monitoring and evaluation. Real time monitoring system. Malnutrition – causative factors. Food security assessment, health assessment and its significance in nutrition surveillance. Indicators of food and nutrition security – types and characteristics of indicators. Application and usefulness of indicators for different objectives and nutritional problems. Selection of indicators and levels of assessment.

Practical

Surveillance of National nutrition programs: ICDS, mid-day meal, availability of iodized salt in markets & households, distribution of iron-folifer tablets. Visit to ICDS centers, PHCs, *Aaganwadis*, assessing

nutritional status, data analysis & report writing, visit to mid-day meal kitchen, supervising food preparation in hygienic manner, report writing.

Suggested Reading

- Bamji M. S, Prahlad Rao N. & Vinodini Reddy. 2003. *Text book of Human Nutrition* (p-p 197-201), New Delhi. Oxford & IBH Publishing Co. PVT. LTD.
- Derrick. B. Jelliffe. 1966. *The assessment of the nutritional status of the community (With special reference to field surveys in developing regions of the World)*. World Health Organization, Geneva.
- Sehgal S. and Raghuvanshi RS. 2007. Textbook of community nutrition Directorate of Information and Publications of Agriculture, Indian Council of Agricultural Research, New Delhi.
- WHO 2014. Food and nutrition surveillance systems A manual for policy-makers and programme manager
- Spinello S. 2018. The duties of a community nutritionist. Cited from: https://careertrend.com/list-6526713-duties-community-nutritionist.html
- Beghan I Cap M Dajardan B 1988. A guide to Nutritional Status Assessment WHO Geneva.
- Flamino Fidanza .1991. Nutritional Status Assessment, Springer Science Business Media.
- Gopaldas T and Seshadri S. 1987. Nutrition monitoring and assessment, Oxford University press.
- Mason J B Habicht J P Tabatabai H Valverde V. 1984: Nutritional Surveillance WHO
- Saln D R Lockwood R Scrimshaw N S. 1981. Methods for the evaluation of the Impact and Nutrition Programme, U N University.

Food Preservation and Storage 2(0+2)

Objectives

- This course will provide the information about the shelflife of different food products,different preservations and processing techniques
- Students will also get hands on experience and knowledge about handling of food items on scientific lines to prepare and develop different preserved food product

Practical

Market survey of raw and preserved products. Preparation of preserved products- Squash, cordial, crush, jams, jellies, marmalade, candy, preserves, *murabbas*, pickles with and without oil, chutneys, ketchup, sauces, candies, toffees, cheese and syrup. Drying of blanched and unblanched fruits and vegetables by solar dryer, sun and oven drying methods. Shelf life and sensory evaluation of developed products Packaging of fruits and vegetables. Labelling and costing of products. Demonstration on canning and bottling of fruits and vegetables. Demonstration on storage of food grains. Preparation of *papad, wadian* utilizing cereals and legumes and their storage. Visits to food processing and preservation units, canning bottling units, grain storage institute.

Suggested Reading

- Bhutani, R. C. 2011. Fruit and Vegetable Preservation. Daya Publishing House.
- Sehgal, S., Grewal, R.B., Kawatra, A. and Kaur, Y. 1997. Practical Aspects of Food Preservation. Directorate of Publications. Haryana Agricultural University, Hisar.

- Vijay K., 1999. Text book of Food, Storage and Preservation, Kalyani Publishers, New Dehi.
- Kalia, M. and Sood, S. 2010. Food Preservation and Processing. Revised Edition, Kalyani Publishers, New Delhi.
- Jood, S. and Khetarpaul, N. 2002. Food Preservation. Geeta Somani, Agrotech Publishing Academy, Udaipur.
- Sivasankar, B. 2002. Food Processing and Preservation. PHI Learning Pvt. Ltd. Delhi
- Srivastava R P and Kumar S. 2019. Fruits and Vegetable Preservation: Principles and Practices. Revised and Enlarged 3rd Edition. CBS publishers and distributors.
- Subbulakshmi, G. and Udipi, S.A. 2006. Food processing and preservation. New Age International Publishers.
- Potter, N.N. (1996). Food Science. The AVI Publishing Company, Inc. Westport, Connecticut.

Personality Development 2(1+1)

Objectives:

To make students realize their potential strengths, cultivate their inter-personal skills and improve employability.

Theory:

Personality Definition, Nature of personality, theories of personality and its types . The humanistic approach - Maslow's self-actualization theory, shaping of personality, determinants of personality, Myers-Briggs Typology Indicator, Locus of control and performance, Type A and Type B Behaviours, personality and Organizational Behaviour.

Foundations of individual behavior and factors influencing individual behavior, Models of individual behavior, Perception and attributes and factors affecting perception, Attribution theory and case studies on Perception and Attribution. Learning: Meaning and definition, theoriesand principles of learning, Learning and organizational behavior, Learning and training, learning feedback. Attitude and values, Intelligence- types of Intelligence, theories of intelligence, measurements of intelligence, factors influencing intelligence, intelligence and Organizational behavior, emotional intelligence. Motivation- theories and principles, Teamwork and group dynamics.

Practical

MBTI personality analysis, Learning Styles and Strategies, Motivational needs, Firo-B, Interpersonal Communication, Teamwork and team building, Group Dynamics, Win-win game, Conflict Management, Leadership styles, Case studies on Personality and Organizational Behavior.

Suggested reading

1. Andrews, Sudhir, 1988, How to Succeed at Interviews. 21st (rep.) New Delhi.Tata McGraw-Hill.
2. Heller, Robert, 2002, Effective Leadership. Essential Manager series. Dk Publishing.

3. Hindle, Tim, 2003, Reducing Stress. Essential Manager series. Dk Publishing.
4. Lucas, Stephen, 2001, Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill.
5. Mile, D.J, 2004, Power of Positive Thinking. Delhi. Rohan Book Company.
6. Pravesh Kumar, 2005, All about Self- Motivation. New Delhi. Goodwill Publishing House.
7. Smith, B, 2004, Body Language. Delhi: Rohan Book Company.
8. Shaffer, D. R.,2009, Social and Personality Development (6th Edition). Belmont, CA: Wadswor

Entrepreneurship Development and Business Management 3(2+1)

Objective:

•To provide student an insight into the concept and scope of entrepreneurship.

•To expose the student to various aspects of establishment and management of a small business unit.

•To enable the student to develop financially viable agribusiness proposal.

Theory:

Development of entrepreneurship, motivational factors, social factors, environmental factors, ch entrepreneurs, entrepreneurial attributes/competencies. Concept, need for and importance of development. Evolution of entrepreneurship, objectives of entrepreneurial activities, types of entrepre of entrepreneurs, importance of entrepreneurial development, and process of entrepreneurship Environment scanning and opportunity identification need for scanning–spotting of opportuni environment– identification of product / service – starting a project; factors influencing sensing th Infrastructure and support systems- good policies, schemes for entrepreneurship development; ro institutions, and other agencies in entrepreneurship development. Steps involved in functioning o Selection of the product / services, selection of form of ownership; registration, selection of site, acquisition of manufacturing know how, packaging and distribution. Planning of an enterprise, projec selection, and formulation of project; project report preparation, Enterprise Management. Production product, levels of products, product mix, quality control, cost of production, production cor management. Production management – raw material costing, inventory control. Personal manageme planning, labour turn over, wages / salaries. Financial management /accounting – funds, fixed capit capital, costing and pricing, long term planning and short-term planning, book keeping, journal, lec books, annual financial statement, taxation. Marketing management- market, types, marketing ass strategies. Crisis management- raw material, production, leadership, market, finance, natural etc.

Practical:

Visit to small scale industries/agro-industries, Interaction with successful entrepreneurs/ agric-entrepreneurs. Visit to financial institutions and support agencies. Preparation of project proposal for funding by different agencies.

Suggested Readings:

- Charantimath P.M., 2009, Entrepreneurship Development and Small Business Enterprises. Pearson Publications, New Delhi.
- Desai V., 2015, Entrepreneurship: Development and Management, Himalaya Publishing House.
- Gupta CB. 2001. Management Theory and Practice. Sultan Chand & Sons.

- Indu Grover. 2008. Handbook on Empowerment and Entrepreneurship. Agrotech Public Academy.
- Khanka SS. 1999. Entrepreneurial Development. S. Chand & Co.
- Mehra P., 2016, Business Communication for Managers. Pearson India, New Delhi.
- Pandey M. and Tewari D., 2010, The Agribusiness Book. IBDC Publishers, Lucknow.
- Singh D. 1995. Effective Managerial Leadership. Deep & Deep Publ.
- Singhal R.K., 2013, Entrepreneurship Development & Management, Katson Books.
- Tripathi PC & Reddy PN. 1991. Principles of Management. Tata McGraw Hill.

Environmental Studies and Disaster Management 3(2+1)

Objective:

To expose and acquire knowledge on the environment and to gain the state-of-the-art - skill and expertise on management of disasters.

Theory

Introduction to Environment - Environmental studies - Definition, scope and importance - Multidisciplinary nature of environmental studies - Segments of Environment - Spheres of Earth - Lithosphere - Hydrosphere - Atmosphere - Different layers of atmosphere. Natural Resources: Classification - Forest resources. Water resources. Mineral resources Food resources. Energy resources. Land resources. Soil resources. Ecosystems - Concept of an ecosystem - Structure and function of an ecosystem - Energy flow in the ecosystem. Types of ecosystem. Biodiversity and its conservation: Introduction, definition, types. Biogeographical classification of India. Importance and Value of biodiversity. Biodiversity hot spots. Threats and Conservation of biodiversity

Environmental Pollution: Definition, cause, effects and control measures of: a. Air pollution. b. Water pollution. c. Soil pollution. d. Marine pollution. e. Noise pollution. f. Thermal pollution h. light pollution. Solid Waste Management: Classification of solid wastes and management methods, Composting, Incineration, Pyrolysis, Biogas production, Causes, effects and control measures of urban and industrial wastes. Social Issues and the Environment: Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Human Population and the Environment: Environment and human health: Human Rights, Value Education. Women and Child Welfare. Role of Information Technology in Environment and human health.

Disaster management - Disaster definition - Types - Natural Disasters - Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves. Man Made Disasters - Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, road accidents, rail accidents, air accidents, sea accidents. International and National strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community-based organizations and media in disaster management. Central, state, district and local administration in disaster control; Armed forces in disaster response; Police and other organizations in disaster management.

Practical

Visit to a local area to document environmental assets river/forest/grassland/hill/mountain. Energy: Biogas production from organic wastes. Visit to wind mill / hydro power / solar power generation units. Biodiversity assessment in farming system. Floral and faunal diversity assessment in polluted and un polluted system. Visit to local polluted site - Urban/Rural/Industrial/Agricultural to study of common plants, insects and birds. Environmental sampling and preservation. Water quality analysis: pH, EC and TDS. Estimation of Acidity, Alkalinity. Estimation of water hardness. Estimation of DO and BOD in water samples. Estimation of COD in water samples. Enumeration of E. coli in water sample. Assessment of Suspended Particulate Matter (SPM). Study of simple ecosystem – Visit to pond/river/hills. Visit to areas affected by natural disaster

Suggested Readings

1. De. A.K., 2010. Environmental chemistry. Published by New Age International Publishers, New Delhi. ISBN:13–978 81 224 2617 5. 384 pp
2. Dhar Chakrabarti. P.G., 2011. Disaster management - India's risk management policy frameworks and key challenges. Published by Centre for Social Markets (India), Bangalore. 36 pp.
3. Erach Bharucha, Text book for Environmental studies. University Grants Commission, New Delhi
4. Parthiban, K.T. Vennila, S. Prasanthrajan, M. Umesh Kanna, S. Forest, Environment, Biodiversity and Sustainable development. Narendra Publishing House, New Delhi, India 2023. (In Press).
5. Prasanthrajan M, P.P. Mahendran., 2008. A text book on Ecology and Environmental Science. ISBN 81-8321-104-6. Agrotech Publishing Academy, Udaipur - 313 002. First Edition: 2008
6. Prasanthrajan M, 2018. Objective environmental studies and disaster management. ISBN 9789387893825. Scientific publishers, Jodhpur, India. Pp. 146.
7. Sharma, P.D. 2009, Ecology and Environment, Rastogi Publications, Meerat, India
8. Tyler Miller and Scot Spoolman. 2009. Living in the Environment (Concepts, Connections, and Solutions). Brooks/cole, Cengage learning publication, Belmont, USA

NCC-II 1(0+1)

Objective

1. To develop qualities of character, courage, comradeship, discipline, leadership, secular outlook, spirit of adventure and sportsmanship and the ideals of selfless service among the youth to make them useful citizen.
2. To create a human resource of organized trained and motivated youth to provide leadership in all walks of life including the Armed Forces and be always available for the service of the nation.

Practical/ Awareness activities

- Arms Drill- Attention, stand at ease, stand easy. Getting on parade. Dismissing and falling out. Ground/take up arms, examine arms. Shoulder from the order and vice-versa, present from the order and vice-versa. Saluting at the shoulder at the halt and on the march. Short/long trail from the order and vice- versa. Guard mounting, guard of honor, Platoon/Coy Drill.
- Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning, and sight setting. Loading, cocking, and unloading. The lying position and holding.
- Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight. Theory of groups and snap shooting. Firing at moving targets. Miniature range firing. Characteristics of Carbine and LMG.
- Introduction to map, scales, and conventional signs. Topographical forms and technical terms.
- The grid system. Relief, contours, and gradients. Cardinal points and finding north. Types of bearings and use of service protractor. Prismatic compass and its use. Setting a map, finding north and own position. Map to ground and ground to map. Knots and lashings, Camouflage and concealment, Explosives and IEDs.
- Field defenses obstacles, mines and mine lying. Bridging, waterman ship. Field water supplies, tracks and their construction. Judging distance. Description of ground and indication of landmarks. Recognition and description of target. Observation and concealment. Field signals. Section formations. Fire control orders. Fire and movement. Movement with/without arms. Section battle drill. Types of communication, media, latest trends and developments.

NSS-II 1(0+1)

Objective

To evoke social consciousness among students through various activities viz., working together, constructive, and creative social work, to be skilful in executing democratic leadership, developing skill in programme, to be able to seek self-employment, reducing gap between educated and uneducated, increasing awareness and desire to help sections of society.

Practical/ Awareness activities

- Importance and role of youth leadership
- Meaning, types and traits of leadership, qualities of good leaders; importance and roles of youth leadership, Life competencies
- Definition and importance of life competencies, problem-solving and decision-making, interpersonal communication. Youth development programs
- Development of youth programs and policy at the national level, state level and voluntary sector; youth-focused and youth-led organizations

- Health, hygiene and sanitation. Definition needs and scope of health education; role of food, nutrition, safe drinking water, water borne diseases and sanitation (Swachh Bharat Abhiyan) for health; national health programs and reproductive health. Youth health, lifestyle, HIV AIDS and first aid. Healthy lifestyles, HIV AIDS, drugs and substance abuse, home nursing and first aid. Youth and yoga. History, philosophy, concept, myths, and misconceptions about yoga; yoga traditions and its impacts, yoga as a tool for healthy lifestyle, preventive and curative method.

Post- Semester II (Only for exit option for UG-Certificate)

S. No.	Course Title	Credit Hours
1.	Internship*(10 weeks)	**10(0+10)***
*Internship (only for exit option for award of UG-Certificate) 10 weeks		10(0+10)

Objectives

To provide students with an opportunity to put into practice the skills they have learned while in the institute, so that in case they exit with UG-certificate, they will be able to get proper engagement/ employment and consider having their own startups.

1. Integrate theory and practice
2. Assess interests and abilities in their field of study.
3. Develop work habits and attitudes necessary for job success.
4. Develop communication, interpersonal and other critical skills in the job interview process.
5. Explore career alternatives prior to graduation.

Activity

The students will have internship/ training for 10 weeks' duration either in the parent institute (attaching the students to facilities such as farm machinery testing centre, incubation centres, prototype production facilities, etc.) or in associated industry, food service centres, etc. The College/ University will facilitate attaching the students to the organisations.

After completion of internship, the students will have to submit a report of their learnings and also present in form of a seminar before nominated faculty members and other students.

The assessment will be based on the report / assessment received from the industry/ organisation and the report and the presentation made at the University. Ideally the weightage will be 50% each for both internal and external. The SAUs may modify the weightage and breakups.

Semester III

S. No.	Course Title	Credit Hours
1.	Principles of Human Nutrition	4(4+0)
2.	Fundamentals of Food Science	2(1+1)

3.	Community Nutrition & Education	3(2+1)
4.	Human Physiology	3(2+1)
5.	Economics & Food Business Management	2(2+0)
6.	Food Psychology	2(2+0)
7.	Skill Enhancement Courses (SEC-V)*	2(0+2)
8.	Physical Education, First Aid and Yoga	2(0+2)
8	Food Nutrition and Agriculture	2(2+0)
	Total	**22 (15+7)**

*From the basket of available SEC modules: **From approved list of UGC courses

Principles of Human Nutrition 4(4+0)

Objective

At the end of the course, the student will have knowledge of

- Different types of carbohydrates, lipids and fatty acids and proteins and amino acids required for human nutrition.
- The energy requirement and expenditure in the human body during rest and physical activity.
- The physiological and biochemical role of water, minerals and vitamins and their metabolism in the human body.
- The diseases and symptoms resulting from deficiency of major and minor nutrients.
- The biochemical monitors used to assess the nutritional status of different nutrients.

Theory

Historical development and the relationship of nutrition to health, growth and human welfare. Definitions of terms used in nutrition- Recommended dietary allowances, balanced diet, health foods, functional foods, phytochemicals, Nutraceuticals, dietary supplements, ethnic foods, organic foods, fabricated foods, extruded foods, convenience foods, junk foods, GM foods and proprietary foods. Food groups (Four, Five, Seven, Nine, Eleven), Food pyramid, my plate concept, Bioavailability, enrichment, fortification and restoration of nutrients. Energy units, sources and requirements, fuel value of foods, methods of measuring energy value of food, energy requirement of body, physical activity and thermogenic effect of food, Respiratory Quotient, SDA, BMR- methods of measurement, factors affecting BMR, Energy expenditure in different activities, Energy balance. Carbohydrates- Types, functions, sources, requirement, Digestion and absorption of carbohydrates, health conditions affected by carbohydrates, Dietary Fiber-Classification, sources, composition, properties & nutritional significance. Lipids- Types, functions, sources, requirement, Digestion and absorption of lipids health problems associated with lipids. Proteins- Types, functions, sources, requirement, Digestion and absorption of proteins, quality evaluation, improvement and deficiency and protein energy malnutrition. Vitamins- Classification, functions, sources, requirement, deficiency and toxicity of fat soluble-(A, D, E, K), (water soluble – C, B Complex (thiamine, riboflavin, niacin, B6, Pantothenic acid, B12 and folic acid). Minerals-Classification, functions, sources, requirements, deficiency

and toxicity of calcium, phosphorus, iodine, fluorine, iron, sodium, potassium, chloride, copper and zinc, factors affecting bio availability of calcium and iron and other minerals. Water- functions, sources, distribution in body. Water balance and electrolyte balance.

Suggested Reading

- Agrawal, A. and Udipi, A.S. 2022. Textbook of Human Nutrition. Jaypee Brothers Medical Publishers.
- Recommended dietary allowances and estimated average requirements nutrient requirements for Indians – 2020- A Report of the Expert Group Indian Council of Medical Research, National Institute of Nutrition
- Raghuvanshi, R. S., Mittal, M. 2014. Food Nutrition and Diet Therapy. India: Westville Publishing House New Delhi
- Bamji, M.S., Krishnaswamy, K. and Brahmam, G.N.V. 2009. Text book of Human Nutrition. Oxford & IBH Publishing Company Pvt. Ltd.
- Sehgal, S. and Raghuvanshi, R.S. 2007. Text Book of Community Nutrition. ICAR Publication.
- Wilson, E.D.; Fisher, K.H. and Garcia P.A. 1980. Principles of Nutrition. John Wiley & Sons, New York.
- Longvah, T., Ananthan, R., Bhaskarachary, K. and Venkaiah, K. 2017. Indian Food Composition Tables. National Institute of Nutrition, ICMR, New Delhi

Fundamentals of Food Science 2(1+1)

Objectives

- This course is designed to introduce students to the field of food science.
- This course will include; possible jobs, food harvest, production methods, food chemistry, preserving methods, meeting nutritional needs, grading procedures used and the science involved.
- Understand both fundamental and applied aspects of food science.
- Provides for fundamental understanding of food chemistry, and food microbiology.
- Gain insights about role of specific nutrients in maintaining health and identifying nutrient specific foods.

Theory

Cooking- Objectives, cooking methods, their types, merits and demerits. Cereals and millets - Structure, composition, processing techniques, effect of heat and acid, functions of starch in the cookery, retrogradation of starch. Legumes, nuts and oil seeds - Composition, processing techniques, effect of heat, acid and alkali. Fruits and vegetables - Types, composition, pigments, changes caused by heat, acid and alkali. Milk and milk products – Composition, types, products, effect of acid on milk cookery, uses and functions. Egg - Structure, composition, grading of egg, function and changes during cooking. Meat, poultry and fish- Types, structure, composition, pigments, factors affecting tenderness, post-mortem changes and changes during cooking. Sugars- Types, composition, manufacturing process, effect of heat and acid, crystallization factors affecting crystallization, functions of sugar in cookery, fondants and fudge. Fats and oils - kinds, composition, effect of heat, functions in cookery, processing techniques, rancidity of fats;

Methods of improving nutritive value of foods – germination, fermentation, malting, mutual supplementation etc. Brief overview of beverages; Condiments and spices, importance in daily life.

Practical

Orientation to kitchen equipment and their uses, weighing and measuring food items. condiments and spices. Cooking of foods using different methods. Cereal cookery– Practical exercise on dextrinization and gelatinization of rice starch, gluten formation in wheat. Legumes – Identification and cooking methods. Nuts and oilseeds- Use in food preparations. Preparations using Germination, fermentation, mutual supplementation. Vegetable cookery- Different preparations with vegetables and effect of heat and alkali on pigments. Preparation of soups, salads and beverages. Milk and milk products- Maillard reaction, Use in various preparations. Egg cookery - Preparations showing functions of egg as binding, coating agent: poached egg, boiled egg, scrambled egg, omelet, egg curry. Meat, poultry and fish cookery – Preparations involving various methods of cooking. Sugar – Preparations showing functions of sugar in cooker-caramelization, coating agent, crystallization, syrups of different consistencies, sweets, chocolates, candies. Fats and oils – Demonstration of smoking point, use in various preparations like deep fat frying, shallow fat frying, shortening effects of oil, factors affecting absorption of oil.

Suggested Reading

- Sharma, A. 2017. Textbook of Food Science and Technology. CBS Publication.
- Fox, B. F. and Cameron, A. G. 1970. Food Science - a Chemical Approach. University Press, London
- Swaminathan, M. 1988. Handbook of Food Science and Experimental Foods BAPPCO, Bangalore.
- Raghuvanshi, R.S. and Bisht, K. 2010. Uses of Soybean: Products and Preparation. Guriqbal Singh (Ed.). *In:* Soybean: Botany, Production and Uses, CAB International, U.K.
- Raghuvanshi, R.S. and Singh, D.P. 2009. Food preparations and use. William Erskina *et al.* (Eds.). *In:* The Lentil: Botany Production and Uses. CAB International, U.K.
- Shakuntala Manay N, Shadaksharaswamy M. 1998. Foods, Facts and Principles, New Age International Publishers, New Delhi

Community Nutrition & Education 3(2+1)

Objectives

At the end of the course, the student will have knowledge of

- Causes, prevalence and consequences of the major nutritional problems existing in India and its control measures.
- Methods of nutritional status assessment of individual and group both directly and indirectly.
- To inculcate concept of food and nutrition security and government and international program running in the field of community nutrition for ameliorating nutritional status of population.
- To enable students to assess nutritional status and impart nutrition education among rural and needy people.

Theory

Basic concept of community nutrition role of nutritionist in improving nutrition in community Food habits and influencing factors, Food taboos, Mortality and morbidity pattern of vulnerable groups and their causes. Nutritional needs of normal infants, prelacteal feeding, exclusive breast feeding, feeding of full term and

premature infants. Importance of breast feeding and supplementary foods in combating malnutrition in infants and young children. Growth monitoring Malnutrition. Definition and causes, classification of grades of malnutrition. Assessment of nutritional status- Nutritional Anthropometry-Need and importance, standard for reference, techniques of measuring Length/ height, weight, head, chest and arm circumference, skinfold thickness, interpretation of these measurements. Use of growth chart, Clinical signs of deficiencies specially PEM (Kwashiorkor, marasmus), vitamin A deficiencies, Anemia, Rickets, B-Complex deficiencies. Bio chemical and biophysical assessment. Diet survey: Need and importance, methods of dietary survey, Interpretation - concept of consumption unit, individual and total distribution of food in family, adequacy of diet in respect to RDA, concept of family food security. Major nutritional problems in community. National programmes and policies for improving nutritional status of community. Role of national and international agencies in improving nutritional status of the community. Nutrition education: objectives, methods, channels and its role in control of malnutrition in community nutrition education - Objectives, principles and importance of nutrition education in a community nutritional survey – NFHS.

Practical

Assessing nutritional status of hostel inmates and local community dwellers. Assessing nutritional status of community as per socio-economic status. Visit to local health centres to identify clinical signs and symptoms of nutritional problems. Visit to Anganwadi centres, MDM and evaluation of feeding provided at these centres. Community survey for nutritional deficiency disorders -Data collection, tabulation, analysis, interpretation report writing. Development of audio- visual aids. Planning, implementation and evaluation of nutrition education programme for a target group.

Suggested Reading

- Das, S. 2022. Textbook of Community Nutrition. Academic Publishers.
- Sehgal, S. and Raghuvanshi, R.S. 2007. Textbook of community nutrition, Directorate of Information and Publications of Agriculture, Indian Council of Agricultural Research, New Delhi.
- Latham, M.C. 1997. Human nutrition in the developing world. Food and agricultural organization of United Nations.
- Dahiya, S., Boora, P. and Rani, V. 2013. A manual on Community nutrition, Dept. of Foods and Nutrition, published under ICAR, Assistance scheme.
- Bamji, S.M., Rao, N.P., Reddy, V. 1996. Textbook of human nutrition. Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.

Human Physiology 3(2+1)

Objective

- An overall goal of this course is to enable students to understand the role of molecules, cells, tissues, organs, and organ systems (endocrine, nervous, muscular and immune systems) in human health and disease.
- This course focuses on understanding physiology –the functioning of a living organism and its component parts.
- This requires going beyond memorization of facts to acquire an understanding of how and why the body functions the way it does, and what happens when it does not function properly.

Theory

Introduction to anatomy and physiology and structural organization of body. The cell – Structure, its organelles, functions and multiplications, different types of cells and their functions, movement of particles across cell membrane - Active transport and passive transport ,Body fluids and its compartments and functions ,Water output and input into the body and maintenance of water balance in human body , the tissues – Types, structure and their functions, the skeletal system - Anatomy and functions, structure, formation and development of bones, different types of bones and types of joints and their movements, Circulatory system - The blood - Composition and function, blood clotting and blood grouping, Heart – Structure, functions, types of circulatory systems, blood pressure and heart rate and factors affecting it, electrocardiogram, the respiratory system - anatomy, functions, mechanism of breathing and respiratory volumes, gas transport and respiratory adaptation, the digestive system - anatomy and functions of alimentary tract and accessory organs, process of digestion of food, absorption and assimilation of digested food, enzymes involved in digestion of food, liver - Structure and functions, Pancreas – Structure and functions, the urinary system - Anatomy and functions, formation and composition of urine, the endocrine system - important ductless glands of the body and their functions, the reproductive system - Male reproductive system – Anatomy and functions, female reproductive system – Anatomy and functions, menstrual cycle, the nervous system - elementary study of (anatomy and functions), sensory organs – (anatomy and functions). Glossary of terms used in physiology.

Practical

Study of a compound microscope, microscopic structure of epithelial, muscular and connective tissue, bone and cartilage, Measurement of body temperature, Basal Metabolic Rate, Recording of systemic arterial blood pressure, Pulmonary function test, Pulse rate and respiratory rate, Effect of posture and exercise on blood pressure. Visit to anatomy and physiology lab, estimation of hemoglobin, red blood corpuscles, estimation of white blood corpuscles, determination of blood groups assessment of blood group, determination of bleeding time (bt) and clotting time (ct). Determination of blood glucose qualitative tests with urine samples -urine sugar and albumin.

Suggested Reading

- Arthur J. V. Human physiology- The mechanisms of body function, Tata McGraw Hill Publishing Company, New Delhi.
- Samson, applied physiology 10th ed. Revised by Keele, C.A. and Neil, B. Oxford University Press, New York.
- Guyton C. Text Book of medical physiology 5th ed. W.B. Saunders Company- Philadelphia, London

Economics & Food Business Management (2+0)

Objectives

- Students will study food from a scientific perspective and the food industry from a business point of view.
- Students will have opportunities to create new food products and develop new ways to manufacture, preserve, and package food products.
- Students will take courses in food production, development, and commercialization.

Theory

Economics definition and key concepts; business economics. The working of competitive markets: business in a competitive market; demand and supply population and growth food production availability, price and output determination; elasticity of demand and supply; Government intervention in competitive markets (FCI, Food Subsidies). Background to demand: marginal utility theory and demand and the firm. Background to supply: cost and production; short vs long-run. Revenue and profit maximization. Market Structures: Perfect competition, monopoly, monopolistic competition. Business in an international environment: globalization (key concepts). Business Management- Definitions, management principles, scientific principles, administrative principles; Maslow's Hierarchy of needs theory; Functions of management: Planning, organizing, staffing, directing, controlling; Organizational structures, principles of organization; Types of organization: Formal and informal, line and staff, matrix, hybrid

Suggested Reading

- L.M. Prasad. 2001. Principles and Practices of Management, 9th Ed. S. Chand & Sons, New Delhi.
- Koontz Harold. Principles of Management. Tata McGraw-Hill Education Private Limited, New Delhi.
- P.C. Thomas. Managerial Economics, 9th Ed. Kalyani Publishers.
- K.K. Dewett and M.H. Navalur. Modern Economic Theory. S. Chand & Sons, New Delhi.
- P. Subba Rao. Human Resource Management. Himalaya Publications.
- S.P. Jain. Financial Accounting. Kalyani Publications, Ludhiana.
- Dorfman, Jeffrey H. 2013. Economics and Management of the Food Industry. Taylor & Francis

Food Psychology 2(2+0)

Objectives:

- To gain a understanding of the psychological factors that influence food choices, eating behaviors, and our relationship with food.
- To explore the impact of sensory experiences (taste, smell, sight, touch) on food perception and preference.
- To examine the psychology behind food marketing and advertising strategies.
- To develop practical strategies to cultivate a mindful and healthy relationship with food.

Theory:

Introduction to Food Psychology, Interaction of Hunger and Satiety, Sensory Perception and Food Preferences, Role of positive and negative emotions on selection / choice of foods – eating behavior. Meal composition and effect of specific nutrients on mood / stress., Understanding and Managing Cravings, Anorexia nervosa and binge eating behaviour, Mindful Eating Practices, Social Cues and Dining Environments, Psychological influence of Food Marketing and Advertising, digital food marketing – public health challenge, Cultural Food Traditions and Practices, Food and Mental Well-being, Practical

Applications of Food Psychology, Overeating, Disordered Eating, and Body Image Concerns, Strategies for Individual and Community Health.

Suggested Readings:

- Hardcastle SJ, Thøgersen-Ntoumani C, Chatzisarantis NL. Food Choice and Nutrition: A Social Psychological Perspective. Nutrients. 2015 Oct;7(10):8712-5.
- Cardoz, F. (2009). India: The cookbook. HarperCollins Publishers India.

Physical Education, First Aid and Yoga 2(0+2)

Objectives

- To make the students aware about Physical Education, First Aid and Yoga Practices
- To disseminate the knowledge and skill how to perform physical training, perform firstaid and increase stamina and general wellbeing through yoga.

Practical

Physical education; Training and Coaching - Meaning & Concept; Methods of Training; aerobic and aerobic exercises; Calisthenics, weight training, circuit training, interval training, Fartlek training; Effects of Exercise on Muscular, Respiratory, Circulatory &Digestive systems; Balanced Diet and Nutrition: Effects of Diet on Performance; Physiological changes due to ageing and role of regular exercise on ageing process; Personality, its dimensions and types; Role of sports in personality development; Motivation and Achievements in Sports; Learning and Theories of learning; Adolescent Problems & its Management; Posture; Postural Deformities; Exercises for good posture.

Yoga; History of Yog, Types of Yog, Introduction to Yog,

•Asanas (Definition and Importance) Padmasan, Gaumukhasan, Bhadrasan, Vajrajasan, Shashankasan, Pashchimotasan, Ushtrasan, Tadasan, Padhastasan, Ardhchandrasan, Bhujangasan, Utanpadasan, Sarvangasan , Parvatasan , Patangasan, Shishupalanasan – left leg-right leg, Pavanmuktasan , Halasan , Sarpasan, Ardhdhanurasan, Sawasan

•Suryanamskar Pranayama (Definition and Importance) Omkar, Suryabhedan, Chandrabhedan, AnulomVilom, Shitali, Shitkari, Bhastrika, Bhramari

•Meditation(Definition and Importance), Yogic Kriyas (Kapalbhati), Tratak, Jalneti and Tribandh

•Mudras (Definition and Importance) Gyanmudra, Dhyanmudra, Vayumudra, Akashmudra, Pruthvimudra, Shunyamudra, Suryamudra, Varunmudra, Pranmudra, Apanmudra, Vyanmudra, Uddanmudra

•Role of yoga in sports

•Teaching of Asanas – demonstration, practice, correction and practice.

History of sports and ancient games, Governance of sports in India; Important national sporting events; Awards in Sports; History, latest rules, measurements of playfield, specifications of equipment, skill, technique, style and coaching of major games (Cricket, football, table Tennis, Badminton, Volleyball, Basketball, Kabaddi and Kho-Kho) and Athletics

Need and requirement of first aid. First Aid equipment and upkeep. First AID Techniques, First aid related with respiratory system. First aid related with Heart, Blood and Circulation. First aid related with Wounds and Injuries. First aid related with Bones, Joints Muscle related injuries. First aid related with Nervous system and Unconsciousness. First aid related with Gastrointestinal Tract. First aid related with Skin, Burns. First aid related with Poisoning. First aid related with Bites and Stings. First aid related with Sense organs, Handling and transport of injured traumatized persons. Sports injuries and their treatments.

Food Nutrition and Agriculture 2(2+0)

Objectives

- Develop skills to apply and evaluate innovative solutions that place nutrition at the heart of a sustainable food system.
- Students will learn about the components of the food system and their link to nutrition and acquire the skills to implement and evaluate nutrition-sensitive interventions.

Theory

Food production and consumption situation in India and in the world; Food production and consumption trends, food balance sheets; Role of nutrition in agricultural planning and national development. Linkages between agricultural practices, food production, food distribution and nutritional status; Factors affecting food distribution at macro and micro level, per capita food availability and consumption; Food and nutrition security at national and household level; Role of agriculture in enhancing food security; Urbanization and food security. Sustainable food systems; Food crop failure and malnutrition, poverty and vicious cycle of low food production. Innovative approaches to enhance local food production and improve food distribution systems. Effect of food production and economic policies on food availability; Impact of physical resources, farming systems, cropping system, inputs and manipulation, agricultural marketing system, post-harvest processing of foods on food and nutrition situation; Nutritional composition of commonly consumed foods. Implementation of nutrition policy, agricultural programmes; nutritional impact of agricultural programmes, food price control and consumer subsidy; Contribution of National and International organization in agricultural development.

Suggested Reading

- FAO. 2017. The State of Food and Agriculture - Leveraging Food Systems for Inclusive Rural Transformation. Food and Agriculture Organization, Rome.
- FAO. 2017. The State of Food Security and Nutrition in the World. Food and Agriculture Organization, Rome.(latest publications of FAO)
- GOI. 2017. Agriculture - Statistical Year Book India. Ministry of Statistics and Programme Implementation, Government of India. (latest publications of GOI)
- Raghuvanshi R.S. 2013 Nutritional Security through Diversified Food Production. in Agrarian Change and Small Farmers, Super markets, Viability and Food Policy. Ed. by K.N. Bhatt and Pradeep Bhargava, Concept Publishing Company PVT. LTD., New Delhi
- GOI. 2011. Census of India. Government of India. (New Census Report)
- GOI. 2018. A Reference Manual by Publication Division. Ministry of Information about Broadcasting, Govt. of India.
- Albert, JL. (Eds.) 2000. Food, nutrition and agriculture. FAO Publication.

- India 2001. A Reference Annual. Publication Division, Ministry of Information and Broad casting, Govt. of India.
- National Family Health Survey (rchiips.org)
- Home - Global Nutrition Report
- Global Food Security Index (GFSI) (economist.com)
- https://www.who.in

Semester IV

S. No.	Course Title	Credit Hours
1.	Normal Nutrition & Meal Planning	3(2+1)
2.	Public Health Nutrition	3(2+1)
3.	Nutritional Biochemistry	3(3+0)
4.	Food Standards & Quality Control	3(2+1)
5.	Skill Enhancement Courses (SEC-VI)*	2(0+2)
6.	Agriculture Marketing and Trade	3(2+1)
7.	Agriculture Informatics	3(2+1)
	Total	**20 (13+7)**

*From the basket of available SEC modules

Normal Nutrition & Meal Planning 3(2+1)

Objectives

- Students will engage in a study of general nutrition information, principles of meal planning, food safety, consumer guidelines, and management techniques for lab experiences.
- This will be followed by a variety of experiences, designed around the actual preparation of foods.
- Vocabulary, reading and following recipe and/or modelled directions, selection and storage of food items, cooking methods, and related techniques will be included.
- Successful completion of this course is a prerequisite to enrolment in Culinary Arts.

Theory

Basic principles of menu planning, planning menus for individual and family. Classification of vegetarianism. Factors influencing food intake and food habits. Basic principles of meal planning, planning meals for individual and family. Factors affecting food requirements of individuals, families and different groups of people. Meal planning for special occasions. Steps involved in meal planning. Food groups and their use in meal planning. Recommended dietary allowances of macro and micro nutrients for different age groups. Food exchange list. Use of food exchange list in diet planning, planning breakfast, lunch, tea, dinner, packed lunch and snacks; considering RDA for individuals Importance of balanced diets. Food and nutrient requirement of adults and diet planning (male and female of all activities level), pregnant women, lactating women, old age. Breast feeding, advantages of breast feeding, prelacteal feeding, breast feeding during

illness, feeding of pre term baby, feeding problems. Complementary feeding. Food and nutrient requirement of pre-school children, school age children, adolescents, geriatric nutrition- physiological and psychological factors affecting the diet plan.

Practical

Standardization of serving sizes, portion, cost of locally available common foods. Food exchange list: method of using and portioning. Planning preparation and nutrient calculation of diets of preschool children, school going children, adolescents, adults and senior citizens, packed lunches for school children. Practice in formal and informal table setting and table manners.

Suggested Reading

- Raghuvanshi, R. S., Mittal, M. 2014. Food Nutrition and Diet Therapy. India: Westville Publishing House New Delhi.
- Gopalan C. and Krishnaswamy K. 2000. Nutrition in Major Metabolic Diseaes. Oxford University Press, New Delhi.
- Longvah, T., Ananthan, R., Bhaskarachary, K. and Venkaiah, K. 2017. Indian Food Composition Tables. National Institute of Nutrition, ICMR, New Delhi
- ICMR, 2020. Recommended Dietary allowance for Indians, ICMR, Delhi.
- Raghuvanshi R.S & Mittal M. 2019 *Upcharatmak Poshan* (Diet Therapy) Brillion Publishing House, New Delhi pp 1-352.(Hindi)
- Joshi, Shubhangini A. 2021. Nutrition and Dietetics. 5th Edn. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
- Sharma S. 2006. Human nutrition and meal planning. Delhi, Jnanada Prakasham (PandD).
- https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=NuAs6SreCGryddEfs4kkBA==
- Sehgal, S. and Raghuvanshi, R. S. 2007. *Textbook of Community Nutrition*, Indian Council of Agricultural Research, New Delhi.
- Robinson and Weicley, (1984). Basic Nutrition and diet Therapy. MacMillian Publishing Co. Inc. New York and London.

Public Health Nutrition 3(2+1)

Objectives

- Public Health Nutrition (PHN) course aims to equip students with the knowledge of community nutrition, national and international nutrition programmes and interventions.
- The programme strengthens student's skills to develop, implement and evaluate the nutrition programmes and policies to address the different nutritional problems with greater impact and efficiency.
- The course envisages to develop an evidence-based approach to address the nutritional problems and to reduce the risk for malnutrition in different populations.

Theory

Concept of Health, Public health, Public Health Nutrition, Nutritional Epidemiology and Community nutrition- Demography, demographic cycle; Health Indicators and their significance – Birth and death rates,

IMR, MMR, TFR, U5MR etc. Health Care System in India – Primary, Secondary and Tertiary, National Health Policy, National Nutrition Policy and National Nutrition Mission-An overview. Public health problems of India, nutrient deficiency diseases and other diseases, their etiology, prevalence, prevention and monitoring. Indicators and data sources from existing macro and micro systems of information in India (NFHS, NSSO, ICDS, NSS, CENSUS). National programmes relevant for public health. Vitamin A deficiency disorder control programme, National diarrhoeal disease programme, national iodine deficiency disorder control programme, iron deficiency anemia prophylaxis programme, National malaria eradication programme, national immunization programme, national programme for control of tuberculosis, national AIDS control programme, other health and nutrition programmes. Communicable and infective disease control: Nature of communicable diseases, infections, contamination, transmission, vector borne diseases, environmental agents, control and prevention. National Malaria Eradication Programme, National Filarial control programme, National Leprosy Eradication programme, Japanese Encephalitis control and other national control programmes (Blindness, Mental Health, etc) National Mental Health Programme (NMHP. Universal Immunization Programme and child survival and safe motherhood programme. COVID-19, its origin, life cycle of virus, mutation, detection, case tracking, vaccine development, and vaccination program.

Practical

Visit to PHC to study the prevalence of the communicable disease. Epidemiological approach to study individual disease in a community. Analysis of data and report writing. Discussion for preventive and therapeutic strategies. Public health campaign in a village.

Suggested Reading

- Vyas, S. 2021. Public Health Nutrition: A textbook. Vishwagyan Prakashan.
- McLaren, D.S. 1976. Nutrition in the community. John Wiley and Sons, London.
- DeMaeyer, E.M. 1989. Preventing and controlling iron deficiency anemia through primary health care. A guide for health administrators and programme managers. WHO, Geneva.
- WHO 2001. Assessment of iodine deficiency disorders and monitoring their elimination. A guide for programme managers 2nd Ed.
- Park, K. (2016). Textbook of Preventive Medicue, New Age international (P) Limited.
- Sehgal, S. and Raghuvanshi, R.S. 2007. Textbook of community nutrition, Directorate of Information and Publications of Agriculture, Indian Council of Agricultural Research, New Delhi.
- https://www.who.int/emergencies/diseases/novel-coronavirus-2019
- Park, K. (2016). Textbook of Preventive Medicue, New Age international (P) Limited.
- International Institute for Population Sciences (IIPS) and ICF. 2021. National Family Health Survey (NFHS-5), 2019-21: India. Mumbai: IIPS.
- Michael J Gibney, Barrie M Margetts, John M Kearney and Lenore Arab. (2004). Public Health Nutrition. Blackwell Science Ltd, UK.

Nutritional Biochemistry 3(3+0)

Objectives

- To understand the chemical characteristics of different classes of nutrients with reference to their physical properties, and to relate this to their functions in the body.
- To explain the processes of digestion, absorption and metabolism of the macronutrients and micronutrients in the context of different meals.
- To consider the main features of metabolism using the concept of energy flux through metabolic pathways as a focus.
- To explore the integration of pathways for the metabolism for fat, protein and carbohydrate and to examine the mechanisms for the regulation of flux through these pathways.
- To discuss the established functions of micronutrients and to examine the clinical and biochemical effects of depletion.

Theory

Recapitulation of basic chemistry and biology Water, pH and buffers, Acid-base balance Cellular constituents, Structure and function: Amino acid and proteins, Carbohydrates, Lipids and bio membranes, Nucleic acids dissolved molecules – Vitamins and minerals. Enzymes, function, properties, mechanism, Metabolism of cellular constituents. Basic concepts of Bioenergetics Carbohydrates metabolism: glycolysis and glycogenolysim, HMP pathway, TCA Cycle, Electron transport chain, Photosynthesis, Gluconeogenesis, Lipids metabolism: Beta-oxidation, Ketone bodies, Fatty acid synthesis. Amino acid metabolism: General reactions of nitrogen assimilation and excretion Biosynthesis of DNA, RNA and Protein replication, transcription, translation and genetic code regulation of gene expression

Suggested Reading

- Conn, EE and Stumpf, PK. 2009. Outlines of Biochemistry. John Wiley. y Nelson, DL and Cox, MM. 2004.
- Lehninger Principles of Biochemistry. 5th Ed. MacMillan.
- Voet D, Voet JG and Pratt, CW. 2007. Fundamentals of Biochemistry. John Wiley y Jayaram. T. 1981. Laboratory manual in biochemistry, New Delhi: Wiley Estern Ltd.
- Plummer D. 1988. An Introduction to Practical Biochemistry. 3rd ed. Tata McGraw Hill, New Delhi.
- Hames B.D., Hooper N.M. and Houghton J.D. 1997. Instant Notes in Biochemistry. BIOS Scientific Publishers.
- Essentials Of Biochemistry.2008. U. Satyanarayana and U.Chakrapani.

https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=NuAs6SreCGryddEfs4kkBA==

Food Standards & Quality Control 3(2+1)

Objectives

- To develop qualified and competent human resource in the field of the food standards and quality management for regulators, industry, academic/research institutions, certifying and accreditation bodies, food trade, food testing and training

- To delve in depth on various aspects of food standards and quality management i.e. food standards, harmonization with global benchmarks, quality management systems, food analysis, instrumentation, risk analysis /management, traceability and auditing to transform the food ecosystem
- To nurture a positive and disciplined food standard and quality culture among the professionals
- To conduct research studies on emerging food standard issues and formulation of science based regulatory framework.

Theory

Importance of food quality control and assurance. Food Standards and Regulations in India: FSSAI, Prevention of Food Adulteration Act, Fruit Product Order, AGMARK, Essential Commodity Act, Consumer Protection Act, Bureau of Indian Standards, Codex Standards, Food and Drug Administration (FDA). Food additives, preservatives, coloring agents, antioxidants, emulsifying agents, leavening agents and stabilizing agents. Various methods for the assessment of quality of different foods. Food safety management systems-GMP/GHP, HACCP, GLP, GAP, The Kosher and Halal Food Laws Food packaging, packaging material. Adulteration, heavy metals. Quality criteria of foods – food grains, fruits, vegetables and animal foods. Quality criteria of processed foods. Physical, chemical and microbial contamination of foods. Food adulteration – common adulterants – health hazards. Tests to detect adulterants in food.. Pesticides-Mechanisms of Toxicity-Residues in Food, Acceptable daily limits.

Practical

Sensory and nutritional evaluation of some finished products. Detection of adulterants and preservatives in products. Identification of food logos. Study of food labelling. Identification of critical control points in a product line. Sensory evaluation of different food samples. Visit to quality control laboratory/food processing industries and note the procedures and parameters used for quality assessment. Estimation of quality parameters- cereals, pulses, fruits and veg. Market survey and quality analysis of street foods. Estimation of quality parameters – cereals, pulses, fruits and vegetables - Evaluation of food quality – objective and subjective methods - Market survey and quality analysis of street foods -

Suggested Reading

- Potter, N.N. 1996. Food Science. The AVI Publishing Company Inc., Westport, Connecticut.
- Jellinek, G. 1985. Sensory Evaluation of Foods: Theory and Practice. Ellis Honwood Ltd. Chichester, England.
- Manual of Food Standards and Quality Control. 2014. Dept. of Foods and Nutrition, CCS HAU, Hisar.
- Detect Adulteration with Rapid Test (DART) booklet fssai https://www.fssai.gov.in/flipbook.php?bookid=201#book2/7
- Radonit Lassztity. 2008. Food Quality and Standards. Encyclopedia of Life effort systems. USA.
- Patricia and Cuuring A. An operational Text book, guide to Food Laws and Regulations.
- Food Safety and Standards (Food Products Standards and Food Additives) Regulation, 2011.
- Kalia, M. and Sood, S. 2010. Food Preservation and Processing. Revised edn. Kalyani Publishers, New Delhi

Agriculture Marketing and Trade 3(2+1)

Objectives:

- To understand the fundamentals of agricultural marketing and trade.
- To analyze the factors influencing supply and demand in agricultural markets.
- To explore different marketing channels and strategies in agriculture.
- To examine the role of government policies and regulations in agricultural markets.

Theory:

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets; demand, supply and producer's surplus of agri commodities: nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – meaning, merits and demerits; marketing process and functions: Marketing process concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labelling (Agmark); Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for innovations in agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR. Role of government in agricultural marketing. Role of APMC and its relevance in the present day context.

Practical:

Plotting and study of demand and supply curves and calculation of elasticities; Study of relationship between market arrivals and prices of some selected commodities; Computation of marketable and marketed surplus of important commodities; Study of price behaviour over time for some selected commodities; Construction of index numbers; Visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodity, collection of data regarding marketing costs, margins and price spread and presentation of report in the class; Visit to market institutions –NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning. Application of principles of comparative advantage of international trade.

Suggested Readings:

- Acharya, S.S. and Agarwal, N.L., 2006, Agricultural Marketing in India, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- Chinna,S.S., 2005, Agricultural Economics and Indian Agriculture. Kalyani Pub, N Delhi.

• Dominic Salvatore, Micro Economic Theory

• Kohls Richard, L. and Uhl Josheph, N., 2002, Marketing of Agricultural Products, Prentice-Hall of India Private Ltd., New Delhi.

• Kotler and Armstrong, 2005, Principles of Marketing, Pearson Prentice-Hall.

• Lekhi, R. K. and Jogindr Singh, 2006, Agricultural Economics. Kalyani Publishers, Delhi.

• Memoria, C.B., Joshi, R.L. and Mulla, N.I., 2003, Principles and Practice of Marketing in India, Kitab Mahal, New Delhi.

• Pandey Mukesh and Tewari, Deepali, 2004, Rural and Agricultural Marketing, International Book Distributing Co. Ltd, New Delhi.

Sharma, R., 2005, Export Management, Laxmi Narain Agarwal, Agra.

Agricultural Informatics 3(2+1)

Objectives

i) To acquaint students with the basics of computer applications in agriculture, multimedia, database management, application of mobile app and decision- making processes, etc.
ii) To provide basic knowledge of computer with applications in Agriculture.
iii) To make the students familiar with Agricultural-Informatics, its components and applications in agriculture.

Theory

Introduction to Computers, Anatomy of Computers, Memory Concepts, Units of Memory, Operating System: Definition and types, Applications of MS-Office for creating, Editing and Formatting a document, Data presentation, Tabulation and graph creation, Statistical

analysis, Mathematical expressions, Database, concepts and types, creating database, Uses of DBMS in Agriculture, Internet and World Wide Web (WWW): Concepts and components.

Computer programming: General concepts, Introduction to Visual Basic, Java, Fortran, C/ C++, etc. concepts and standard input/output operations.

e-Agriculture, Concepts, design and development, Application of innovative ways to use information and communication technologies (IT) in Agriculture, Computer Models in Agriculture: Statistical, weather analysis and crop simulation models, concepts, structure, inputs-outputs files, limitation, advantages and application of models for understanding plant processes, sensitivity, verification, calibration and validation, IT applications for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management, Smartphone mobile apps in agriculture for farm advice: Market price, postharvest management etc., Geospatial technology: Concepts, techniques, components and uses for generating valuable agri-information, Decision support systems: Concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc. for supporting farm decisions. Preparation of contingent crop-planning and crop calendars using IT tools, Digital India and schemes to promote digitalization of agriculture in India.

Practical

Study of computer components, accessories, practice of important DoS Commands, Introduction of different operating systems such as Windows, Unix/ Linux, creating files & folders, File Management. Use of MS-WoRD and MS Power-point for creating, editing and presenting a scientific documents, MS- EXCEL - Creating a spreadsheet, Use of statistical tools, Writing expressions, Creating graphs, Analysis of scientific data, Handling macros. MS-ACCESS: Creating Database, preparing queries and reports, Demonstration of Agri- information system, Introduction to World Wide Web (WWW) and its components, Introduction of programming languages such as Visual Basic, Java, Fortran, C, C++, Hands on practice on Crop Simulation Models (CSM), DSSAT/Crop-Info/Crop Syst/ Wofost, Preparation of inputs file for CSM and study of model outputs, computation of water and nutrient requirements of crop using CSM and IT tools, Use of smart phones and other devices in agro-advisory and dissemination of market information, Introduction of Geospatial Technology, Hands on practice on preparation of Decision Support System, Preparation of contingent crop planning, India Digital Ecosystem of Agriculture (IDEA)

Suggested Readings

1. Fundamentals of Computer by V. Rajaroman.

2. Introduction to Information Technology by Pearson.

3. Introduction to Database Management System by C. J. Date.

4. Concepts and Techniques of Programming in C by Dhabal Prasad Sethi and Manoranjan, Wiley India.

5. Introductory Agri Informatics by Mahapatra, Subrat K et al, Jain Brothers

Publication.

Post- Semester IV (Only for exit option for UG- Diploma)

S. No.	Course Title	Credit Hours
1.	Internship (10 weeks)	**10(0+10)***

*Mandatory requirement for UG-Diploma.

Details as given for Post- Semester II

Semester V

S. No.	Course Title	Credit Hours
1.	Therapeutic Nutrition	4(3+1)
2.	Food Analysis	3(2+1)
3.	Current Food Processing Technologies	3(2+1)
4.	Statistical Methods	3(2+1)
5.	Diet & Nutrition Counselling	2(0+2)
6.	Nutraceuticals and Health Foods	2(2+0)
7.	Introduction to Clinical Nutrition	3(2+1)

8.	Educational Tour(10-12 days)	2(0+2) Non-gradial
	Total	**20 (13+7)**

Therapeutic Nutrition 4(3+1)

Objectives

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

- To acquire basic knowledge of nutrient requirements, recommended dietary allowances, and dietary modification under different physiological conditions.
- To acquire basic knowledge of food groups, food exchange system and their nutritional significance, and application of knowledge acquired for healthy eating.
- To develop practical skills in planning and management of diets for the different age groups under normal/ physiological conditions keeping in mind the dietary guidelines.
- To gain knowledge on the nature and scope of therapeutic nutrition; and understand the principles of dietary modification and apply in planning.
- To understand nutrition-related diseases of the: gut, liver, gallbladder, pancreas, and heart.
- To know the etiology, incidence, nature, clinical symptoms, diagnosis, and medical and dietary management of disease.
- To modify the diet plans to suit the disease condition

Theory

Terminologies used in the therapeutic nutrition; Use of food groups and food pyramid. Importance and components of diet history; Different principle of therapeutic diets, Therapeutic modifications of normal diet in terms of consistency and nutrients; Normal and artificial feeding methods, Role of Dietician in medical nutrition therapy, Diet during malnutrition- undernutrition and over nutrition; Diet during infection and fever; Diet during Gastro intestinal disorder- esophagitis, diarrhea, constipation, peptic ulcers, IBD/IBS. Liver and gall bladder disorders- dietary management of jaundice, hepatitis, liver cirrhosis, cholelithiasis. Kidney disorders- dietary management of nephrosis, nephritis, renal failure, renal calculi and dialysis. Arthritis and gout, Cardiovascular disorders- dietary management of atherosclerosis, hypertension and stroke and congestive heart failure. Diabetes mellitus- dietary management during diabetes mellitus and complications, glycemic index and glycemic load of food items. PCOD/PCOS: etiology, signs & symptoms, types, risk factors and dietary management. Cancer- dietary management; Inborn errors of metabolism; allergies and intolerance, burns and trauma; Common auto immune diseases/disorders.

Practical

Planning of food exchange list, taking diet history. Planning and preparation of diet modified in consistency and nutrients for severely ill patients. Plan a diet for artificial feeding patients. Plan a diet patient with malnutrition, infections and fevers - PEM, typhoid, tuberculosis, influenza. Plan a diet for a patient with during atherosclerosis, hypertension. Plan a diet for patient with diarrhea, constipation, peptic ulcers and esophagitis. Plan a diet for a patient suffering from liver cirrhosis, jaundice, hepatitis and cholelithiasis. Plan a diet for a diabetic patient. Plan a diet of a patient renal failure, renal calculi. Plan a diet for a patient with cancer.

Plan a diet for patient with lactose intolerance and celiac diseases.

Suggested Reading

- Sharma, A. 2017. Principles of Therapeutic Nutrition & Dietetics. CBS.
- Mahan, L.K. and Escott-Stump, S. 2000. Krause's Food, Nutrition and Diet Therapy, W.B. Sanders Company, Philadelphia.
- Corinne H. Robinson, Marilyn, R. Lawler, Wanda L. Chenoweth, Ann E. Garwick. (2013) Normal and therapeutic Nutrition (pp-1-16). New York, Macmillan Publishing Company.
- Raghuvanshi, R. S., Mittal, M. 2014. Food Nutrition and Diet Therapy. India: Westville Publishing House New Delhi.
- National Institutes of Health Diet History Questionnaire. Diet History Questionnaire (nih.gov)
- Raghuvanshi R.S. and Mittal M. 2016. Clinical Nutrition *Chikitskeey Poshan*. Vikas Publishing House Pvt. Ltd. New Delhi.

Food Analysis 3(2+1)

Objectives

The objective of the course is to impart knowledge to students on principles and techniques of food analysis by using physical, chemical, biological methods and to apply their knowledge and skills acquired to solve real-world problems associated with food analysis.

Theory

Terminologies associated with food analysis, Rules and regulation of food analysis. Different official methods of analysis. Familiarization to terms and calculations used in preparation of various standard solutions. Sample and sampling techniques. Principles, techniques and applications of: spectrophotometer, colorimeter, pH meter, refractometer, electrophoresis, centrifuge, HPLC, GLC, TLC, GCMS, UPLC, AAS, AES. Proximate composition analysis methods. Moisture analysis- direct and indirect methods of analysis. Protein analysis method – dumas, Biuret, Lowry's, dye binding and Spectroscopy method, amino acid analyzer. Mineral analysis- dry ashing, wet ashing, titrimetric, gravimetric, colorimetric and instrumental methods-AAS, AES. Physical characteristic of foods, rheological properties of food. Anti-nutrients in foods: phytate, tannins, oxalates, saponins, trypsin and chymotrypsin. Animal assay: Principles, techniques and applications. Principles for estimation of water- and fat-soluble vitamins.

Practical

Orientation of food analysis laboratory. Calculation and preparation of various standard solution. Preparation of sample for food analysis. Proximate composition of analysis- moisture, kjeldahl method of protein analysis, Fat analysis – soxhlet, soxplus, estimation of free fatty acid (FFA), , ashing and CHO by difference. Estimation of sugar, reducing and non-reducing sugars and starch. Mineral analysis- iron, calcium. Testing acidity of foods. Estimation of anti-nutrients: phytate/ tannins/oxalates/saponins. Estimation of rancidity in foods and peroxide values. Functioning and use of HPLC, GLC and pH meter, GCMS, UPLC. Visit to food quality control lab.

Suggested Reading

- Pearson, D. (1973). Laboratory Techniques in Food Analysis. United States: Wiley.
- Pomeranz, Y. (2013). Food Analysis: Theory and Practice. United States: Springer US.

- N. Raghuramulu, K. Madhavan Nair, S. Kalyanasundaram. 2003. A manual of laboratory techniques. National Institute of Nutrition (India).
- Oser, B.L. 1979. Hawk's physiological chemistry. Tata Mc Graw Hill Pub. Co. Ltd., New Delhi.
- AOAC (2012). Association of official analytical chemists. Washington, DC.
- Ranganna, S. (2000). Handbook of Analysis and Quality Control for Fruit and Vegetable Products. India: Tata McGraw-Hill.
- Nielsen. S. 2010 Food Analysis, Springer Science and Business Media Pub.

Current Food Processing Technologies 3(2+1)

Objectives

- To explain major food preservation techniques and underlying principles.
- To understand the technology available for food processing.
- To determine suitable methods of processing techniques for a chosen food.
- To understand novel food processing methods including non-thermal food processing techniques.
- To understand the purpose and principles of food packaging.
- To develop an understanding of major packaging materials used in food packaging.
- To evaluate the suitability of packaging material for a particular type of food.
- To understand the operations involved in packaging material manufacture.
- To gain knowledge of the legal, environmental and quality aspects associated with packaging materials and operations used in the food industry.

Theory

Current scenario in food processing industry, post-harvest loss and losses in post-harvest operation. Upcoming trends in food processing-thermal treatment, ultrasound, freezing, pulse electric field, shockwave technology. Minimal processing- application of Ultra sonic food processing techniques – membrane processing – applications in food processing industries – robotics – applications and opportunities – issues and obstacles Food preservation using chemicals, radiation and hurdle technology. Nanotechnology in food preservation, food processing, agriculture and in packaging. Processing of convenient cereals and millets, processing of pulses and legumes, oilseed processing. Principle and method of preservation by- pasteurization, canning, bottling, sterilization. Advance dehydration technologies- Freeze drying, microwave dehydration, electric dehydrator, osmotic dehydration, hybrid drying technologies, vacuum drying methods, spray drying methods. High pressure processing- principle, safety and stability of high-pressured processed food. Encapsulation technology – principle, mechanism involved, encapsulation agents and uses. 3D printing and application in food manufacture. Government policy on import and export of processed fruits and vegetables.

Practical

Processing of breakfast cereals, Processing of pulses into flour, flakes and fermented Demonstration of dehydration of foods via- freeze drying, osmotic dehydration, spray drying, vacuum drying, microwave dehydration. Processing of fruits and vegetables via- canning using brine and syrup. Blanching in food items. 3D printed foods. Preservation using pasteurization and sterilization. Visit to food processing unit and nanotechnology lab

Suggested Reading

- Chakraverty (1995). Post-harvest technology of cereal, pulses and oilseeds, III Edn. Oxford and IBH publishing co., Pvt. Ltd.,
- Fellows, PJ (2017). Food Processing Technology, Principles and Practice.4thEdition, Wood head Publishing Ltd. Cambridge.
- Hartel R Wand Heldman D (2012). Principles of Food Processing. Aspen Publishers Inc. New York.
- Potter, N.N. (2003). Food Science, AVI publishing company, INC, West Port, Connecticut.
- Shafiur Rahman. M. (2007). Hand book of food preservation. Second edition. Published by CRC Press, London.
- Sivshankar, B (2002). Food Processing and Preservation. Prentice-Hall of India Pvt. Ltd. Delhi.
- Srivastava, R.P. and Sanjeev Kumar. (1994). Fruit and vegetable preservation, International book distributing Co. Lucknow.

Statistical Methods 3(2+1)

Objectives

- Organize, manage and present data.
- Analyze statistical data graphically using frequency distributions and cummulative frequency distributions.
- Analyze statistical data using measures of central tendency, dispersion and location.
- Use the basic probability rules, including additive and multiplicative laws, using the terms, independent and mutually exclusive events.
- Translate real-world problems into probability models.
- Derive the probability density function of transformation of random variables.
- Calculate probabilities, and derive the marginal and conditional distributions of bivariate random variables.
- Analyze Statistical data using MS-Excel.

Theory

Introduction to Statistics and its Applications in Agriculture, Graphical Representation of Data, Measures of Central Tendency & Dispersion, Definition of Probability, Addition and Multiplication Theorem (without proof). Simple Problems Based on Probability. Binomial & Poisson Distributions, Definition of Correlation, Scatter Diagram. Karl Pearson's Coefficient of Correlation. Linear Regression Equations. Introduction to Test of Significance, One sample & two sample test t for Means, Chi-Square Test of Independence of Attributes in 2 ×2 Contingency Table. Introduction to Analysis of Variance, Analysis of One-Way Classification. Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample. Introduction to various statistical packages.

Practical

Graphical Representation of Data. Measures of Central Tendency (Ungrouped data) with Calculation of Quartiles, Deciles & Percentiles. Measures of Central Tendency (Grouped data) with Calculation of Quartiles, Deciles & Percentiles. Measures of Dispersion (Ungrouped Data). Measures of Dispersion (Grouped Data). Moments, Measures of Skewness & Kurtosis (Ungrouped Data). Moments, Measures of Skewness & Kurtosis (Grouped Data). Correlation & Regression Analysis. Application of One Sample t-test. Application of Two Sample Fisher's t-test. Chi-Square test of Goodness of Fit. Chi-Square

test of Independence of Attributes for 2 ×2 contingency table. Analysis of Variance One Way Classification. Analysis of Variance Two Way Classification. Selection of random sample using Simple Random Sampling. Use of software packages.

Suggested reading

- Agarwal, B. L. 2006. Basic Statistics. New Age International Publisher.
- Sprent P. 1993. Applied Non-parametric Statistical Methods. 2nd Ed. Chapman & Hall.
- Wetherill GB. 1982. Elementary Statistical Methods. Chapman & Hall.
- William S. Cleveland (1994) The Elements of Graphing Data, 2ndEd., Chapman & Hall

Diet & Nutrition Counselling 2(0+2)

Objectives

- Understanding, critically assessing and knowing how to use and apply information sources related to nutrition, food, lifestyle and health.
- Able to provide nutrition counselling and education to individuals, groups, and communities throughout the lifespan using a variety of communication strategies

Practical

Qualities of counsellor (confidence, knowledge, communication skills, patient listener, empathetic. Self-assessment of role as a dietitian – Pre-test on role, summary of competencies. Developing diet history questionnaire and taking diet history. Preparation of standard protocol based on case studies and group discussion. Preparation of overweight and underweight fact list handout and development of counselling guidelines for weight loss and weight gain. Weight loss counselling – Use of role play technique, counselling on diet, exercise and life style Visit to hospitals with therapeutic kitchen setup. Diabetic diet counselling development of dietary fat facts list, cholesterol facts list, sodium facts list. Development of dietary counselling tips for different cardiovascular disorder and counselling; cardiac patients using role play technique, presentation in gathering. Diet exhibition cardiovascular disorders in a specialty hospital / general hospital, preparation of handouts on ulcer facts list, high fibre facts list, low residue facts list, low lactose facts list, counselling for patients suffering from diarrhoea, constipation, gastro-esophageal reflex (GERD, colitis, diverticulosis and ulcer. Preparation of SOAP notes and gall bladder facts list handout and counselling a patient of gall stones. Preparation of liver disease facts list handout, collection of case history of patient suffering from hepatitis, cirrhosis of liver, alcoholics. Counselling the patient and conducting group discussion. Preparation of kidney disease facts list handout and development of counselling tips for kidney disorders, dietary counselling in a specialty hospital / diet and nutrition counselling centre for kidney disorder and diet exhibition for kidney disorder. Preparation of cancer facts list handout, Preparation of list of parenteral and enteral products available in the market for use during counselling. Setting up a unit for nutrition counselling. Role play exercises for counselling. Supervised counselling of patients/clients.

Suggested readings

- Antia, P. 1986. Clinical dietetics and nutrition. Oxford univ. Bombay.
- Moris,E.S. 1994. Modern nutrition in health and disease. Leaned febiger, USA.
- Corinne H. Robinson, Marilyn R. Lawler, Wanda L. Chenoweth, Ann E. Garwick. 1982. Normal and Therapeutic Nutrition. (Pp- 1-16). New York, Macmillan Publishing Company

- ICMR, 2020. Recommended Dietary allowance for Indians, ICMR, Delhi.
- Park, K. 1997. Textbook of Preventive and Social Medicine. 1st Ed. Jabalpur: Banarsidas Bhanot.
- Raghuvanshi, R. S., Mittal, M. 2014. Food Nutrition and Diet Therapy. India: Westville Publishing House, New Delhi.
- Raghuvanshi R.S.and Mittal M. 2016. Clinical Nutrition *Chikitskeey Poshan*. Vikas Publishing House Pvt. Ltd. New Delhi.
- https://aghealth.nih.gov/collaboration/qx/dhq.pdf
- DietaryGuidelinesforNINwebsite.pdf

Nutraceuticals and Health Foods 2(2+0)

Objectives

- The objectives of this course are to provide students with an overview of the field of functional foods, nutraceuticals and natural health products.
- The course enables students to understand the functional food concept as related to ingredient efficacy and safety.
- In addition, it familiarizes students with: examples of bioactive ingredient-disease relationships and the importance of clinical study support; regulatory aspects of functional foods; and requirements for standards of evidence of efficacy for health claims; and market determinants of the functional food industry.

Theory

Nutraceuticals & functional food definition, synonymous terms, basis of claims for a compound as a nutraceutical, regulatory issues including CODEX, FSSAI Regulation. Classification of nutraceutical substances based on food sources and based on mechanism of action, and based on chemical nature. Nutrition claims by FSSAI. Regulatory issues for nutraceuticals including national and international standards. Potential health benefits of major nutraceuticals, omega-3, lycopene, isoflavonoids, prebiotics and probiotics, glucosamine, phytosterols etc, Metabolism, bioavailability and pharmacokinetics of nutraceuticals. Concept of angiogenesis, nutraceuticals for joint heath, cardiovascular diseases, cancer, diabetes, obesity, eye health, cholesterol management. mental health, immune enhancement, age-related macular degeneration, endurance performance and mood disorders. Clinical testing of nutraceuticals and health foods - interactions of prescribed drugs and nutraceuticals; adverse effects and toxicity aspects of nutraceuticals; Nutrigenomics – an introduction and its relation to nutraceuticals. Current research in functional foods.

Suggested Reading

- Robert EC. 2013. Handbook of Nutraceuticals and Functional Foods. 2nd Ed. Wildman. CRC Press.
- Rotime E. Aluko. 2012. Functional Foods and Nutraceuticals. Springer Publ.
- Saarela, M. 2011. Functional Foods. 2nd Eds. Elsevier Publ.
- Food Safety and Standards (Health Supplements, Nutraceuticals, Food for Special Dietary Use, Food for Special Medical Purpose, Functional Food and Novel Food) Regulations, 2016.
- Sarkate, A.P., Patil, M.A. and Aghar de P.V. 2021. Nutraceuticals and Human Health. Brillion Publishing.
- Microsoft Word - 5925gi.doc (fssai.gov.in)

Introduction to Clinical Nutrition 3(2+1)

Objectives

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

- To acquire a basic understanding of the various clinical changes related to nutrition, which are seen in different diseases, both deficiency and otherwise.
- To understand the etiology, prevalence, clinical signs and symptoms of nutritional deficiency diseases (Vitamin A deficiency, anemia, IDD, PEM etc).
- To gain understanding of physiology in health and pathophysiology in disease.
- Complications occurring in various conditions and the inter relationships thereon.

Theory

Metabolic changes and clinical diagnosis in various diseases: Nutrient deficiency diseases like Anemia, vitamin B complex deficiencies, Vitamin A deficiency disease, Iodine deficiency disorders, Calcium and vitamin D deficiency diseases, ascorbic acid deficiency. Metabolic changes and clinical diagnosis in degenerative diseases: Diabetes, Cardiovascular diseases, renal disorder, liver diseases, cancer. Normal cut-off values for blood and urine parameters. Interpretation of report of blood and urine in different disease conditions. Drug and nutrient interaction, effect of drugs on nutritional status. Effect of diet and nutritional status on drug effectiveness. Depletion and repletion studies; Nutrient balance studies; Use of isotopically labelled nutrients. Nutrition screening and assessment methods (Mini Nutritional Assessment (MNA), Subjective Global Assessment (SGA), Patient-Generated Subjective Global Assessment (PG-SGA), Malnutrition Universal Screening tool (MUST), disease specific tools. Nutrition care process- Assessment, Diagnosis, Interpretation, Monitoring, and Evaluation (ADIME).

Practical

Identification and interpretation of clinical signs of nutritional deficiency diseases- sampling of blood and urine for nutritional status, estimation of hemoglobin. Estimation of glucose in blood and urine in normal and diabetic persons. Estimation of lipid profile in normal and heart patients. Estimation of Glycosylated Hemoglobin, Estimation of serum total protein and serum albumin, visit to a clinical laboratory.

Suggested Reading

- Connie WB and Christine SR (2016). Handbook of Clinical Nutrition and Ageing. Humana Press.
- Gibney MJ, Elia M, Ljungqvist O and Dowsett J (2013). Clinical Nutrition. Wiley Blackwell Publishing Company, Boston.
- Gibney MJ, Macdonald IA and Roche HM (2011). Nutrition and Metabolism. WileyBlackwell Publishing Company, Boston.
- Width M and Reinhard T (2017). The Essential Pocket Guide for Clinical Nutrition. LWW Pub.
- Gopalan C. and Krishnaswamy K. 2000. Nutrition in Major Metabolic Diseaes. Oxford University Press, New Delhi
- Joshi, Y.K. 2004. Basics Of Clinical Nutrition. Jaypee Brothers
- Lee, R.D. and Nieman, D.C. 1993. Nutritional assessment. Pub. Brown and Benchmark, USA.

- Pathak, N.N. 1997. Analytical techniques in clinical nutrition (manual); Centre of Advanced Studies in animal nutrition IVRI, Izatnagar.
- Oser, B.L. 1979. Hawk's physiological chemistry. Tata Mc Graw Hill Pub. Co. Ltd., New Delhi
- Bamji, M.S, Krishnaswamy, K. and Brahmam, GNV. 2019. Textbook of Human Nutrition. 4th ed. Oxford & IBH Publishing Co Pvt. Ltd
- https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=NuAs6SreCGryddEfs4kkBA==
- Raghuvanshi, R. S., Mittal, M. 2014. Food Nutrition and Diet Therapy. India: Westville Publishing House New Delhi.

Educational Tour (Non-gradial) 2(0+2)

Semester VI

S. No.	Course Title	Credit Hours
1.	Food and Nutrition Security	2(1+1)
2.	Nutrition, Body Composition & Physical Fitness	3(2+1)
3.	Food Microbiology	3(2+1)
4.	Milk Processing and Technology	3(2+1)
5.	Cereals & Millets: Processing & Technology	3(2+1)
6.	Sustainable Nutrition	3(2+1)
7.	Hospitality Management	3(2+1)
8.	Food Hygiene and Sanitation	3(2+1)
	Total	**23(15+8)**

Food and Nutrition Security 2(1+1)

Objectives

- This course explains the concepts of food and nutrition, malnutrition, food security and livelihoods. Understanding these concepts is important to assess the nutrition situation, design and implement programmes, investments and policies that address nutrition problems (also called "nutrition-sensitive"), and evaluate the nutritional outcomes of programmes, investments and policies.
- This course introduces the concepts and tools used in food security analysis. It defines food security and its relationship to the concepts of vulnerability, hunger, malnutrition and poverty.
- The course also provides guidelines on how to interpret and use conceptual frameworks for analyzing food security.

Theory

Food Security: Concept & definition, pillars and determinants. Global Food Security Index. Global hunger index and its indicator and how they measured. Global challenges to food & nutrition security. Inter-relationship between hunger and food insecurity. Strategy to achieve food security at household, national and global level. Role of nutrition in human health and sustainable development. Relationship between nutrition, diet and lifestyle. Growing global concern for non-communicable diseases. Opportunities and

challenges of nutrition and food preferences as a means of preventing the spread of chronic and non-infectious diseases. Impact of social, cultural and economic factors on the food and nutrition security. Nutrition security: Concept & definition, pillars and determinants. Nutrition sensitive approaches to combat malnutrition. Dietary diversity for nutrition security. Dietary diversification through utilization of bio-fortified crops, indigenous and under-utilized foods. Millennium Development Goals, Sustainable Development Goals (SDG) II and way ahead. National and international policies and programs related to food and nutrition security: POSHAN Abhiyan, NARI (Nutri-sensitive Agricultural Resources and Innovations), NFSA (National Food Security Act), NFSM (National Food Security Mission), NNM (National Nutrition Mission), WFP (World Food Programme), FAO (Food and Agricultural Organization). Public distribution system in context to food and nutrition security, International Fund for Agriculture Development (IFAD) etc.

Practical

Household survey for assessment of indicators of Food insecurity. Proforma dev, survey, report writing, validation. Assessment of dietary diversity, quality, food security, nutrition security. Food product development and formulation for intervention of nutri-sensitive approaches and strategies to eradicate poverty and malnutrition. Impact of nutritional policies and programmes on the nutritional status of the vulnerable group. Framing questionnaire to conduct dietary survey – using Food Frequency Questionnaire.

Suggested Reading

- Sunderland, T., Powell, B., Ickowitz, A., Foli, S., Pinedo-Vasquez, M., Nasi, R., & Padoch, C. 2013. Food security and nutrition. *Center for International Forestry Research (CIFOR), Bogor, Indonesia*.
- Ruel, M. T., Garrett, J., Yosef, S., & Olivier, M. 2017. Urbanization, food security and nutrition. *Nutrition and health in a developing world*, 705-735.
- Pingali, P., Alinovi, L., & Sutton, J. 2005. Food security in complex emergencies: enhancing food system resilience. Disasters, 29(s1), 5-24.
- Coates et al, (2007). "Household Food Insecurity Access Scale (HFIAS) for Measurement of Food Access: Indicator Guide. Version 3"
- Willett W. Nutritional Epidemiology, Oxford University Press. 2013.
- Raghuvanshi R.S. 2013 Nutritional Security through Diversified Food Production. In Agrarian Change and Small Farmers, Super markets, Viability and Food Policy. Ed. by K.N. Bhatt and Pradeep Bhargava, Concept Publishing Company PVT. LTD., New Delhi
- Swindale, A., and P. Bilinksy. 2006. Household Dietary Diversity Score (HDDS) for Measurement of Household Food Access: Indicator Guide. Vol. 2. Washington, D.C.: FHI 360/FANTA.

Nutrition, Body Composition & Physical Fitness 3(2+1)

Objectives

- This course provides an understanding of the interactions between nutrition and exercise by integrating metabolism and physiology concepts in the context of recreational physical fitness training
- Identify and describe disordered eating and exercise patterns.
- Gain an understanding of the training and experience necessary to obtain various nutrition and exercise credentials.

Theory

Body composition, methods of assessment- tools and techniques, changes in Body composition with age and fitness. Interrelationship between physical fitness and performance. Basic structure of a muscle with the help of a diagram - Functions and locations of muscles in the body - muscle groups –Major skeletal muscles. Basics of exercise regime - FITT formula – Frequency, Intensity, Time & Type of exercises for fitness. - Warm up exercises - Cool down exercises: Exercises - Benefits of regular and adequate exercise - Types of exercises and health benefits with suitable examples. Anaerobic exercises Flexibility exercises Effect of nutrition in physical fitness and sports performance and athletics. Concept of energy balance - factors affecting energy – equations to assess BMR. . Aerobic exercise to increase cardiovascular endurance – benefits and examples -Treadmill, Elliptical cycle, Stationary cycle. Aerobics workouts Macronutrients metabolism in exercise – Carbohydrates: lactose intolerance, Diabetes, hypoglycemia; Lipids & Oils, Fatty Acids, Triglycerides, Phospholipids, Sterols. Functions of fats, needs, deficiencies role of water and electrolytes in performance. Vitamins metabolism in sports - Free radicals in exercise role of antioxidants in exercise - Minerals and trace minerals metabolism in exercise and essential minerals and trace minerals in sports. Sports nutrition products - supplements related to energy metabolism - weight reduction and botanical and herbal supplements - sports nutrition theory to practice –, Special consideration in sports nutrition- Women, young, diabetic, vegetarian athletes - Sport specific nutrition – Gymnastics, weight lifters, skiers, cyclists, swimming, skating, Winning recipes for peak performance. Assessment of Physical fitness Functional tests: Cardiorespiratory and muscular assessment; Type of measurement and protocol for evaluation and interpretation of performance; Aerobic Power or VO2max; Anaerobic Threshold; Economy of Movement. Fitness assessment: Types of exercise, Components of physical fitness and its evaluation in health and performance. Activity Recording: Self-reporting of activities vs. Direct monitoring of activities. Techniques to measure energy expenditure and energy intake. Techniques to assess physical fitness. Aging theories, physiology, mechanism and role of nutrients in arresting aging process.

Practical

Recording of Dietary intake by 24-hour recall method for 3 consecutive days. Recording of energy expenditure by 24-hour recall method by using multipliers for 3 consecutive days. Calculation of energy balance by using above data. Demonstration and use of body composition analyzer calculation of total fat and fat free muscle mass. Calculation of fat % and BC of adults, equations to assess BMR. Physical tests: Harvard STEP test, Treadmill test to assess heart health, muscular grip test. Visit to established fitness center.

Suggested Reading

- Srilakshmi, B., Suganthi, V., Ashok and Kalaivani, C. 2017. Exercise Physiology Fitness and Sports Nutrition. 1st Edn. New Age International (P) Ltd. Publishers, New Delhi.
- Falkner F & Tanner JM. 1978. Human Growth - Principles and Prenatal Growth. Vol. I. Bailliere
- Tindall, Falkner F & Tarnner, JM. 1980. Human Growth Methodology.
- https://egyankosh.ac.in/bitstream/123456789/42208/3/Unit-3.pdf
- Falkner, F. and Tanner JM. 1978. Human growth - Principles and prenatal growth. Vol. I.
- Falkner, F. and Tarnner JM. 1980. Human growth methodology. Ecological, genetic, and nutritional effects on growth. Vol. III. Plenum Press.
- Dunford M and Andrew Dogle J. 2008. Nutrition for Sports and Exercise. Peter Adams. Thomson Higher Education, USA
- Heather Hedrick Fik and Alan E. Mikesky. 2015. Practical Application in Sports and Nutrition. Fourth Edition. Jones & Bartlett Learning, Burlington, MA 01803.

Food Microbiology 3(2+1)

Objectives

Learner will acquire the knowledge about:

- Scope of food microbiology and food safety
- Important genera associated with food
- Techniques for enumeration of microbes and methods (traditional to advanced) for preserving food
- Role of different microorganisms in food spoilage, food fermentation and food-borne diseases
- Microbiological quality control and food-borne illnesses investigation procedures for ensuring food safety & hygiene
- The food safety rules and regulations, Food Safety Management System (FSMS), and Microbiological Risk Assessment

Theory

The discovery of micro-organism, spontaneous generation conflict, germ theory of diseases, microbial effect on organic and inorganic matter. Development of microbiology in India and composition of microbial world. Difference between prokaryotic and eukaryotic cells. Basic aspects and scope of food microbiology; Intrinsic and extrinsic factors that affect microbial growth in foods. Food preservation - Physical methods. Chemical preservatives and natural antimicrobial compounds, biology-based preservation system. Importance and scope of microorganisms in food. Primary sources of microorganisms in food. Assessment of microbial load in foods-microscopic, cultural, immunological and DNA based methods. Fermentation: methods, applications, fermented foods. Lactic acid bacteria – production of cultures for food fermentation. Fermented foods- cereals, dairy products, vegetables and fruits. - bread, beer, yoghurt, butter, cheese, kefir, kumiss, sauerkraut, olives, pickles, wine, vinegar. Control of microorganisms by use of low and high temperature, asepsis, water activity, drying, preservatives, radiation and pressure for control of microorganisms; Microbiology of milk and milk products; Sources of contamination, spoilage and prevention; Microbiology of fruits and vegetables; cereal and cereal products; meat and meat products; fish and other sea foods; poultry and eggs; sugar and sugar products; salts and spices; contamination, spoilage and prevention. Microbial spoilage of fruits, fruit juices, vegetables, cereals, meat, poultry, sea foods, carbonated soft drinks, canned foods; chemical changes caused by microorganisms; control of spoilage. Food borne diseases and safety measures.

Practical

Changes in practices: General laboratory practices in microbiology laboratory, Equipment used in food microbiology laboratory, Aseptic methods, Sterilization methods, Morphological studies, Preparation of media, Isolation and enrichment of microorganisms, Microbial analysis of food products and water. Isolation of molds from foods. Microbial examination of cereal and cereal products, vegetable and fruits, meat and meat products, fish and other sea foods, Eggs and poultry, milk and milk products; sugar, salts and spices. Preparation of fermented whey beverages.

Suggested Reading

- Frazier J and Westhoff DC. 2017. Food microbiology. 5th Ed. McGraw Hill.
- Jay JM, Loessner MJ and Golden DA. 2005. Modern food microbiology. 7thEd. Springer.
- Ray B. 2004. Fundamentals of food microbiology.3rd Ed. CRC.

- Steinkraus, KS. 1996. Handbook of Indigenous Fermented Foods. Marcel Dekker
- Adams, MR and Moss MO. 2008. Food Microbiology, Third Edition, RCS publishing, UK
- http://www.gitam.edu/eresource/environmental/em_maruthi/food.htm
- http://www.cdc.gov
- http://www.asm.org/division/w/web-sites.htm
- http://www.fda.gov/downloads/Food/FoodborneIllnessContaminants/UCM297627.pdf

Milk Processing and Technology 3(2+1)

Objectives

- To introduce students to an understanding of the chemistry of milk constituents. Milk and various dairy products are discussed from the perspective of the chemical, physical and biological changes that occur during processing.
- Students will be able to describe the composition of milk, identify the approximate content of individual types present, and describe physicochemical characteristics of the main components.
- Students will integrate their knowledge of food chemistry/engineering/microbiology and physical properties of foods to understand the processing of dairy products.
- Student will be able to explain how dairy products (such as fluid milk, yogurt, butter, powder, cheese) are made and the key functions of the processing steps involved.

Theory

Introduction, importance and scope of fluid milk industry in India and abroad: Brief history and present status. Composition of milk, nutritive value of milk of cow and buffalo. Physico-chemical properties of milk and milk constituents: Physical state, acidity, pH, density and specific gravity, freezing point, color and flavor. Microbiology of milk. Types of microorganisms, their production and consequent results in milk production. Types of milk: Sterilized Milk; Homogenized Milk; Flavored Milks; Standardized Milk; Reconstituted/Re-hydrated Milk; Recombined Milk; Toned Milk. Milk products- traditional products- butter, ghee, khoa, cheese in theory. Steps of milk processing: collection, chilling, standardization, pasteurization, homogenization, bactofugation, and principles of dehydration. Management of processing plant: Various kinds of designs and layouts of plants Value addition for fluid milk. Fortification of milk Waste management, Quality control aspects of milk: Status of antibiotics, pesticides, heavy metals etc., good manufacturing practices, implementation of HACCP standards, cleaning and sanitization of fluid plant: Indian standards for milk and milk products as per PFA, BIS, AGMARK etc., cleaning and sanitization procedures. Judging and grading of milk, defects in milk, their causes and prevention.

Practical

Platform test of raw milk (clot on boiling (COB) test, alcohol test). Adulteration in milk and its detection. Sampling of milk. Estimation of fat, SNF, TS platform tests. Cream separation. Detection of adulterants Microbiological quality evaluation of milk and milk products Preparation of milk products. Paneer, chenna, ice-cream, khoa, burfi, flavored milk, rasogulla. Visit to modern milk processing and manufacturing plants.

Suggested Readings:

- Aneja R.P., Mathur B.N., Chandan, R.C., and Banerjee, A.K. 2002. Technology of Indian milk products. Dairy India Yearbook
- Lampert, L.M. 1970. Modern dairy products. Chemical Publishing Company Inc. New York

- Srinivasan, M. R. and Anantkrishanan C.P. 1964. Milk Products of India
- Sukumar, De. 2001. Outlines of dairy technology Oxford Uni. Press New Delhi
- Swarup. A 2013. Milk processing technology. Discovery publishing house pvt. ltd.

Cereals & Millets: Processing & Technology 3(2+1)

Objectives

- To create understanding about the processing of major cereals like paddy, maize etc.
- To study the storage and handling techniques of cereals.
- To study about the byproducts obtained during processing along with their uses.
- To gain knowledge on processing and milling of pulses

Theory

Production and consumption scenario of cereals and millets; Structure, Chemical composition and nutritive value of cereals and millets. General unit operations in agricultural process engineering and importance of these unit operations in grain processing, Structure and composition of cereals, millets. Morphology, physico-chemical properties of cereals, major and minor millets, Chemical tests- sedimentation test, flour swelling volume; Conventional and modern milling technology of paddy processing, estimation of milling efficiency, quality characteristics of milled cereals and millets. Parboiling of rice, bran stabilization and methods. Wheat milling and processing: purification and reduction system. Different types wheat flour, Quality characteristics of flour. Characteristics of wheat flour suitable for baking. Milling and processing of oats, corn, barley, sorghum. Primary and secondary products of cereal processing. Processing of breakfast cereals: flaked, puffed, expanded, extruded and shredded. Malted cereals and cereal products. By-products of cereals and millets processing**.** Structure and composition of major millets - maize, sorghum - wet and dry milling methods - processing and by products. Composition of minor millets – pearl millet, finger millet, little millet, kodo millet, foxtail millet and barnyard millet. Processing of minor millets. Structure, composition and processing of oats and barley. Malting of cereals and millets - production of weaning and supplementary foods, nutrient dense foods – amylase rich foods (ARF).

Practical

Study of physicochemical properties of cereals; Parboiling of paddy; Cooking quality of rice, milling of rice; Conditioning and milling of wheat; Production of cereal flakes; Production of popcorns, flaked rice, puffed rice, noodles; Preparation of cereal malt. Determination of gelatinization temperature by amylograph; Processing of value-added products from millets. Estimation of gluten content in wheat flour. Preparation of snacks based on cereals and millets (roasting, popping, pearling, flaking, malting). Study of different unit operations and machineries in rice mills; wheat/ flour mills**;** Study of extrusion process**.**

Suggested Reading

- Chakraverty A and Singh R.P, 2014. Post-Harvest Technology and Food Process Engineering. CRC Press, Boca Raton, FL, USA.
- Dash S K, Bebartta J P, Kar A. 2012. Rice Processing and Allied Activities. Kalyani Publishers, New Delhi
- Khan, K and Shewry P.R., 2009. Wheat: Chemistry and Technology, 4th Ed., AACC International, Inc., St. Paul, MN, USA.

- Chakraverty A, Arun S. Mujumdar, G.S. Vijaya Raghavan and Hosahalli S. Ramaswamy. 2003. Handbook of Post-Harvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices. Marcel Dekker, Inc., NY, USA.
- David A.V. Dendy and Bogdan J. Dobraszczyk. 2001. Cereal and Cereal Products: Technology and Chemistry. Springer-Verlag, US.
- Khader, V. 2001. Text book of Food Science and Technology. Directorate of Information and Publications of Agriculture, ICAR, Krishi Anusandhan Bhawan, Pusa, New Delhi
- Pillayar P. 1988. Rice: Post Production Manual. Wiley Eastern Limited.
- Manay N.S and Shadakshara swamy, M.(2001). Foods facts and principles. Wiley Eastern Ltd. New Delhi.

Sustainable Nutrition 3(2+1)

Objectives

- To explore the relationship between health, nutrition, environment and sustainability
- To investigate the potential causes of unhealthy eating patterns
- To discover the importance of a sustainable diet

Theory

Sustainable development goals and sustainable nutrition. Definition of sustainable diets, dimensions of sustainable diets. Aims and guiding principles of sustainable diets. Climate change and sustainable and healthy diets. Indicators and measures of sustainable diets. Assessing the environmental impact of diet. Nutritional indicators of sustainability. Sustainable diet: Social and cultural perspective. Sustainable diets and food-based dietary guidelines. Traditional food at the epicentre of the sustainable food system. Determinants of food choice and dietary change. Organic food and sustainable nutrition. Indian diets and sustainability. Attaining healthy and sustainable diets. Economics, food waste, biodiversity, The environmental impact and sustainability of existing food systems. Sustainable Healthy Diets: Models and Measures - the dietary dimension, the economic dimension, the sociocultural domain, the environmental domain. Metrics for Characterizing Sustainable Nutrition Security: Nutrient Adequacy of Foods, Diets and the Food Supply, Ecosystem Stability, Food Affordability and Availability, Sociocultural Wellbeing, Resilience, Food Safety, Waste and Loss Reduction.

Practical

Develop a meal plan for nutritional adequacy and sustainability; Undertake a market survey of food products with sustainable or climate-friendly labels; Assess the 7-day food menu served in university hostels in terms of sustainability; Pilot study on assessment of food choice motives of university students.

Suggested Reading

- Burlingame, B. and Dernini, S. (Ed.). 2019. Sustainable diets linking nutrition and food systems. Wallingford, Oxfordshire; Boston, MA: CABI.
- Sarilo, S. 2018. Towards Healthy and Sustainable Diets: Perspectives and Policy to Promote the Health of People and the Planet. Springer Briefs in Public Health. Switzerland.
- Contento, I. R. 2011. Overview of Determinants of Food Choice and Dietary Change: Implications for Nutrition Education. In *Nutrition education: Linking research, theory, and practice* (2nd ed., pp. 26–42). Jones and Bartlett Publishers.
- FAO. 2012. *Sustainable Diets and Biodiversity—Directions and solutions for policy, research and actions* (Proceedings of the International Scientific Symposium BIODIVERSITY AND SUSTAINABLE

DIETS UNITED AGAINST HUNGER). Food and Agriculture Organization of the United Nations. www.fao.org/3/i3004e/i3004e00.htm

- FAO, & WHO. (2019). *Sustainable healthy diets – Guiding principles*. www.fao.org/3/ca6640en/ca6640en.pdf
- https://www.kerry.com/content/dam/kerry/sustainability/people/nutrition-health/Sustainable-Nutrition-Profiling-Whitepaper.pdf

Hospitality Management 2(1+1)

Objectives

- To develop industry-ready professionals for the hospitality sector.
- Gear students for operational and supervisory roles in all sectors.
- Prepare students for each food production and service roles.

Theory

Food preparation- Principles of food purchasing, Methods of food purchasing; Storages of foods; Different kitchen equipment- Heavy and Light equipment, Care & maintenance and their use; Management- Principles of management, Steps of effective management, techniques of effective management; Attitude towards work, behavior & personal hygiene , Do's and don'ts while working in the kitchen ; Understanding the functioning of Food Production Dept. in any catering establishment / setup- Organizational structure, layout, Duties & responsibilities; **Menu planning-** Definition and Principles of menu planning, Types of menus; **Financial management-** Introduction, Principles, Costing, Budgeting. Accounting. Food cost control methods, Factors affecting food cost, labour cost, operating cost and overhead cost; **Standardization of recipe-** Definition of standardization of recipe, Standard recipe format and uses, portioning equipment, portion control; Personnel **management-** Introduction, Personal management concepts. Staff employment, Employee benefits, Methods of selection, Orientation, Training & development, Supervision, Motivation of employees

Practical

Menu planning for industrial canteen/ hospital canteen/ cafeteria/ snack bar/ residential hostel. Standardization of recipes suitable for fast food outlet/ industrial canteen/ hospitals/ college hostel. Multiplication of standard recipes for quantity food production, quantity food management, portioning and fixing of cost. Visit to any one canteen attached to hospital and dietary department cafeteria, 3-star hotel/restaurant, 5-star hotel / restaurant, industrial canteen. Presentation of report on hospital canteen, cafeteria, 3-star hotel / restaurant, 5-star hotel / restaurant in terms of organizational set up, production, preparation and service. Calculate food cost, labour cost, operating cost and overhead cost of any standardized recipe.

Suggested reading

- Sethi and Malhan. 1993. Catering Management: An Integrated Approach. Wiley Eastern.
- Gregoire, MB. 2017. Foodservice Organizations: A Managerial and Systems Approach, 9th ed. Food Service in Institutions. John Willey.

Food Hygiene and Sanitation 2(1+1)

Objectives

This course is designed to:

- Present the rules of personal hygiene and the importance of adhering to safety rules and regulations.
- Introduce the causes and prevention of food poisoning and to introduce the requirements of safety in the workplace.
- Introduce local legislation relating to the food service industry

Theory

Meaning and principle of food hygiene. Interrelationship of health, hygiene and sanitation Food Hazards. Personal hygiene. Water Requirement and use, sources of water supply, water pollution, purification of water, portable water and its quality-Criteria and standards, hardness of water and its treatment, defluorination of water. Food hygiene: Contamination of foods from various sources. Green plants and fruits, animals, sewage, soil, air and water and their health hazards. Food spoilage. Perishable, semi perishable and non-perishable foods. Sanitary procedures for preparation, handling and storage of foods Food borne infection and intoxication. Food poisoning caused by bacteria: *Salmonella, Staphylococcal poisoning, Botulinum, Clostridium perfringens and B.cerus.* Sources, incubation period, mechanism of action. Investigation of Food Poisoning, prevention and control. Food Poisoning caused by agents other than microorganism. Poisonous plants, animals, chemicals, metals and pesticides etc. Pests and Rodent Control. Hygiene Requirements for Licensing and Sale. Health status of Food Handlers. Cross-contamination and its prevention methods. Introduction to HACCP principles and their application. Concept of TQM, GMP and Risk Assessment.

Practical

Identification of microorganism, preparation of slides, preparation of media. Collection of water samples. Testing of water for: (i) Physical quality (ii) Bacteriological quality. Survey of hygienic and sanitary condition in food shops/food vendors/ canteens. Report writing.

Suggested Reading

- Adams M.K. and Moss M.O. 2000. Food Microbiology, New Delhi: Panima Corp.
- Longree K.L. and Blaker G.C. 1982. Sanitary Techniques in Food Service. New York: John Wiley and Sons.
- Park, K. 1997. Textbook of Preventive and Social Medicine. 1st Ed. Jabalpur: Banarsidas Bhanot.
- Srivastava, A. 2013. Food Hygiene and Sanitation, Neha Publishers and Distributers.
- Yadav, S. 1997. Food Hazards and Food Hygiene 1st, Ed. Annual Publication Ltd., New Delhi.
- Willliam, C., Frazierad Dennie. C Westheff. 1996. Food Microbiology, 4thEditions, Tata McGraw Hill Company Limited.

Semester VII

S. No.	Course Title	Credit Hours
1.	Ethics in Human Research	1(1+0)
2.	Seminar	1(0+1)
3.	Elective courses (totaling credit hours of 18)*	18
	Total	**20**

Semester VIII

S. No.	Course Title	Credit Hours
1	Student READY	
	Option A (Any Two)	10(0+10)
	IV. In plant Training (10 weeks) *	10(0+10)
	V. Student Project**	10(0+10)
	VI. Hands on Training	
	Option B	20(0+20)
	Internship***	
	TOTAL	**20**

*Internship/ In plant training / attachment with Industry/ Research Institute (May be conducted in split manner in more than one industry/ institution/ organization).

** The student project will be R & D based, field study based or entrepreneurship based (incubation/ experiential learning)

*** The internship can be taken in service Industry (e.g.Hospital or Hotel) OR in Production Industry (e.g. Food/ nutraceuticals Industry) OR in Food Quality and Analysis Laboratories

Internship Options in 7th and 8th semesters

a. In-plant in hospitals

Understanding role of dietitian – role, concept, the recipients, duties, work schedule, Licenses, Certifications, and Registrations. Preparation of SOAP notes based on case studies and group discussion. Planning component. Preparation of list of parenteral and enteral products. Diabetic diet counselling- organizing exhibition in for the benefit of public- food exchange list and software used in diabetic diet counselling. Cardiovascular diseases- planning and presentation of different types of diet for disease conditions. Practicing diet counselling for CV patients. Preparation of diet chart for different types of liver diseases, collection of case history of patient suffering from hepatitis, cirrhosis of liver and alcoholics. Kidney diseases- preparation of facts list handout and development of counselling tips- dietary counselling in a specialty hospital and diet exhibition for kidney disorder. Diet for gastro intestinal disorders- preparation of

handouts- ulcer, high fiber, low residue- counselling- diarrhea, constipation, colitis, diverticulosis and ulcer. Preparation of overweight and underweight fact list handout and development of counselling guidelines, workshop for patients, Weight loss counselling– use of role play technique and workshop for patients at obesity clinic and fitness centers. Diet for pre and post-surgery, burns. Preparation of cancer facts list handout. Home care for critically ill and requiring long term nutrition support. Planning normal and therapeutic diets – diabetes, cardiovascular diseases, liver diseases, kidney diseases, gastrointestinal disorders. Role play exercises for counselling. Supervised counselling of patients/clients.

b. In-plant in testing labs

Role of regional testing laboratories - methods of sample collection- handling and storage of samples, physical, chemical and microbiological. FSSAI - Role of Food Safety officer, method of inspection, processing of license, conducting awareness camps for stakeholders. Analysis of energy, protein, fat, vitamin, mineral and antioxidants in food groups. Attachment with food testing laboratories.

c. In-plant in food processing units

Attachment with – primary processing cereal, pasta making, flaking and puffing, cereal based convenience foods manufacturing, primary pulse processing, RTE / RTU foods manufacturing, fruit beverage manufacturing, Canning, pickling, preserve/ candy/ jam manufacturing, banana processing, milk processing, oil manufacturing, bakery and confectionary units.

ELECTIVE COURSES

Course Number	Course	Credit Hours
Elective-1 Nutrition and Dietetics		
1.	Diet Therapy for Hospitalized Cases	4(1+3)
2.	E-applications for Dietetics	4(1+3)
3.	Nutrigenomics	2(2+0)
4.	Nutrition for Special Conditions	3(2+1)
5.	Nutrition through life cycle	3(2+1)
6.	Fundamentals of research methodology and library search	2(1+1)
7.	Sports Nutrition	3(2+1)
8.	Diet and Immunity	3(2+1)
9.	Global Nutrition	2 (2+0)
Elective-2 Food Science		
1.	Food processing and packaging	4 (3+1)
2.	Fruits & Vegetables Processing and Technology	4(2+2)
3.	Food Safety and Packaging	2(1+1)
4.	Food Toxicology and Quality Testing	3(2+1)
5.	Food Chemistry	3(3+0)
6.	Meat Processing and Technology	3(2+1)
7.	Pulses and oilseeds: Processing and Technology	3(2+1)
8.	Sensory Evaluation of Foods	2(1+1)
Elective-3 Institutional Food Service Management		
1.	Institutional Food Service Management	3(0+3)

2.	Sensory Evaluation of Foods	2(1+1)
3.	Event Management	3(0+3)
4.	Food processing and packaging	4 (3+1)
5.	Ergonomics in Food Service	2(2+0)
6.	Food Standards & Quality Control	3(2+1)
7.	Food Toxicology and Quality Testing	3(2+1)
8.	Print and Electronic Journalism	3(0+3)
9.	Tourism and Hospitality Management	3(1+2)

*The institutions may formulate additional Elective courses as per specific local needs and facilities/expertise available.

Students of other disciplines may choose any elective courses from the list of following minor courses in Food Nutrition and Dietetics.

Course Number	**Course**	**Credit Hours**
Elective-1 Nutrition and Dietetics		
1.	Principles of Human Nutrition	4(4+0)
2.	Community Nutrition & Education	3(2+1)
3.	Diet & Nutrition Counselling	3(0+3)
4.	E-applications for Dietetics	4(1+3)
5.	Nutrition for Special Conditions	3(2+1)
6.	Nutrition through life cycle	3(2+1)
7.	Fundamentals of research methodology and library search	2(1+1)
8.	Normal Nutrition & Meal Planning	3(2+1)
Elective-2 Food Science		
1.	Fundamentals of Food Science	2(1+1)
2.	Principles of Human Nutrition	4(4+0)
3.	Food processing and packaging	4 (3+1)
4.	Food Preservation and Storage	2(0+2)
5.	Fruits & Vegetables Processing and Technology	4(2+2)
6.	Meat Processing and Technology	3(2+1)
7.	Pulses and oilseeds: Processing and Technology	3(2+1)
8.	Sensory Evaluation of Foods	2(1+1)
Elective-3 Institutional Food Service Management		
1.	Food Psychology	2(2+0)

2.	Fundamentals of Food Science	2(1+1)
3.	Principles of Human Nutrition	4(4+0)
4.	Normal Nutrition & Meal Planning	3(2+1)
5.	Food Standards & Quality Control	2(1+1)
6.	Sensory Evaluation of Foods	2(1+1)
7.	Event Management	3(0+3)
8.	Ergonomics in Food Service	2(2+0)
9.	Food processing and packaging	4 (3+1)
10.	Print and Electronic Journalism	3(0+3)

ELECTIVE COURSES

Course Number	Course	Credit Hours
Elective-1 Nutrition and Dietetics		
	Diet Therapy for Hospitalized Cases	4(1+3)
	E-applications for Dietetics	4(1+3)
	Nutrigenomics	2(2+0)
	Nutrition for Special Conditions	3(2+1)
	Nutrition through life cycle	3(2+1)
	Fundamentals of research methodology and library search	2(1+1)
	Sports Nutrition	3(2+1)
	Diet and Immunity	3(2+1)
	Global Nutrition	2 (2+0)

Diet Therapy for Hospitalized Cases 4(1+3)

Objectives

- To learn about specialized dietary regimes or meal plans
- Nutritional requirement of hospitalized cases
- Learning to apply of principles of therapeutic nutrition in hospital settings

Theory

Enteral and parenteral feeding, feed formulation, diseases antagonism and synergism, use of nutraceuticals and supplements for hospital cases, diet for bariatric surgery. Reading prescription, interaction with drug, taking diet and medical history, duration hospitalization in following conditions: GIT disorders, surgery (liver, kidney, CVD), cancer, ICU patients, burns, injury, sepsis, trauma, pre- and post-operative conditions,

hospitalization due to diabetes, malnourished neonates, premature infants, multiple organ problems. Neoplastic diseases – goals of nutritional care for cancer patients.

Practical

Planning and preparation of a clear fluid, full fluid diet, soft diets and tube feeding formula for prep and post operative patients. Diet plan and nutrient calculation for peptic ulcer, dysentery, diarrhea and constipation. Preparation of SOAP for liver disorders. Diet plan and nutrient calculation for fatty liver, hepatitis cirrhosis, cholecystitis and cholelithiasis of liver. Preparation of SOAP for obesity. Diet planning for obese patients and bariatric patients Preparation of SOAP for underweight and diet planning. Preparation of SOAP for diabetes mellitus and dietary modification. Formulation of carbohydrate, protein, fat, fiber and sodium exchange list. Preparation of SOAP for Cardiovascular diseases. Diet planning for atherosclerotic, and congestive heart failure. Preparation of SOAP for hyper tension and diet planning. Preparation of SOAP for kidney diseases. Diet planning for glomerulonephritis, nephrotic syndrome, nephrosclerosis syndrome, renal calculi, dialysis and renal failure. Diet planning for febrile conditions Diet planning for febrile conditions, AIDS, tuberculosis and burns. Preparation of SOAP for allergy and diet planning. Diet planning for inborn errors of metabolism. Diet planning for cancer patient. Diet planning for protein energy malnutrition.

Suggested reading

- Eastwood. M. 2000. Principles of Human Nutrition, Chapman and Hall, London
- Raghuvanshi, R.S. and Mittal M 2014 Food Nutrition and Diet therapy. Westvill Publication New Delhi.
- Mahan. L.K. and Escott-Stump. S. 2000. Krause's Food, Nutrition and Diet Therapy. W.B. Sanders Company. Philadelphia.
- Suitor, C.W. and Crowley, M.F, 2000. Nutrition-Principles and Application in Health promotion. J.B.Lippin cott, Company. Philadelphia.
- Towsend, C.E and Roth, R.A. 2000. Nutrition and Diet Therapy. Delmar Publishers. New York.
- Peckenpaugh, N.J and Poleman, C.M., 1999. Nutrition Essentials and Diet Therapy. W.B. Saunders Company, Philadelphia.

Web Resources

- www.cellinteractive.com
- www.nutrition.org.uk
- www.fnic.nal.usda.gov

E-applications for Dietetics 4(1+3)

Objectives

- Introducing the concept AI among students
- Understanding the role of nutrition applications as the means for automatic dietary intake and energy expenditure measurements

Theory

Basic principles in developing a e-applications, Planning process, rules of web designing, Designing navigation bar, Page design, Home Page Layout, Design Concept. Audience requirement. audience requirement, Idea creation – Sketching – Wireframing - Graphic designing - Coding and programming, Importance of e-applications in Dietetics- role of AI. Diet and nutrition tracking App – Calorie calculating

app – app for calculating energy expenditure – app for calculating energy requirement – Stages of developing nutri App for dieting. Six types of technology assisted instruments for dietary assessment -: interactive computer-based technologies - Personal Digital Assistants (PDAs) - web-based technologies - mobile devices, specialized cameras and tape recorders- scan and sensor technologies. Integration of e-Dietary Assessment tools into the care process. Food atlas -artificial intelligence in dieting. Advantages and disadvantages of e-dietary assessment methods. e-courses on nutrition and available platforms.

Practical

Apps listing- Commercially available AI Based food and nutrient assessment system- Nutrition facts, CRON-O-METER, Diet organizer, e-fit, Easy menu balanced meal planner, food file, Nutrition info. Software for nutrient intake calculation and Dietary assessment software, e-portals of NIN such as Count What you Eat, ICMR-NIN TATA Dashboard center, NUTRIFY INDIA NOW, Tracking commercial apps and developing inventory of available apps related to health and nutrition tracking. Diet history- Google forms, photography method, electronic household weighing, sensor based health assessment for apps for tracking and measuring BP, blood sugar, hemoglobin, smart watches, fitness tracker, Online survey design for nutritional and dietary assessment for understanding current trends in dietary intake in particular group. Developing messages for public masses. Developing web page/blog/e-course. Info. graphic designing/posters/pamphlets. Attending training and workshops related to e-application/AI/coding or programming. Generating awareness using e-application. Organizing awareness camps among general public on use of nutrition related online platforms and application for tracking their dietary intake. Application based assignment- nutrient analysis/estimation, data collection – 24-h recall, diet history, food record, menu planning, nutrition counselling, food portion size estimation, standardized recipe formulation. Project to be submitted by student using any e-tool.

Suggested reading

- Emma Tonkin, Julie Brimblecombe, Thomas Philip Wycherley, Characteristics of Smartphone Applications for Nutrition Improvement in Community Settings: A Scoping Review, *Advances in Nutrition*, Volume 8, Issue 2, March 2017, Pages 308–322, https://doi.org/10.3945/an.116.013748
- Count What You Eat. NIN http://count-what-you-eat.ninindia.org:8080/CountWhatYouEat/Receipes.do
- Tom Taulli. 2019. Artificial Intelligence Basics: A Non-Technical Introduction apress.
- Wendy Willard . 2010. Web Design: A Beginner's Guide. Second Edition. McGraw-Hill Education.
- Côté, M., & Lamarche, B. (2021). Artificial intelligence in nutrition research: perspectives on current and future applications. *Applied physiology, nutrition, and metabolism = Physiologie appliquee, nutrition et metabolisme*, 1–8. Advance online publication. https://doi.org/10.1139/apnm-2021-0448

Nutrigenomics 2(2+0)

Objective

This course aims to understand, in depth, the influence of genetics on micronutrient metabolism, and implications for human diseases including inherited inborn disease, metabolic disease, cancer, neurodevelopment, and neurodegenerative diseases, etc.

Theory

Introduction - role of nutrition in preventing risk of disorders – proposed strategies for management of nutrient disorders – personalized medicine – personalized nutrition; Introduction to genomics and its

importance in health care, agriculture and environment – Introduction to Nutrigenomics Definition - role of Personalized nutrition in human diseases. Genes – structure – biochemical and molecular nature of genes; Central Dogma of Life; - regulation of gene expression –Role of diet/nutrition in regulation of gene expression – metabolic programming - Genetic basis of Dietary responses - Diet Vs Gene interactions. Genetic susceptibility to diets. Introduction to methods of developing nutritious foods/diet – intervention of biotechnology/genomics in producing nutritionally important molecules/compounds – production of therapeutic/medicinal proteins/hormones/molecules through genetic engineering –Biotech processes in value addition of dietary foods - fermentation process, and genetic improvement of food grade microorganisms; crop varieties with enhanced nutrition. Introduction to transcriptomics, proteomics, metabolomics; applications in nutrition research - Metabolic Syndrome in humans - Nucleotide polymorphisms associated with common/major dietary disorders - inborn errors of metabolism – lactose intolerance, gluten enteropathy and phenylketonuria. Biomarkers – importance, discovery and validation- screening for bioactive nutrients and compounds - Cell line testing – zebrafish model and animal model - Scientific, technological and resource constraints on genomics - important factors affecting development in nutrigenomics.

Suggested reading

- Ferguson R. Lynnette. 2013. Nutrigenomics and Nutrigenetics in Functional Foods and Personalised Nutrition. CRC Press.
- Carlsberg, C, Ulven, M. S., Molnar, F. 2016. Nutrigenomics. Springer Pub.
- Nestle M. 2003. Safe Food: Bacteria, Biotechnology & Bioterrorism. Univ. of California Press.
- Rogers PL and Fleet GH. 1989. Biotechnology and Food Industry. Univ. of Minnesota.

Journals

- Journal of the American Dietetic Association,

Web Resources

- https://scholar.google.co.in/scholar?q= (search)
- http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3602567/pdf/13197_2012_Article_775.pd

Nutrition for Special Conditions 3(2+1)

Objectives

- To gain basic knowledge on changes occurring in the physiology and metabolism of human body as a result of change in extreme environment.
- To know the nutrition in emergency, nutrition and health problems, food distribution strategies and dietary management.
- To acquire basic knowledge about immune nutrition in acute and chronic inflammation .

Nutritional requirements for extreme environments: Introduction - General adaptive mechanisms to environmental extremes and role of nutrition in successful acclimatization –decreased oxygen availability at high altitude – nutrition requirements for high altitude – Nutrition requirements in cold and polar environment- thermoregulation in cold –dietary guidelines for cold conditions. Nutrition requirements in hot environments- effect of heat stress –energy expenditure in hot environment. Nutrition on requirements for astronauts (space missions); Sea and air travel nutrition**:** introduction, need and scope for space travel, history of space travel; **-**changes in body composition during space expedition and nutrition requirements.

Physiological changes in human body, psychological preparedness, health and nutritional problems, nutrient requirements and dietary management during sea and air travel. Nutrition in Emergencies: need and importance, types of emergency situations such as natural and manmade, nutritional and health problems in emergencies. Control of communicable diseases through sanitation and immunization- Food distribution strategies- nutrient requirement and dietary management during emergencies. Nutritional requirements during starvation: total starvation – biochemistry of starvation, conditions developing starvation, features of starved body – survival period, effects of starvation/human body adaptation, metabolic alterations and nutrition requirements during starvation. Immuno-nutrition: nutrients affecting the immune system at the physiological, cellular and genetic level. Nutrients involved in the inflammatory response, role of specific nutrients in immune suppression and in immune promotion. Acute inflammation-- features, causes, vascular and cellular events, inflammatory cells and mediators. Chronic inflammation- causes, types, classification non-specific and granulomatous with examples, repair, and wound healing by primary and secondary union, factors promoting and delaying the process. Healing in specific site including bone healing.

Practical

Studying the existing ration scale for army personnel in plains/high altitudes, space foods/ emergency ration foods, planning and preparation of diet for army person in the high altitudes, hot environment and cold environment, Planning and preparation of diet for space mission, preparation of snacks foods for space , fibre rich foods ,ergogenic foods / bars for high altitude, ready to eat appetizers - juices/candy, high energy foods for starvation, RTE/ RTC foods for emergencies, high protein foods, planning and preparation of diet for acute and chronic inflammation condition – Rheumatic arthritis/Asthma, Planning and preparation of diet for immunity

Suggested Readings:

- Moris,E.S. (1994). Modern nutrition in health and disease. Leaned Febinger, USA
- Corinne H.R, Marilyn R. L, Wanda L. C and E. Garwick. (1982). Normal and therapeutic nutrition. (Pp-1-16). New York, Macmillan Publishing Company.
- Kathleen ML and JL Raymond (2016) Krause's Food and the Nutrition Care Process. 14th Edition, Saunders, Philadelphia.
- WHO. (1997). Applied health research priorities in complex emergencies, Geneva
- Bharat B. Aggarwal, David Heber, (2014), "Immuno-nutrition: Interactions of Diet, Genetics, and Inflammation", CRC Press.
- Sehgal S. and Raghuvanshi RS. (2007). Textbook of community nutrition Directorate of Information and Publications of Agriculture, Indian Council of Agricultural Research, New Delhi.
- https://www.cdc.gov/ncbddd/adhd/index.html
- https://www.unhcr.org/45fa745b2.pdf
- http://apps.who.int/disasters/repo/13849_files/i/nutrition_in_emergencies_ppt.pdf
- https://www.unicef.org/media
- https://www.nasa.gov/sites/default/files/space_nutrition_book.pdf
- http://spacelink.nasa.gov/products

Nutrition through life cycle 3(2+1)

Objectives

- Nutrition in the Life Cycle will cover nutritional needs of individuals during critical stages of development.

- Students will learn about the biological basis for nutritional requirements in normal development and maintaining health in adulthood.
- Consequences of over- and under-nutrition and how to identify and address these issues will be discussed.

Theory

Infancy- Role of nutrition on physical and mental development, rate of growth-weight as an indicator, assessment of growth, nutrient requirement during infancy, feeding of infants, value of breast feeding on infants, breast feeding versus artificial feeding, types of milk and their use in infant feeding. Weaning and supplementary foods, weaning practices in community, feeding of premature and low-birth-weight infants. Nutritional disorders and common ailments in infancy, feeding the sick child, immunization schedule and growth charts Preschool age: Physical growth and mental development, prevalence of malnutrition in preschool years and food habits, nutritional requirements during preschool age and supplementary foods School age. Physical growth and mental development, nutritional requirements during school age, specific problems, specific problems in feeding school children Adolescence. Physical and physiological changes, nutritional requirements, food preferences and nutritional problems, problems, growth spurt and nutrition, adolescent fads influencing nutrition. Adulthood, Sex, occupation and income, nutritional requirements, biological and nutritional consequences and complications due to pollutants, vegetarianism. Nutrition, wok capacity and physical fitness. Nutrition, infection and immunity, nutrients and drugs interaction. Pregnancy. Physiological changes in pregnancy, weight gain during pregnancy, food and nutrient requirements. Complications of pregnancy and their nutritional management, impact of nutrition on the outcome of pregnancy. Nutritional need of fetus during different stages of fetal cell growth and maternal nutritional needs. Psycho-physiology of lactation; milk synthesis and secretion, maternal needs during lactation, composition of colostrums and mature human milk, milk of mothers of pre-term babies. Non-nutritional factors of human milk; immunological factors, enzymes, hormones. Human milk banking. Elderly. Physical and physiological changes, nutritional requirements, problems of old age, nutrients influencing aging process

Practical

Grouping of foods based on richness of nutrients and quantifying foods to give uniform content of each nutrient. Planning and formulation of food exchange lists. Planning, preparation and evaluation of diet for adult men and women involved in different activities. Planning, preparation and evaluation of diets for pregnant women, , lactating mothers, weaning and supplementary foods for infants, preschool children, school going children, packed lunches for preschoolers and school children, adolescent boys and girls, elderly, preschool children with PEM and vitamin. A deficiency Planning diets for anemic children, adolescents and pregnant women.

Suggested Readings:

• Moris,E.S. (1994). Modern nutrition in health and disease. Leaned Febinger, USA

• Srilakshmi, B. (1995). Dietetics. Newage international publishers, New Delhi.

• Corinne H.R, Marilyn R. L, Wanda L. C and E. Garwick. (1982). Normal and therapeutic nutrition. (pp- 1-16). New York, Macmillan Publishing Company.

• Williams, S.R.; Worthington, R.S.; Sneholinka, E.D.; Pipes, P.; Ress, J.M. and Mahal, K.L. (1988). Introduction to nutrition throughout the life cycle. Times Mirroe/Mosby College Publishers.

Fundamentals of research methodology and library search 2(1+1)

Objectives

- Understand some basic concepts of research and its methodologies
- Identify appropriate research topics
- Select and define appropriate research problem and parameters
- Prepare a project proposal (to undertake a project)
- Organize and conduct research (advanced project) in a more appropriate manner
- Write a research report and thesis
- Write a research proposal (grants)

Theory

Introduction to Research - Research: Meaning, Types, Scope and Significance, Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method - Understanding the language of Research - Concept, Construct, Definition, Variable. Research Process. Guiding Principles in Selection of Research Problem; Research Objectives and Approaches, Problem Identification & Formulation, Research Question – Investigation Question Measurement Issues - Hypothesis - Qualities of a good Hypothesis, Null Hypothesis & Alternative Hypothesis. Hypothesis Testing - Logic & Importance. Research Process and Criteria of Good Research; Research Method ; Research Design – Meaning, Need, Key Components, Data Collection, Survey and Sampling, Data: Meaning, Nature, Types and Sources; Methods of Collecting Secondary Data, Surveys – Definition, Purpose and Scope; Survey Techniques and their Limitations., Questionnaires and Schedules – Definition and Differentiation; Types of Questionnaires; Salient Features of an Effective Questionnaire, Sampling and Sample Designs: Concept, Purpose and Types; Criteria for Selecting appropriate sampling Procedure; Data Analysis – Tools and Techniques, Use of proper statistical procedures, Preparation of Research Report, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism. Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline.

Practical

Identifying problem, formulating research hypothesis, questionnaire design, collection of secondary data, analysis & report writing. Use of reference management software, article writing.

Sports Nutrition 3(2+1)

Objectives

- To develop an understanding about the concept of diet planning for exercise and sports
- To gain knowledge of nutritional requirements for sports persons and making diet plans
- To understand the current theories on the relationships between diet and performance in sports, exercise, and health.

Theory

Introduction, Nutritional considerations for sports / exercising person as compared to normal active person. Energy substrate for activities of different intensity and duration, aerobic and anaerobic activities. Fluid balance in sports and exercise, importance, symptoms and prevention of dehydration, Sports drink, Energy enhancers and other commercial sports food products. Macro Nutrients-Carbohydrate as an energy source for sport and exercise, Carbohydrate stores, Fuel for aerobic and anaerobic metabolism, Glycogen re-synthesis, CHO Loading, CHO composition for pre exercise, during and recovery period. Role of fat as an energy source for sports and exercise. Fat stores, regulation of fat metabolism, factors affecting fat oxidation (intensity, duration, training status, CHO feeding), effect of fasting and fat ingestion. Protein and amino acid requirements, Factors affecting Protein turnover, Protein requirement and metabolism during endurance exercise, resistance exercise and recovery process. Important micronutrients for exercise- B complex vitamin and specific minerals. Exercise induced oxidative stress and role of antioxidants. Chronic dieting and eating disorder. Female athletic triad, sports anaemia Dietary supplements and ergogenic aids (nutritional, pharmacological and physiological). Use of Nutritional supplements in strength/power sports and team sports- use, effects, efficacy and safety − Creatine monohydrate, Sodium bicarbonates, Nitrates − B-Alanine, Caffiene − Protein supplements − Fat burners.

Suggested Readings

1. Jeukendrup, A., & Gleeson, M. (2010). Sport nutrition: an introduction to energy production and performance (No. Ed. 2). Human Kinetics.
2. McArdle, W. D., Katch, F. I., &Katch, V. L. (2009). Sports and exercise nutrition. Lippincott Williams & Wilkins.
3. Recommended Dietary Intakes for Indian Sportsman and Women. Satyanarayan, K; Nageshwar Rao. C; NarsingaRao,B.S.; Malhotra, M.S. (1985)., Hyderabad, National Institute of Nutrition.
4. Banardot, Dan (2000). Nutrition for Serious Athletes. Human Kinetics
5. Energy-Yielding Macronutrients and Energy Metabolism in Sports Nutrition. Edited by Judy A Driskell, Ira Wolinsky, CRC Press 2000.

Diet and Immunity 3(2+1)

Objectives:

- To gain a comprehensive understanding of the immune system and its role in protecting the body from disease.
- To explore the impact of various nutrients on immune function.
- To understand the potential benefits of specific foods for immune health.

Theory:

Introduction to Immune System: Cells, Organs, and Functions, Innate and Adaptive Immunity Immunodeficiency and evaluation of Immune function.

The Importance of Gut Microbiome for Immune Health, Nutrient-Immune Interactions Essential Vitamins and Minerals for Immune Function, Role of Antioxidants in Immune Response, Impact of Macronutrients) on Immunity, Indian Diet and Immune System Benefits, Herbs, Medicinal plants and other Plant-Based Diets

for immunity enhancement. , Role of Hydration in Immune Function, Immunomodulation by Probiotics and Prebiotics Food, Understanding the Role of Dietary Fats and Immune Function, Intolerances and Immune System Response, Immunity Booster Foods, Diets and Autoimmune Conditions, Technology and apps in promoting healthy eating habits for immune support.

Practical:

Exploring local herbs and medicinal plants as immunity booster. Study of different pathogenic organism and their interaction with food compounds. Planning of individualized diet plan for different auto immune diseases. Planning of individualized diet plan for different conditions of food intolerances.

Suggested Readings:

- Gershwin M E, Nestel P and Keen CL. (2004) Handbook of Nutrition and Immunity. Humana Press, Totowa, New Jersey.
- Bhaumik, D., & Chattopadhyay, S. (2012). Immunity and Ayurvedic Nutrition. Springer India.
- Chopra, A., & Singh, V. (2017). Ayurveda for Life. Penguin Random House India Private Limited. Indian Council of Medical Research. (2010). Dietary Guidelines for Indians - A Manual. National Institute of Nutrition (India).
- Sharma, H. L. (2014). Cooking with Ayurveda. Penguin Random House India Private Limited.
- National Institute of Nutrition (India). https://www.nin.res.in/
- Indian Dietetic Association. https://idaindia.com/

Global Nutrition 2 (2+0)

Objectives

- To analyze the global burden of malnutrition and its various forms (undernutrition, overnutrition, micronutrient deficiencies).
- To explore the ethical considerations in global food systems, including food justice, sustainable practices, and corporate accountability.
- To examine the role of technology and innovation in addressing global nutrition challenges.
- To understand the effectiveness of international nutrition programs and initiatives

Theory:

Defining Global Nutrition: Scope and Challenges, Nutritional Transition, Global Trends and Regional Differences in Food Systems and Nutrition, Sustainable Agriculture and Food Production Practices, Micronutrient Deficiencies, Nutritional Epidemiology, Food Traditions and Dietary Practices in Different Regions, Food Waste and Loss: Global Challenges and Solutions, Ethics of Industrial Food Production and Food Justice Issues, Global Nutrition Programs and Policies, National Governments and International Collaboration, Issues and Trends in Global Food and Nutrition Security.

Suggested Readings:

- Branca, F., Lardeux, M., & Leroy, J. (2007). Food security, food safety and the right to adequate food. Agriculture and Human Values, 24(3), 285-294.
- Fanzo, J., Hawkes, C., & Berry, E. M. (2013). Global food security and the right to food. Public Health Reviews, 35(1), 22-31.
- Albert, JL. (Eds.) 2000. Food, nutrition and agriculture. FAO Publication.
- Home - Global Nutrition Report

Course Number	Course	Credit Hours
Elective-2 Food Science		
	Food processing and packaging	4 (3+1)
	Fruits & Vegetables Processing and Technology	4(2+2)
	Food Safety and Packaging	2(1+1)
	Food Toxicology and Quality Testing	3(2+1)
	Food Chemistry	3(3+0)
	Meat Processing and Technology	3(2+1)
	Pulses and oilseeds: Processing and Technology	3(2+1)
	Sensory Evaluation of Foods	2(1+1)

Food processing and packaging 4 (3+1)

Objectives

- To impart knowledge of various areas related to food processing and packaging.
- To enable the students to understand food composition and its physic chemical, nutritional, microbiological and sensory aspects.

Theory

Food processing and preservation techniques for cereals, milk, fruits and vegetables, oil seeds, meat, fish and poultry and their impact on physical and chemical characteristics. Physico-chemical characteristics, nutritional quality and shelf-life studies. Factors effecting quality of processed foods. Food packaging, package functions, requirement and packaging materials. Principles in the development of protective packaging. Laws related to packaging. Shelf-life of packed food, special problems in packaging of foodstuffs.

Practical

Market survey for packaged processed food stuffs. Cereal cookery. Preparations showing dextrinization and gelatinization, gluten formation and influence factors. Vegetable cookery: effect of heat and alkali on pigment, preparation of soups, salads and beverages. Use of milk and milk products and egg in various preparations Estimation of shelf- life of packaged food stuffs.

Suggested Readings:

• Potter, N.N. (1996). Food science. The AVI Publishing Company, Inc., Westport, Connecticut.

• Kalia, M. and Sood, S. (2010). Food preservation and processing. Revised edition, Kalyani Publishers, New Delhi.

• Srilakshmi, B. (2010). Food science (Fifth ed.) New Age International Pvt. Limited Pub., New Delhi.

• Frank, A., and Paine, H.Y. (2003). A Handbook of food packaging. Springer science and business Media, U.K.

Fruits & Vegetables Processing and Technology 4(2+2)

Objectives

- To acquire a basic knowledge of in the field of fruit and vegetable processing
- To acquire a basic understanding of agriculture sector and processing of fruits and vegetables is of vital importance
- To develop an essential understanding of the scope of fruit and vegetable processing in the country
- To acquire a fundamental background of the methods of fruit and vegetable processing.
- To practice the methods and techniques of fruit and vegetable processing at laboratory scale, and to evaluate the student`s produce in each lab.

Theory

Importance and scope of fruits and vegetables in human diet. Scenario of fruit and vegetable production and processing at national and international level. General principles involved in preservation of fruits and vegetable products. Tools, equipment, lay out and other requirements of fruit and vegetable processing unit. Processing using sugar - principles and processing of jam, jelly, marmalade, fruit bar, preserves and candies. Unfermented and fermented products - fruit juices, RTS, nectar, cordial, squash, syrup, carbonated beverages, cider and vinegar. Processing using salt - principle – brining. Preservation of horticultural produces - preparation of pickles, ketchup and sauces. Tea, coffee and cocoa products Wine and fermentation technology. Drying and dehydration: definition, principle, method, suitability - types of driers - solar, cabinet, spray drier, drum drier, fluidized bed drier and freeze drying. Methods of concentration - open kettle, flash evaporators, thin film evaporators, vacuum evaporators, freeze concentration, dehydro-freezing, ultrafiltration and reverse osmosis. Processing of dehydrated fruits, vegetables and spice products and fruit pulp. Canning - principles, methods - preparation of canned products - spoilage of canned foods and its prevention. Preservation by low temperature: definition, principle, method, suitability - refrigeration, freezing, preparation of frozen foods. Preservation by controlled atmosphere, modified atmosphere - definition, principle, method, suitability. Processing by irradiation - definition, principle, method, suitability and application of irradiation in food industry.

Practical

Evaluation of pectin grade; Canning of mango/guava/papaya; Preparation and quality evaluation of fruit jam with fruits of regional importance; Preparation and quality evaluation of fruit jelly with fruits of regional importance ;Preparation and quality evaluation of fruit marmalade; Preparation and quality evaluation of fruit preserve and candy; Preparation and quality evaluation of fruit RTS; Preparation and quality evaluation of squash / syrup; Preparation of grape raisin / dried fig / dried banana; Processing of tomato products; Preparation and evaluation of dehydrated vegetables; Preparation and quality evaluation of wafers with vegetables / tubers; Preparation of fruit cheese; Preparation of pickle / mixed pickle; Preparation of dried ginger / mango powder (amchur).

Suggested reading

- Giridharilal, Sidappa.G.S and Tandon.G.L.1979. Preservation of Fruits and Vegetables. ICAR. New Delhi.

- Kalia, M. and Sood, S. 2010. Food Preservation and Processing. Revised edition, Kalyani Publishers, New Delhi.
- Singh, I. S. 2009. Post-harvest handelling and processing of fruits and vegetables. Westville Publishing House, New Delhi.
- Sudheer, K.P and V.Indira. 2007. Post-Harvest Technology of Horticultural Crops. New India Publishing Agency, PitamPura, New Delhi-110088.
- Verma, L.R. and V.K. Joshi. 2000. Post-Harvest Technology of Fruits and Vegetables. Vol. 1 and 2. Indus Publishing Company. New Delhi.
- Horticulture at a glance. 2018. Government of India Ministry of Agriculture & Farmers' Welfare Department of Agriculture, Cooperation & Farmers' Welfare Horticulture Statistics Division.

Web Resources

- www.cfs.purdue.edu/class
- https://agritech.tnau.ac.in/postharvest/pht_intro.html

Food Safety and Packaging 2(1+1)

Objectives

- The course objective is to provide students with an insight into advanced packaging (technical and business) topics with a food safety focus.

Theory

Factors affecting shelf life of food material during storage, Interactions of spoilage agents with environmental factors. General principles of control of the spoilage agents; Difference between food infection, food intoxication and allergy. Food safety and standard regulations national and international standards. Food safety, safety hazards and risks, food related hazards, microbiological considerations in food safety, effect of processing and storage on microbial safety, microbiological methodology, HACCP as a method to prevent food borne illness, chemical hazards associated with foods. Types of Packaging systems, special solutions and packaging machines. Different types of packaging materials, their key properties and applications, Metal cans, Plastic packaging, different types of polymers used in food packaging and their barrier properties. Glass containers, types of glass used in food packaging, manufacture of glass and glass containers, closures for glass containers. Paper and paper board packaging, paper and paper board manufacture process, modification of barrier properties and characteristics of paper/ boards. Relative advantages and disadvantages of different packaging materials; effect of these materials on packed commodities. Nutritional labelling on packages, CAS and MAP, shrink and cling packaging, vacuum and gas packaging; Active packaging, Smart packaging. Factors affecting the choice of packaging materials, Disposal and recycle of packaging waste, Printing and labelling, Lamination, Package testing: Testing methods for flexible materials, rigid materials and semi rigid materials; Tests for paper plastic film and laminates aluminum foil glass containers (visual defects, color, dimensions, impact strength, etc.), metal containers (pressure test, product compatibility, etc.).

Practical

Identification of different types of packaging materials, Determination of tensile/ compressive strength of given material/package, To perform different destructive and non-destructive tests for glass containers, Vacuum packaging of agricultural produces, Determination of tearing strength of paper board, Measurement of thickness of packaging materials, To perform grease-resistance test in plastic pouches, Determination of bursting strength of packaging material, Determination of water-vapors transmission rate, Shrink wrapping of various horticultural produce, Testing of chemical resistance of packaging materials, Determination of drop test of food package and visit to relevant industries.

Suggested reading

- Coles, R., McDowell, D., Kirwan, M.J. 2003. Food Packaging Technology. Blackwell Publishing Co.
- Gosby, N.T. 2001. Food Packaging Materials. Applied Science Publication
- John, P.J. 2008. A Handbook on Food Packaging Narendra Publishing House,
- Mahadevia, M., Gowramma, R.V. 2007. Food Packaging Materials. Tata McGraw Hill
- Robertson, G. L. 2001. Food Packaging and Shelf life: A Practical Guide. Narendra Publishing House.
- Robertson, G. L. 2005. Food Packaging: Principles and Practice. Second Edition. Taylor and Francis Pub.
- Kalia, M. and Sood, S. (2010). Food Preservation and Processing. Revised Edition, Kalyani Publishers, New Delhi.
- Manay, N.S. and Shadaksharswamy, M. (2001). Food facts and principles, II Ed. New Age International (P)Ltd. Publishers, New Delhi.
- Roday, S. 2011. Food Hygiene and Sanitation with Case Studies. Tata McGraw-Hill Education. 425p.
- Adams M.K. and Moss M.O. 200. Food Microbiology, New Delhi: Panima Crop.
- Longree K.L. and Blaker G.C. 1982. Sanitary Techniques in Food Service. New York: John Wiley and Sons.

Food Toxicology and Quality Testing 3(2+1)

Objectives

- The course gives an introduction to possible toxic effects of food additives and naturally occurring environmental toxins in food.
- Student will be able to define toxicology
- Student will be able to define the most important contaminants in food, the toxicology of various additives and environmental toxins, as well as their sources
- Student will be able to explain what food safety is and which substances are of relevance for food safety
- Student will be able to explain what risk analysis, assessment and management in relation to food safety is, and know which organizations are involved in this type of work nationally and internationally

Theory

Food toxicology – definition, introduction and significance. Classification of toxic constituents. Food poisoning –types, causative factors, signs and symptoms, preventive measures. Natural food toxins – pulses, oil seeds, sea foods, processed animal foods. Anti-nutritional factors, other food toxins, their harmful effects and methods of removal. General characteristics, occurrence, properties and inactivation of protease

inhibitors, trypsin inhibitors, haemagglutinins, goitrogens, gossypol. General characteristics, occurrence, properties and inactivation of saponins, lathyrogens, avidin and other antimetabolites. Microbial toxins – classification, source of contamination, effect on health, preventive measures, methods of inactivation / destruction. General characteristics, occurrence and properties of mycotoxins, aflatoxin, ochratoxin and patulin. Methods to detect and prevention of mycotoxins. Chemical toxins – Pesticides - Pesticide and insecticide residual toxicity – sources and health hazards, insecticides, metallic and others. Mineral toxicity – Chlorine and Fluorine, Heavy metals toxicity – Lead and Chromium, Mercury, Arsenic and Iron, residual effects, preventive measures, methods of removal. Food additives – classification, toxicity and effects. Toxins developed during processing. Food packaging material – Potential contaminants from food packaging material. Detection of toxins in food chain.

Practical

Methods of detect aflatoxin and gossypol**.** Methods of detect trypsin inhibitors and protease inhibitors. Use of AAS for detection of lead, chromium, mercury, arsenic, iron, detection of tannin and phytic acid. Visit to toxicology lab and public health laboratory. Visit to Quality Testing Laboratory, food processing industry/ government laboratory.

Suggested readings:

- Debasis Bagchi, Anand Swaroop. 2016. Food Toxicology, CRC Press.
- Takayuki Shibamoto, Leonard F. Bjeldanes. 2012. Introduction to Food Toxicology. Academic Press.
- Hodgson, Ernest. 2004. A Textbook of Modern Toxicology. John Wiley & Sons, IncI.
- M.J. Derelanko and M.A. Hollinger. 2002. Handbook of toxicology, 2nd ed., CRC Press.
- Srinivasan Damodaran, Kirk L. Parkin, Owen R. Fennema. 2007. Fennema's Food Chemistry, Fourth Edition. Taylor & Francis.
- Gordon L. Robertson, 2006. Food Packaging Principles and Practice, 2nd Edition, CRC press. London.
- Compendium_Food_Additives_Regulations_08_09_2020-compressed.pdf (fssai.gov.in)
- http://www.fda.gov/downloads/Food/FoodSafety/FoodborneIllness/FoodborneIllnessFoodbornePathogensNaturalToxins/BadBugBook/UCM297627.pdf
- http://www.fda.gov/
- www.standardsdata.in/
- www.fssai.gov.in
- http://www.foodqualitynews.com/
- http://www.cdc.gov/

Food Chemistry 3(3+0)

Objectives

1. To provide an understanding of the chemical function and properties of major food components.

2. To provide an understanding of the chemical interactions of food components and their effects on sensory and nutritional quality, functional properties, and safety of foods

Theory

Nature, scope and development of food chemistry. Properties of foods: Solubility, vapour pressure, boiling point, freezing point, osmotic pressure, viscosity, surface tension, specific gravity, oxidation and reduction. Acids, bases and buffers. Chemical bonding - Colloids - Water and moisture in foods- Hydrogen bonding, bound water, capillary water and loosely bound water; structure and properties of water molecule Water activity and effects on storage life.. Carbohydrates- classification, structure and properties of carbohydrates and dietary fiber. Proteins in foods- classification, structure and properties of proteins and amino acids, Pure proteins of plant and animal origin - their functional characteristics, physical, chemical and nutritional changes in protein during processing. Chemical and enzymatic modification of protein. Lipids – introduction classification, physical and chemical characteristics. Chemistry of fats and oils– processing aspects Changes of lipids / fats during processing and storage.. Role and use of lipids /fat, physiological effects of lipids - physiochemical aspects of fatty acids in natural foods, crystallization and intersification. Vitamins and minerals - Properties of Vitamins and minerals, enrichment, restorations, fortifications, Losses of vitamins and minerals. Structure and properties of chlorophyll, anthocyanin, flavonoid, tannin, betalin, quinone, carotenoid, myoglobin and hemoglobin. Pigments used in food industry. Flavor compounds - terpenoids, flavonoids, Sulphur compounds and volatile flavor compounds. Enzymes, enzyme inhibitors, enzymatic browning, enzymes in food processing. Composition of beverages- hot drinks, tea, coffee, cocoa, cold drinks, soft-drinks, fruit beverages and alcoholic drinks-beer, wine etc. Sugars and sweeteners, reaction of sugars, non-nutritive sweeteners. Food additives: Antioxidants, chelating agents, coloring agents, curing agents, emulsions, flavors, and flavor enhancers, humectants and anti-caking agents, leavening agents, nutrient supplements, preservatives, stabilizers, thickeners.

Suggested reading

- Meyer L.H, (1991) Food Chemistry, AVI Publications, New York
- Potter, N.N. (1996). Food Science. The AVI Publishing Company Inc., Westport, Connecticut.
- Vijaya Khader, 2001, Textbook of Food Science and Technology, Indian Council of Agricultural Research, New Delhi.
- Pieter Walstre. 2001. Physical chemistry of foods, Marcel Dekker, Inc. New York.
- Manay, N.S. and Shadaksharswamy, M. (2001). Food facts and principles, II Ed. New Age International (P)Ltd. Publishers, New Delhi.
- Meyer, L.H., Food Chemistry, CBS publishers and distributors private limited, Chennai, 2004.
- Chopra, H.K., Panesar, P.S. 2010, Food Chemistry, Narosa Publishing House, New Delhi, 2010.
- www.fssai.gov.in

Meat Processing and Technology 3(2+1)

Objectives

- To provide knowledge and skills for quality production of meat and meat products
- Develop human resource for meat industry and associated activities
- Train personnel for self-employment

- Impart knowledge and technical proficiency in:

  (a) Good slaughter practices

  (b) Handling of meat on scientific lines

  (c) Production of quality meat and meat products

  (d) Testing and quality control of meat and meat products

  (e) Managing small and medium enterprises.

Theory

Animal foods – needs – availability – demand and supply of animal foods. Growth and development of Indian meat industry. Meat and poultry - pre-slaughter operations - preparation of animals and poultry birds for slaughter. Slaughtering of animals – requirements -stunning methods. External treatment of carcasses - skinning, depilation – external and internal treatment of carcasses – evisceration - slaughter lines and systems. Identification of parts of the animal - structure – composition – nutritive value of meat. Post mortem changes of meat – eating quality of meat tissues. Equipment in processing of meat - their design – usage and its application. Meat cutting – types of carcasses - indicators of quality of carcass. Meat composition – quality and spoilage. Eating quality of meat – color - chemical nature of myoglobin - discoloration of meat - texture and tenderness of meat - pre-slaughter and post slaughter factors effecting tenderness – improvement of tenderness. Spoilage of meat - sources of contamination, growth of microorganisms – identification of spoilage. Meat inspection, sanitation and preservation techniques. Principles of preservation of meat -hurdle concept. Methods of preservation of meat - chilling and freezing – heating – canning and thermal processing - curing and smoking, dehydration - Intermediate moisture foods – freeze drying, irradiation, high pressure treatment. Ohmic heating, High power ultra sound processing technology. Direct microbial inhibition – antibiotics – chemical preservation. Processed meats - formulation of meat products- enrobed meat products– fermented, canned and restructured meat products – restructured steaks, roasts, blocks – portion and sticks. Dried meat – pickled, spiced and marinated meat – prefabricated meat- effect of processing on quality of meat products. Equipment's used in processing of meat. Poultry - dressing - composition - nutritive value - processing and preservation methods - storage, spoilage and preventive measures of poultry meat. Standards and quality control measures adopted for meat and meat products. National and International - HACCP for meat and poultry and processed meat products. Fraudulent substitution of meat - its recognition and impact. Waste utilization of animal foods - edible and non-edible parts. New concept in meat technology: cultured meat, lab-grown meat. Plant-based meat analogues, *in-vitro* meat.

Practical

Formulation of Questionnaire and conduct of survey on the availability of animal foods in selected areas. Effect of processing on sheep meat (moisture content, color change, shrinkage and sensory quality attributes). Curing of meat using sugar, salt and nitrite. Effect of tenderizing agents on meat cookery. Quality evaluation of processed meat and chicken products - preparation of battered chicken. Pickling and canning of meat. Microbial quality of stored animal and chicken meat products. Visit to slaughter house and meat cold storage unit.

Suggested reading

- Lawrie, R. A., and Ledwad, D.A., Meat Science. 2006. Woodhead Publishing Limited.

- Ioannis.S. Boziaris. 2013. Seafood Processing Technology: Quality and Safety, 2013, Wiley and Blackwell Ltd.
- Vikas Nanda. 2014. Meat, Egg and Poultry Science & Technology. I.K. International Publishing House Pvt. Ltd., New Delhi.
- B.D. Sharma and Kinshuki Sharma. 2011. Outlines of Meat Science and Technology. Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi.
- Fidel Toldra, Y. H. Hui, Iciar Astiasaran, Wai-Kit Nip, Joseph G. Sebranek, Expedito-Tadeu F.
- Silveira, Louise H. Stahnke, Regine Talon. 2007. Handbook of Fermented Meat and Poultry. Blackwell Publishing Professional, Ames, Iowa, USA.
- Joseph Kerry, John Kerry and David Ledward. 2005. Meat Processing-Improving Quality. Woodhead Publishing Ltd., Cambridge, England.
- NIIR Board of Consultants & Engineers. 2005. Preservation of Meat and Poultry. Asia Pacific Business Press, Inc., Delhi.
- Annual report. Department of Animal Husbandry and Dairying Ministry of Fisheries, Animal Husbandry and Dairying Government of India. Latest issues
- https://gfi.org/science/the-science-of-cultivated-meat/
- Kyriakopoulou, K., Dekkers, B., & van der Goot, A. J. (2019). Plant-based meat analogues. In *Sustainable meat production and processing* (pp. 103-126). Academic Press.
- Tziva, M., Negro, S. O., Kalfagianni, A., & Hekkert, M. P. (2020). Understanding the protein transition: The rise of plant-based meat substitutes. *Environmental Innovation and Societal Transitions*, *35*, 217-231.
- Stephens, N., Di Silvio, L., Dunsford, I., Ellis, M., Glencross, A., & Sexton, A. (2018). Bringing cultured meat to market: Technical, socio-political, and regulatory challenges in cellular agriculture. *Trends in food science & technology*, *78*, 155–166. https://doi.org/10.1016/j.tifs.2018.04.010

Pulses and oilseeds: Processing and Technology 3(2+1)

Objectives

- This course will impart knowledge to the students on Legume and Oil Seed Processing.
- By the end of the course students will be able to develop good expertise on the technical aspects of dhal milling, oil milling and various legumes and oil seeds-based product preparations.

Theory

Food uses of major pulses- Bengal gram, green gram, black gram, red gram, lentils etc. Primary processing of pulses- Cleaning, drying, storage, control of storage pests. Secondary processing methods-Dehulling, small scale processing, large scale processing. Traditional dal mills and modern dal mills, nutrient losses during processing. Processing methods of pulses like soaking, germination, cooking, fermentation etc. Major oilseeds produced in India and their utility groundnut, rapeseed/ mustard, soybean, sesame seed, sunflower, safflower, cottonseed, linseed, caster. Pre-treatments and oil extraction from different oilseeds. Refining, bleaching, deodorization, hydrogenation processes of edible oils Anti-nutritional factors and toxic

constituents of pulses and oilseeds. Technology of production of oilseed meals/flours, protein concentrates and isolates of pulses and oilseeds and their utilization. By product utilization of pulses and oilseeds.

Practical

Market survey of pulse and oilseed-based snack foods, Preparation of pulses and oilseed-based snack foods. Demonstrations on soaking, dehulling, germination, fermentation methods Analysis of antinutrients- Phytic acid, saponins, trypsin inhibitors etc. Preparation of snacks based on pulses and oilseeds. Preparation of recipes based on germinated and fermented pulses. Visit to traditional dal mills, modern dal mills, oil mills to expose students to dal milling operations and oil extraction operations.

Suggested reading

- Chakraverty. A. 1995. Post-harvest technology of cereals, pulses and oilseeds, 3rd Ed. Oxford and IBH publishing co., Pvt. Ltd.
- Vijaya Khader, 2001, Textbook of Food Science and Technology, Indian Council of Agricultural Research, New Delhi.
- Kalia, M. and Sood, S. (2010). Food Preservation and Processing. Revised Edition, Kalyani Publishers, New Delhi.
- Raghuvanshi, R.S. and Bisht, K. 2010. Uses of Soybean: Products and Preparation. Guriqbal Singh (Ed.). *In:* Soybean: Botany, Production and Uses, CAB International, U.K.
- Raghuvanshi, R.S. and Singh, D.P. 2009. Food preparations and use. William Erskina *et al.* (Eds.). *In:* The Lentil: Botany Production and Uses. CAB International, U.K.
- Agricultural Statistics at a Glance. 2021. Ministry of Agriculture & Farmers Welfare Department of Agriculture & Farmers Welfare Directorate of Economics & Statistics goi.
- http://www.fao.org
- http://ecoursesonline.iasri.res.in/mod/resource/view.php?id=5933
- https://agritech.tnau.ac.in/postharvest/pht_pulses_processing.html#:~:text=Processing A%20Processing%20of%20pulses%20is,of%20preparing%20pulses%20for%20consumption.

Sensory Evaluation of Foods 2(1+1)

Objectives

- This course introduces the methodology used in sensory evaluation of food product.
- Students will be exposed to the ability of humans to use their senses to evaluate the quality attributes of food product using sensory evaluation methods such as analytical and effective methods.
- This course will also cover the use of relevant statistics in analyzing sensorial evaluation data.

Theory

Sensory quality evaluation - introduction, method, sensory panel; physiological and psychological foundations of sensory evaluation; Principles of good practice: the sensory testing environment, test protocol considerations, Factors influencing sensory measurements, Basic principles: Senses and sensory perception, Physiology of sensory organs, Sensory and instrumental analysis in quality control. Sensory attributes of foods and beverages and their perceptions, appearance, flavor, taste, aroma, texture/mouthfeel, trigeminal

sensations, Sensory evaluation methodology, threshold measurements, difference tests, scaling procedures, descriptive analytical methods, consumer tests, Instrumental measurements, color texture, flavor, Correlation of sensory and instrumental measures, Applications of sensory tests for quality assurance product development product optimization marketing. Objective methods of evaluation. Relationship between objective and subjective methods.

Practical

Determination of threshold value for basic tastes and odor; Odor recognition, difference (PC, Duo trio, triangle); Selection of judging panel; Training of judges, for recognition of certain common flavor and texture defects using different types of sensory tests; Descriptive analysis methodology; Texture profile methodology; Sensory evaluation of various food products using different scales, score cards and tests; Estimation of color; Designing a sensory laboratory.

Suggested Reading

- Amerine, M.A., Pangborn, R.M. and Rossles, E.B. 1965. Principles of Sensory Evaluation of Food. Academic Press, London.
- Early, R. 1995. Guide to Quality Management Systems for Food Industries. Blackie Academic.
- Lawless, H.T. and Klein, B.P. 1991. Sensory Science Theory and Applications in Foods. Marcel Dekker. y Macrae, R., Rolonson Roles and Sadlu, M.J. 1994. Encyclopedia of Food Science & Technology & Nutrition. Vol. XI. Academic Press.
- Maslowitz, H. 2000. Applied Sensory Analysis of Foods. Vols. I, II. CRC Press, Boca Raton, FL, USA.
- Rai, S.C. and Bhatia, V.K. 1988. Sensory Evaluation of Agricultural Products. Indian Agricultural Statistics Research Institute (ICAR), New Delhi.
- Harry, T. Lawless, Hildegarde Heymann. 2010. Sensory Evaluation of Food: Principles and Practices. 2nd Ed., Springer, New York or Dordrecht Heidelberg, London.

Course Number	Course	Credit Hours
Elective-3 Institutional Food Service Management		
	Institutional Food Service Management	3(0+3)
	Sensory Evaluation of Foods	2(1+1)
	Event Management	3(0+3)
	Food processing and packaging	4 (3+1)
	Ergonomics in Food Service	2(2+0)
	Food Standards & Quality Control	3(2+1)
	Food Toxicology and Quality Testing	3(2+1)
	Print and Electronic Journalism	3(0+3)

Institutional Food Service Management 3(0+3)

Objectives

- The course includes various topics from designing the kitchen and work space, selection of equipment and maintenance, personal and finance management, food management, hygiene and sanitation to menu planning and food composition and nutritional values.
- This course will be very useful to those who are interested in establishing a food service industry in making available hygienically prepared, wholesome and nutritious food to the consumers.

Practical

Introduction to quantity food production, familiarization to equipment for quantity food production, Weight, measures and conversion, Recipe conversion standardization of recipes – procedure. Practical exercise on standardization of recipe, multiplication of standard recipe, portioning and cost calculation. Standardization of recipes suitable for different catering services i.e., cafeterias /canteens, snack bars, industrial canteens, residential hostels. Costing of recipes planned and fixing the price. Exercise on quantity food production for different type of food service establishments. Visit to residential hostel, hospital canteen, industrial canteen, star hotel and fast-food centre to observe the organization, management and administration. Making a detailed project report for establishing a food service unit including making purchase documents for equipment purchase and tenders etc. Organizing and planning menu for college canteen as a catering enterprise, setting up of a canteen, management of college canteen - procurement of materials. Practical exercise on food preparation, pricing and sale. Preparation and presentation of report on management of canteen. Catering for Birthday party/Mocktail Party/ Convention / Seminar / Conference.

Suggested reading:

- Sethi M and Malhan S. 1997. Catering Management - An Integral Approach. New Age International.
- Treat N and Richards. 1997. Quantity Cookery. Little Brown & Co.
- West BB, Wood L, Harger VF and Shugart GS. 1977. Food Service in Institutions, John Wiley & Sons.
- Raske L. 2017. Foodservice Management Fundamentals by Lina, Scitus Academics
- Ratti M. 2000.Food Service Management. Neha Publishers & Distributors.
- Fuller J. 1966. Chefs Manual and a Kitchen Management. B.T. Badtsford Ltd.

Sensory Evaluation of Foods 2(1+1)

Objectives

- This course introduces the methodology used in sensory evaluation of food product.
- Students will be exposed to the ability of humans to use their senses to evaluate the quality attributes of food product using sensory evaluation methods such as analytical and effective methods.

- This course will also cover the use of relevant statistics in analyzing sensorial evaluation data.
- **Theory**
- Sensory quality evaluation - introduction, method, sensory panel; physiological and psychological foundations of sensory evaluation; Principles of good practice: the sensory testing environment, test protocol considerations, Factors influencing sensory measurements, Basic principles: Senses and sensory perception, Physiology of sensory organs, Sensory and instrumental analysis in quality control. Sensory attributes of foods and beverages and their perceptions, appearance, flavor, taste, aroma, texture/mouthfeel, trigeminal sensations, Sensory evaluation methodology, threshold measurements, difference tests, scaling procedures, descriptive analytical methods, consumer tests, Instrumental measurements, color texture, flavor, Correlation of sensory and instrumental measures, Applications of sensory tests for quality assurance product development product optimization marketing. Objective methods of evaluation. Relationship between objective and subjective methods.
- **Practical**
- Determination of threshold value for basic tastes and odor; Odor recognition, difference (PC, Duo trio, triangle); Selection of judging panel; Training of judges, for recognition of certain common flavor and texture defects using different types of sensory tests; Descriptive analysis methodology; Texture profile methodology; Sensory evaluation of various food products using different scales, score cards and tests; Estimation of color; Designing a sensory laboratory
- **Suggested Reading**

- Amerine, M.A., Pangborn, R.M. and Rossles, E.B. 1965. Principles of Sensory Evaluation of Food. Academic Press, London.
- Early, R. 1995. Guide to Quality Management Systems for Food Industries. Blackie Academic.
- Lawless, H.T. and Klein, B.P. 1991. Sensory Science Theory and Applications in Foods. Marcel Dekker. y Macrae, R., Rolonson Roles and Sadlu, M.J. 1994. Encyclopedia of Food Science & Technology & Nutrition. Vol. XI. Academic Press.
- Maslowitz, H. 2000. Applied Sensory Analysis of Foods. Vols. I, II. CRC Press, Boca Raton, FL, USA.
- Rai, S.C. and Bhatia, V.K. 1988. Sensory Evaluation of Agricultural Products. Indian Agricultural Statistics Research Institute (ICAR), New Delhi.
- Harry, T. Lawless, Hildegarde Heymann. 2010. Sensory Evaluation of Food: Principles and Practices. 2nd Ed., Springer, New York or Dordrecht Heidelberg, London.

Event Management 3(0+3)

Objectives

The course will enable the students to:

- Be aware of event management as a profession.
- Gain basic knowledge about establishing and managing an event.
- Understand and develop soft skills that would help in event management

Practical

Identifying practical situations for event management, conceptualizing goal and objectives, Overall show management. Exhibit sales and promotion. Festivals (diwali, religious ceremonies). Social gathering. Food fair/Conference/ workshop/seminar/congress programming. SWOT analysis of event. Portfolio preparation; presentation and projection for work. Project report on visit to different types of organizational settings like hotel, guest house, hostel, small offices, clubs, fast food centres for management and organization of events. Project planning. Programme planning and execution. Project development. Event accountancy. Event communication and sponsorship. Event marketing and advertising. Live event management. Visit to different organizations/hotels etc. Project preparation and report presentation.

Suggested readings:

- Aditya, Suvarna. (2003). Event Management Development Institute. I.E.S. Management College. 4th Floor, 791, S.K.Marg, Opp. Lilavati Hospital, Bandra (W), Mumbai - 400 050.
- Kit, Potions, H.P. Bhuson. (1998). Festival and Special Event Management. IBM Cooperation, 60 Renfrew Drive, Suite 105, Markham, Ontario, Canada L3R0E1.
- National Institute of Event Management. Ground Floor, Nandavan Building, Corner of Vallabhbhai Road and Ansari Road, Vile Parle (W), Mumbai.
- Sulekha, Narayna. (2001). International Institute of Event Management. SNDT Women's University, Juhu Campus, Juhu Tara Road, Santacruz (W), Mumbai - 400 049.
- Anukrati Sharma, Shruti Arora. 2018. Event Management and Marketing: Theory, Practical Approaches and Planning (English, Paperback)

Food processing and packaging 4 (3+1)

Objective

- To impart knowledge of various areas related to food processing and packaging.
- To enable the students to understand food composition and its physic chemical, nutritional, microbiological and sensory aspects.

Theory

Food processing and preservation techniques for cereals, milk, fruits and vegetables, oil seeds, meat, fish and poultry and their impact on physical and chemical characteristics. Physico-chemical characteristics, nutritional quality and shelf-life studies. Factors effecting quality of processed foods. Food packaging, package functions, requirement and packaging materials. Principles in the development of protective packaging. Laws related to packaging. Shelf-life of packed food, special problems in packaging of foodstuffs.

Practical

Market survey for packaged processed food stuffs. Cereal cookery. Preparations showing dextrinization and gelatinization, gluten formation and influence factors. Vegetable cookery: effect of heat and alkali on pigment, preparation of soups, salads and beverages. Use of milk and milk products and egg in various preparations Estimation of shelf- life of packaged food stuffs.

Suggested Readings:

• Potter, N.N. (1996). Food science. The AVI Publishing Company, Inc., Westport, Connecticut.

• Kalia, M. and Sood, S. (2010). Food preservation and processing. Revised edition, Kalyani Publishers, New Delhi.

• Srilakshmi, B. (2010). Food science (Fifth ed.) New Age International Pvt. Limited Pub., New Delhi.

• Frank, A., and Paine, H.Y. (2003). A Handbook of food packaging. Springer science and business Media, U.K.

Ergonomics in Food Service 2(2+0)

Objectives

- To identify the current problems related to ergonomic in food production process,
- To understand and analyze the actual production data by using Rapid Upper Limb Assessment (RULA) and Rapid Entire Body Assessment (REBA)
- To recommend the ergonomic workplace environment based on the condition of the study.

Theory

Introduction to Ergonomics, principles, domains, significance and applications, Functional design, Facility design, Work zones, Work flow and travel distance, Work triangle, Managing central kitchens, kitchen layout, kitchen storage, kitchen planning, kitchen forms, Equipment selection and cart selection and maintenance, Material selection and placement, Managing human resource issues, Operational issues, food safety and hygiene and service ware., Ergonomics for Waiter staff, Cooks, food preparation workers, dishwashers, Musculoskeletal disorders – meaning, causative factors. Common MSD in food industry-Awkward posture, repetition, force. Ergonomic injury signs, symptoms and reporting. Ergonomic Risk Factors and safety Trends in accidents, Task Specific Ergonomics. Safety Responsibilities, Safety Responsibilities of Employers, Employees and Health Care Providers, Ergonomics Solutions & Stress-Engineering Improvements, Administrative Improvements and Personal Protective Equipment.

Suggested readings

- Brudger, R. S. (2003) Introduction to Ergonomics, Taylor and Francis London
- Grandjean, E. (2000) Fitting the Task to the Man, Taylor and Francis, London
- California Department of Industrial Relations (2003) Ergonomics in Action: A Guide to Best Practices for the Food-Processing Industry, OSHA.
- Dan Macleod (2006) The Ergonomics Kit. (Second Edition). Taylor and Francis, London.
- https://www.tdi.texas.gov/pubs/videoresource/fsergofood.pdf

Food Standards & Quality Control 3(2+1)

Objectives

- To develop qualified and competent human resource in the field of the food standards and quality management for regulators, industry, academic/research institutions, certifying and accreditation bodies, food trade, food testing and training

- To delve in depth on various aspects of food standards and quality management i.e. food standards, harmonization with global benchmarks, quality management systems, food analysis, instrumentation, risk analysis /management, traceability and auditing to transform the food ecosystem
- To nurture a positive and disciplined food standard and quality culture among the professionals
- To conduct research studies on emerging food standard issues and formulation of science based regulatory framework.

Theory

Importance of food quality control and assurance. Food Standards and Regulations in India: FSSAI, Prevention of Food Adulteration Act, Fruit Product Order, AGMARK, Essential Commodity Act, Consumer Protection Act, Bureau of Indian Standards, Codex Standards, Food and Drug Administration (FDA). Food additives, preservatives, coloring agents, antioxidants, emulsifying agents, leavening agents and stabilizing agents Sensory Evaluation of Food Quality – Introduction -Panel Screening-Selection of Panel members .Objective/Instrumental analysis of Quality Control .Statistical Quality Control of Foods Determination of Sensory thresholds and taste Interactions. Fundamentals of Food regulations-pertaining to Additives and Contaminants . Food safety management systems- GMP/GHP, HACCP, GLP, GAP, The Kosher and Halal Food Laws Food packaging, packaging material. Adulteration, heavy metals. Quality criteria of foods – food grains, fruits, vegetables and animal foods. Quality criteria of processed foods. Physical, chemical and microbial contamination of foods. Food adulteration – common adulterants – health hazards. Tests to detect adulterants in food.. Pesticides-Mechanisms of Toxicity-Residues in Food, Acceptable daily limits.

Practical

Sensory and nutritional evaluation of some finished products. Detection of adulterants and preservatives in products. Identification of food logos. Study of food labelling. Identification of critical control points in a product line. Sensory evaluation of different food samples. Visit to quality control laboratory/food processing industries and note the procedures and parameters used for quality assessment. Estimation of quality parameters- cereals, pulses, fruits and veg. Market survey and quality analysis of street foods. Estimation of quality parameters – cereals, pulses, fruits and vegetables - Evaluation of food quality – objective and subjective methods - Market survey and quality analysis of street foods -

Suggested Reading

- Potter, N.N. 1996. Food Science. The AVI Publishing Company Inc., Westport, Connecticut.
- Jellinek, G. 1985. Sensory Evaluation of Foods: Theory and Practice. Ellis Honwood Ltd. Chichester, England.
- Manual of Food Standards and Quality Control. 2014. Dept. of Foods and Nutrition, CCS HAU, Hisar.
- Detect Adulteration with Rapid Test (DART) booklet fssai https://www.fssai.gov.in/flipbook.php?bookid=201#book2/7
- Radonit Lassztity. 2008. Food Quality and Standards. Encyclopedia of Life effort systems. USA.
- Patricia and Cuuring A. An operational Text book, guide to Food Laws and Regulations.
- Food Safety and Standards (Food Products Standards and Food Additives) Regulation, 2011.
- Kalia, M. and Sood, S. 2010. Food Preservation and Processing. Revised edn. Kalyani Publishers, New Delhi

Food Toxicology and Quality Testing 3(2+1)

Objectives

- The course gives an introduction to possible toxic effects of food additives and naturally occurring environmental toxins in food.
- Student will be able to define toxicology
- Student will be able to define the most important contaminants in food, the toxicology of various additives and environmental toxins, as well as their sources
- Student will be able to explain what food safety is and which substances are of relevance for food safety
- Student will be able to explain what risk analysis, assessment and management in relation to food safety is, and know which organizations are involved in this type of work nationally and internationally

Theory

Food toxicology – definition, introduction and significance. Classification of toxic constituents. Food poisoning –types, causative factors, signs and symptoms, preventive measures. Natural food toxins – pulses, oil seeds, sea foods, processed animal foods. Anti-nutritional factors, other food toxins, their harmful effects and methods of removal. General characteristics, occurrence, properties and inactivation of protease inhibitors, trypsin inhibitors, haemagglutinins, goitrogens, gossypol. General characteristics, occurrence, properties and inactivation of saponins, lathyrogens, avidin and other antimetabolites. Microbial toxins – classification, source of contamination, effect on health, preventive measures, methods of inactivation / destruction. General characteristics, occurrence and properties of mycotoxins, aflatoxin, ochratoxin and patulin. Methods to detect and prevention of mycotoxins. Chemical toxins – Pesticides - Pesticide and insecticide residual toxicity – sources and health hazards, insecticides, metallic and others. Mineral toxicity – Chlorine and Fluorine, Heavy metals toxicity – Lead and Chromium, Mercury, Arsenic and Iron, residual effects, preventive measures, methods of removal. Food additives – classification, toxicity and effects. Toxins developed during processing. Food packaging material – Potential contaminants from food packaging material. Antibacterial drugs, hormones and growth promoters of animal origin. Detection of toxins in food chain.

Practical

Methods of detect aflatoxin and gossypol**.** Methods of detect trypsin inhibitors and protease inhibitors. Use of AAS for detection of lead, chromium, mercury, arsenic, iron, detection of tannin and phytic acid. Visit to toxicology lab and public health laboratory. Visit to Quality Testing Laboratory, food processing industry/ government laboratory.

Suggested readings:

- Debasis Bagchi, Anand Swaroop. 2016. Food Toxicology, CRC Press.
- Takayuki Shibamoto, Leonard F. Bjeldanes. 2012. Introduction to Food Toxicology. Academic Press.
- Hodgson, Ernest. 2004. A Textbook of Modern Toxicology. John Wiley & Sons, IncI.
- M.J. Derelanko and M.A. Hollinger. 2002. Handbook of toxicology, 2nd ed., CRC Press.
- Srinivasan Damodaran, Kirk L. Parkin, Owen R. Fennema. 2007. Fennema's Food Chemistry, Fourth Edition. Taylor & Francis.
- Gordon L. Robertson, 2006. Food Packaging Principles and Practice, 2nd Edition, CRC press. London.
- Compendium_Food_Additives_Regulations_08_09_2020-compressed.pdf (fssai.gov.in)

- http://www.fda.gov/downloads/Food/FoodSafety/FoodborneIllness/FoodborneIllnessFoodbornePathogensNaturalToxins/BadBugBook/UCM297627.pdf
- http://www.fda.gov/
- www.standardsdata.in/
- www.fssai.gov.in
- http://www.foodqualitynews.com/
- http://www.cdc.gov/

Print and Electronic Journalism 3(0+3)

Objectives

- To develop the learner into competent and efficient in the field of reporting news, processing and program production in the field of media.
- The Subject is designed to make the students learn about script, interviews techniques, phone-ins, panel discussion, voice over, live shows and field reporting.

Practical

Visit to print and electronic stations for familiarization with equipment's, Interaction with personnel of print and electronic media. Report writing on observations and presentation. Planning a press note/ press release for print media, Screening of radio news programmes. Screening of TV news programmes. Exercises on writing different types of reports for radio. Exercises on writing different types of reports - television formats, Hands-on experience with editing. Planning a press note/ press release for electronic media, Writing and presentation of radio and television news, Orientation to photography/videography and its equipment. Hands on training with different types of professional cameras, Writing captions for photographs. Writing and editing photo features for selected photographs and presentation. Familiarization with different online articles. Content creation for online journal. Creating a blog, awareness videos. Using social media channels such as Facebook/Instagram/LinkedIn/Twitter/WhatsApp, to create nutrition related post.

Suggested readings:

- Kumar A. (1999). The Electronic Media. Anmol Publications, New Delhi.
- Bhatt, S.C. (1993) Broadcast Journalism. Basic Principles Har Anand Publications, Delhi
- Bhatnagar, R. (2001). Print Media and Broadcast Journalism. Indian Publisher Distributors, Delhi
- Katyal, V.P (2007). Fundamentals of Media Ethics. Cyber Tech Publishers, New Delhi.
- Fernández-Celemín, L., & Jung, A. (2006). What should be the role of the media in nutrition communication? British Journal of Nutrition, 96(S1), S86-S88. doi:10.1079/BJN20061707
- http;//hosbeg.com.printmedia.an
- https;//www.vskills.in certification
- https://www.nyfaedu.print.journal.

Tourism and Hospitality Management 3(1+2)

Objectives

The course aims to help the students to gain a basic knowledge of:

1. Skills associated with problem solving, creative and critical thinking; related to tourism industry.
2. Applying the concepts and skills necessary to achieve guest satisfaction.
3. Demonstrating knowledge of multi - cultural perspectives to meet the needs of the guests and employees.
4. Leading with the knowledge that the foundation of tourism and hospitality is based on the respect for the host culture with the responsibility to perpetuate unique values, traditions, and practices of that place.
5. Demonstrating ability to perform basic and supervisory level job functions in hotel and restaurant careers.

Theory

Tourism Management Introduction to Tourism, Growth and development of modern tourism, Tourism in India, Heritage/ Cultural, Pilgrimage Tourism, Medical, Hot Spots and Culinary Tourism -Business and Cruise Tourism - Eco-tourism/ Rural tourism - Emergence of Eco-tourism / Rural tourism - Concept and definitions - Growth and development issues in eco-tourism - Travel Agency and Tour Operation and logistics (Airlines operation and ticketing. Ships cruise services) business in India, Emerging trends of tourism, Impacts of Tourism, Ethics issues in tourism - Introduction to Hospitality Management. Basic Management Principles: planning, organizing, staffing, leading, controlling with specific reference to hospitality. Hotel hierarchy: GM, departmental heads, supervisors, operational employees Soft Skills in Hospitality; personal development, motivation. Communication techniques and skills, Hostess training Services offered to guests such as food and accommodation services and personal services Front Office management. Maintenance of front office records - housekeeping services - cleaning and linen services, bed making Accommodation Operations - Role of accommodation operations in hospitality. Public areas – maintenance and decoration

Practical

Study of all the activities of a tourism office and report Planning for a tour - Heritage, Eco, Wildlife, Pilgrimage, medical etc. - Planning for Accommodation operations - Preparation of a tour package -Visit to different tourist spots - Planning layouts of front office of different institutions - Mock sessions on front office handling - Mock sessions on Communication Techniques and Skill - Mock sessions on Handling Complaints and Emergencies - Mock sessions on Handling various types of clients - Practical sessions on Hostess training - Services offered - Practical sessions on housekeeping services - Report writing

Suggested Readings

1. Dharmarajan.S. and R. Seth, Tourism in India-Trends and Issues, HarAnand Publications Pvt. Ltd. New Delhi, First edition.
2. Gupta. S., World Tourism in New Millennium, ABD Publishers, Jaipur, First edition.
3. Kamra, K.K and M.Chand, Basics of Tourism-Theory, Operation and Practice, Kanishka Publishers, New Delhi. First Edition. 2006

4. Maken. D. Strategies and Planning in Tourism and Industry, Adhyayan Publishers and Distributors, Delhi, First edition.

5. Puri M. and G.Chand, Tourism Management, Pragun Publications, New Delhi. First Edition. 2006.

6. Roday. S, Biwal. A. and Joshi. V., TOURISM Operations and Management, Oxford University press publication, New Delhi, First addition 2009

7. Sharma. R.B., World Tourism in 21st Century, Alfa Publications, New Delhi, First edition

SKILL ENHANCEMENT COURSES

Broad course syllabi for SEC, Institutions may modify, add more courses as per the expertise and need of the area; the courses may be conducted by the institution or in partnership with any organization

Indicative list* of SEC Modules

S. No.	Course Title	Credit Hours
1.	Jam jelly preparation	2(0+2)
2.	Cake making	2(0+2)
3.	Indian traditional sweets	2(0+2)
4.	Cake decoration and icing	2(0+2)
5.	Pickle preparation	2(0+2)
6.	Candy making	2(0+2)
7.	Savory Snack preparation	2(0+2)
8.	Ready to eat snacks	2(0+2)
9.	Hygiene management in food service units	2(0+2)
10.	Quality control in food processing units	2(0+2)
11.	Web designing and multimedia production	2(0+2)
12.	Development of nutritional educational material	2(0+2)
13.	Development of audio-visual aid	2(0+2)
14.	Sugar processing and confectionary	2(0+2)
15.	Assessment of clinical signs and symptoms	2(0+2)
16.	Development of project proposals	2(0+2)
17.	Laboratory analysis	2(0+2)
18.	Practical skills in Writing and Speaking	2(0+2)

*University/HEI may offer courses in any area as identified by it, based on institutional expertise/capabilities/resources. In addition, SEC list as suggested by UGC is given in item IV listed under 3.1.12 are also suggested.

Jam jelly preparation 2(0+2)

Practical

Nutritional aspect of Fruits; Basic characteristics of jams, jellies, marmalades, fruit preserves , glazed and crystallized fruits; Role of sugar and other ingredients in fruit preservation; Introduction to various food additives used in jams, jellies and other fruit preserves; Basic tools and equipment used in the preparation of jams, jellies and crystallized fruits such as pulper, sealers, juice extracting machines, autoclaves, steam jacketed kettle, etc.; Introduction to different types of packaging materials used

Identification of different types of spoilage occurring in fruits; Selection and grading of raw and ripe fruits for preservation; Preparation of Jam, jelly and marmalades - ripe mango, green mango, pineapple, apple, guava, orange, mixed fruits, etc.; Preparation of glazed and crystallized fruit preserves- ginger, orange, apple, etc.; Analysis of the raw material and finished product - Pectin grade, Acidity of fruit juice and pickle, Total Solid content, Brix measurement, Moisture content, Ash content, reducing and non-reducing sugar content. Study on the shelf life of the finished product.; Basics of labeling, packaging and presentation of sweets; Waste Management and up keeping of work place

Cake making 2(0+2)

Practical

Ingredient used in Cake Making Types & Varieties: Flour, Sugar, Shortening – Fats and oil, Egg, Moistening agent, Leavening Agents; Cake Making Methods: Sugar butter process, Flour butter process, Genoise method, Blending and rubbing method; Characteristic of Cakes: External characteristics, Internal Characteristics; Balancing cake formula; Cake Faults and remedies; Basic Cake Making: Plain Sponge, Madeira Cake, Rock Cake, Fruit Cake, Fatless Sponge, Swiss Rolls, Genoise Sponge; Market survey for cake and confectionary food stuffs; Project writing of small-scale bakery and confectionery unit

Indian traditional sweets 2(0+2)

Practical

Basic ingredients and their role in preparation different types of traditional sweets; Basic tools and equipment used in the preparation sweets; Stages of Sugar cookery; Preparation of Bengali sweets like-Rasogolla, Rajbhog, Rasbhari, Chamcham, Rasomalai, Sandesh Raskadam, Mohanbhog, Kheer Mohan & Channa Toast; Preparation of milk and khoya based sweets like- khoa Burfi, chocolate burfi, khoa peda, kesar peda, pista burfi, badaam pista burfi , kesar khoa burfi, kalakand, milk cake, khoa roll, kheer kadam, coconut burfi, meva bati etc.; Preparation of ghee based sweets -Patisa, Gulab Jamun, Soan Papdi, Gujia, Imarti, Motipak, Balushahi, Laddu; Preparation of khaju and dry fruits based sweets like-Kaju Burfi, Kaju Roll,Kaju Laddu, Badam Burfi, Pista Lauj & Anjeer Burfi etc.; Basics of labeling, packaging and presentation of sweets; Waste Management and up keeping of work place

Cake decoration and icing 2(0+2)

Practical

Techniques of Icing –ingredients used in icing and their role; Tools of icing, preparing, and applying various types of icing; Icings and Toppings; Fondant; American frosting; Butter cream icing; Royal icing; Gum paste, marzipan; Marshmallow; Lemon meringue; Fudge, almond paste; Glace icing

Pickle preparation 2(0+2)

Practical

Nutritional aspect of Fruits and vegetables; Basic characteristics of pickles; Role of various ingredients used in fruit and vegetable preservation; Introduction to various food additives used in pickle making- Spices and other constituents, condiments and other additives and ingredients, and flavouring, colouring agent and preservative; Basic tools and equipment used in the preparation of pickle making such as boilers, choppers, mechanized peelers, sealers, autoclaves, steam jacketed kettle, pickle mixer, etc.; Introduction to different types of packaging materials used; Identification of different types of spoilage occurring in fruits; Selection and grading of raw and ripe fruits and vegetables for preservation; Preparations of different types of pickles from fruits and vegetables- i. Preparation of salty and oily pickle (green mango, green chili, lemon, ginger, mixed type), ii. Preparation of sweet pickle (Mango, plum, papaya, date, mango lather, mixed type etc.); Examination of processed products- Examination of processed products- Detection of benzoic acid, sulphur dioxide and KMS in fruits and vegetable products. Cleaning and maintenance of the equipment; Study of containers like Glass, Tin, packaging materials, such as plastic pouches, glass containers, plastic bottle and cartons; Information to be mentioned on label and pack; Waste Management and up keeping of work place

Candy making 2(0+2)

Practical

Introduction to candy making; Basic ingredients and their role in preparation different types of candies; Basic tools and equipment used in the preparation of candies; Stages of Sugar cookery, caramelization of sugar, crystallization of sugar, invert sugar, corn syrup; Preparation of: Ganache- Ganache techniques & uses, -Various types of ganache, How to work with ganache, Piped & Filled Truffles- Making various recipes of ganache used for piped truffles and filled truffles; Tempering chocolate, Slab Ganache, Finishing truffles - Tempering white, milk & dark chocolate; Molded Truffles- Producing chocolates using shell molds and slabbing with metal bars, Learn how to prepare & decoratively color molds before filling, Cut ganache slabs with use of guitar, proper dipping and finishing technique with tempered chocolate, including use of transfer sheets; Finish all Truffles- How to store & freeze finished Truffles; Candy Bars- Discussion of different characteristics of a candy bar, History and popularity of the Candy bar, How to Assemble a candy bar; Jellies & Pate de Fruit- Learn the differences between the use of gelatin and pectin in gummy candies, Preparation of jellies and Pate de fruit; Crystalline Confections- Learn how the crystallization of sugar creates candy, Preparation of different Fondants and Fudges; Preparation of Chocolate Eggs; Basics of labelling and packaging , Waste Management and up keeping of work place

Suggested Reading

Chocolates & Confections, 2nd Ed by Greweling Publisher: Wiley, ISBN: 9780470424414

Savory Snack preparation 2(0+2)

Practical

Market survey for availability of different types of savory snacks; Preparation of snacks with some shelf life: Types of Namkeen; Preparation of Chiwda; Chakli preparation and its variations; Preparation of mathri in different flavours; Gathiya preparation; Preparation of snacks eaten when prepared: Khaman and Dhokla

with chutnies; Preparation of Dahi Vada and its chutnies; Making types of bhelpuri; Making Corn bhel/Chat; Preparations of Sago: Sago Vada and Sago Khichadi; Frying skills by preparing types of fritters and potato twisters; Cutlet preparation with various variations; Preparing Sprout Chat and Masala Peanut; Preparation of Garlic bread , Focaccia and Bruschetta; Project writing of small scale savory snack production unit

Suggested Reading

- Brown, A. (2018). Understanding Food: Principles and Preparation. Wadsworth Publishing Co Inc.
- Sethi, M. (2007). Catering Management – An Integrated approach. New age International (P) Limited Publishers, New Delhi.
- Pant P (2007) Cuisines – Incredible India. Wisdom Tree, India.
- Richard E. Martland., Derek A. Eelsy. (1998). Text book of Basic cookery, Fundamental recipes and variations.

Ready to eat snacks 2(0+2)

Practical

Introduction to convenience foods based on various food groups; Selection of raw materials, Overview of various food additives used for snacks; Preparation of Grain/pulse based snacks: whole grains –roasted, toasted, puffed, popped and flakes Coated grains-salted, spiced and sweetened Flour based snack–batter and dough based products; savoury and farsans; formulated chips and wafers, papads; Preparation of fruit and vegetable based snacks: chips, wafers, papads etc. , ready to eat fruits and vegetable based food products like, sauces, fruit bars, glazed candy etc., ready to eat canned value added fruits/vegetables and mixes and ready to serve beverages etc.; Preparation of Dairy based convenience foods; Preparation of ready-to-eat baked food products, drying, toasting roasting and flaking, coating, chipping. Preparation of coated nuts – salted, spiced and sweetened products-chikkis, Sing bhujia; Extruded snack foods: Formulation of cold and hot extruded snacks, assessment of quality; Food packaging material for snack foods, Food labels; Visit to snack making plant

Hygiene management in food service units 2(0+2)

Practical

Introduction, importance and need of food hygiene and sanitation if food service establishments; Identification of microorganism, preparation of slides, preparation of media; Collection of water samples, Testing of water for: (i) Physical quality (ii) Bacteriological quality (iii) water hardness; Food Borne Diseases- Define Food Borne illness – Food Infections – Food Poisoning- Bacterial infections -Types of Food Inspections; Sanitary Procedures in Catering Industry- Sanitary Procedures for purchasing foods - categories of commodities – Storage areas Temperature Zones- Thawing, Blanching, maceration, Blast, Freezing, Pasteurization; Introduction to Daily Cleaning Procedures in Commercial Kitchen; Visit to food service establishments; Survey of food service establishments, data collection, tabulation, report writing and presentation

Quality control in food processing units 2(0+2)

Practical

Concept of quality control and quality assurance in food processing industry; Food and nutrition labelling on foods as per FSSAI regulations and international standards; Food safety management systems-GMP/GHP, HACCP, GLP, GAP, The Kosher and Halal Food Laws Food packaging, packaging material; Evaluation of food quality – Assessment of quality of some finished foods through objective and subjective methods; Market survey and quality analysis of street foods; Visit to food processing Units to understand the quality control methods used while processing food; Simple physical and chemical tests to determine quality and detect adulterants in Oil and Fats, Spices and Condiments (any five), Food Grains, Pulses and Oilseeds, Flours – Wheat, Canned foods – Drained wt., Sugar and Honey, Milk & Milk products, Tea, Coffee; Report writing

Web designing and multimedia production 2(0+2)

Practical

Study of creating Webpages using HTML elements like <html>, <head>, <title>, <body>, <u>, <b>, <i>, <p>, <marquee>,
, <ol>, <ul> with all its attributes. Familiarization with different types of websites, Hands-on-experience with Adobe photoshop for designing of website, Hands-on-experience with HTML 4.01 writing for construction of website, Hands-on-experience with Dreamweaver for construction of website. Hands-on-experience with flash for animations of website, Familiarization with cascading sheet styles. Familiarization with web analytics, Practical orientation to Multimedia application. Exposure to multimedia hardware and maintenance-parts and connection, peripheral. Handling multimedia-parts, connections and peripheral. Scanning, retrieval, capturing and navigating skills. Planning and Production of multimedia package, Multimedia authoring tools - CD and DVD writing techniques, Presentation of the prepared Multimedia kit by using LCD Projector.

Suggested Reading

- Jennifer Niederst Robbins. Developing web design latest edition.
- Frain and Ben. Responsive Web Design with HTML5.

Development of nutritional educational material 2(0+2)

Practical

Objectives, principles and importance of nutrition education in a community; Deficiency diseases and public health problems-Vit. A, iron and iodine deficiencies, other micronutrient deficiencies; Identification of nutritional problems and target groups (Survey); Communication techniques: Process, its components. Mass, group and individual Communication; advantages and disadvantages; Classification and use of audio-visual aids (Electronic aid, non-projected and three dimensional); Preparation of instructional material (Chart, Poster, Flipbook, Pamphlet, Calendar); Practicing and use of nutrition education material on

vulnerable groups in the community, rural and urban; Planning and organizing nutritional education programme for community; Evaluation of nutrition education programme

Development of audio-visual aid 2(0+2)

Practical

Introduction, need, importance of audio-visual aids; Classification of AV aids, characteristics, advantages and disadvantages of different types of AV aids; Principles to be followed for the effective use of AV aids; Development of various types of AV aids (digital/non digital) like flash cards, posters, charts, puppets, video spots, podcasts, role plays, cultural programmes like folk songs etc.; Field testing of the developed AV aids

Sugar processing and confectionary 2(0+2)

Practical

Introduction to Sugars: Composition and nutritional Composition; Types, properties and functions of Sugars; Identification and description of different stages of Sugar; Demonstration of 1 thread, 1.5 thread 2 thread consistency of sugar and Caramelization; Preparation of sweets using 1 thread sugar syrup (Gulab jamun, Makhanvada, Jalebi, Besan chakki, Ghewar etc.); Preparation of sweets using 1.5 thread and 2 thread sugar syrup (Kaju Katali, Shakkarpare, Mava petha, Gujia etc.); Preparation of Fondant and Fudge (Cake, Chocolate fudge etc.); Preparation of Toffee (Milk toffee, Chocolates, Stick jaws, liquor Chocolates etc.); Basics of labeling, packaging and presentation of sweets and confectionary products; Storage and preservation of sweets and confectionary products

Assessment of clinical signs and symptoms 2(0+2)

Practical

Preparation of list of signs and symptoms of PEM; Preparation of poster on signs and symptoms of vitamin deficiency; Preparation of folder on mineral deficiencies; Visit to Aanganwadi to assess signs of PEM deficiency in children; Visit to hospital to assess the deficiency signs and symptoms in pregnant women; Survey of adolescent boys and girls to assess micronutrient deficiency; Assessment of clinical signs and symptoms of malnutrition in school age children; Nutrition education to target groups on micro nutrient deficiency; Visit to local health centre to identify clinical signs and symptoms of nutritional problems; Community survey for nutritional deficiency disorders – data collection ,tabulation analysis, interpretation , report writing; Presentation of reports and group discussion; Comparison of data on status of various deficiency diseases in India (NFHS 3, NFHS 4, NFHS 5) in vulnerable groups; Development of tools for assessing signs and symptoms of micronutrient deficiency in vulnerable groups; Collection of data on locally available common foods and their cost and unavailability of certain foods leading to the deficiencies in particular region; Surveillance of national nutrition programmes; Data analysis and Report writing

Suggested Reading

- Mason J. B., Habicht J., Tabatabai H., Valverde V., 1984. National Surveillance WHO.

- Bamji M.S., Prahlad R. N. And Vinodini R.2003. Text book of Human Nutrition. New Delhi, Oxford & IBH Publishing Co. Pvt. Ltd.
- Sehgal S., Raghuvanshi R. 2007. Text Book of Community Nutrition. ICAR Publication.
- Das, S. 2022. Textbook of Community Nutrition. Academic Publishers.

Development of project proposals 2(0+2)

Practical

It will be a group activity of 3-5 students in each group –

The students will do the background research on the project, will present an oral report, write and submit a formal project proposal on related aspects of food processing, dietetics, community nutrition, nutrition education, etc. The students are expected to: Identify an appropriate and manageable topic. A concise statement of objectives and what you intend to design and build will be one of the outcomes of the course. Conduct a background history of the topic and a current literature search of the topic. Students are expected to search in journals, magazines and Internet. This background report will be submitted with the project proposal. Budget development. Project work plan and timeframe (including GANTT charts). Monitoring and evaluation plan. Management Plan and Institutional Capability. Prepare the proposal appropriate to the objectives of the project with budgetary details, and submit a complete written proposal

Laboratory analysis 2(0+2)

Practical

Unit-1: General introduction to laboratory glass wares. General introduction to the laboratory instruments. Preparation of samples and buffer solutions. Qualitative and quantitative analysis of carbohydrates. Qualitative analysis of amino acids. Qualitative analysis of protein. Qualitative analysis of fat. Determination of milk quality by MBRT test; Unit-2: Estimation of bulky density of food stuffs. Estimation of color by spectroscopy. Physical analysis- specific gravity. Determination of food quality by standard plate count method. Estimation of reducing and non-reducing sugar. Estimation of starch digestibility. Estimation of minerals by UV spectrophotometer. Determination of acid values; Unit-3: Quantitative estimation of proximate principles- Estimation of moisture in food stuffs. ash minerals, Estimation of nitrogen by khjeldal method. Estimation of fat by soxhlet method. Estimation of carbohydrate by difference; Unit-4: Saponification and iodine number. Preparation of culture media. Isolation and enrichment of microorganisms. Isolation of mould from different food samples. Microbial examination of – milk products, Cereal and pulses, vegetables and fruits.

Suggested Reading

- Pomeranz Y and molean CE 1977. Food analysis theory and practical. AVI publication.
- Sawhney SK and Singh R. 2000. Introduction practical biochemistry. Noroda.

Practical skills in Writing and Speaking 2(0+2)

Practical

Reading and Comprehension: Unseen Passage and Unseen Poems; Assessment of basic grammar: Worksheets on Articles, Verbs, Punctuations, Prepositions and conjunction; Worksheets on Tenses: Present tense; Simple present tense, Present Continuous Tense, Present perfect tense, Present Perfect Continuous Tense; Worksheets on Past Tense- Simple past tense, Past Continuous Tense, Past perfect tense, Past Perfect Continuous Tense; Worksheets on Future Tense- Simple future tense, Future Continuous Tense, Future perfect tense, Future Perfect Continuous Tense; Writing of letters – Informal letters, Formal letters, Emails; Notice writing / Advertisement; Essay writing; Story writing; Dairy Entry / CV writing; Writing of Blogs and technical articles; Oral Presentation skills; Extempore; Note taking and Summarizing; Individual presentations / Radio talks; Group presentations and Discussions

Suggested Reading

- Kumar S. and Pushpa L. (2011). Communication Skills. Oxford University Press.
- Seely J.2005. Oxford Guide to Effective writing and speaking. Oxford University Press.
- Thomson A. And Martinet A.V. (1977). A Practical English Grammar. Oxford University Press.

ONLINE COURSES

In addition, students will have to opt for 20 credits equivalent courses either from MOOC/Swayam or any other portal accepted by the University. The credits may relate with the main discipline or from any other discipline like social science, psychology, anthropology, economics, business management, agriculture, veterinary, language/humanity, music, etc. Or Student may opt for a project or a start-up, internship; based on the time and content, credits will be decided by the University level committee.

Suggestive list of on-line courses

Swayam Portal

1- Food chemistry
2- Food fortification
3- Food microbiology
4- Food microbiology & Food safety
5- Food preservation Technology
6- Food & Nutrition
7- Food Laws & standards
8- Functional foods & Nutraceuticals
9- Fundamentals of food process engineering
10- Thermal processing of Foods
11- Dairy & Food process & product technology
12- Adolescent nutrition
13- Basics of nutrition
14- Mother health & Nutrition

PG Pathshala

1- Food safety & quality control
2- Food preservation
3- Principles of food processing
4- Innovation in food packaging
5- Food biotechnology
6- Food science
7- Macronutrients
8- Micronutrients
9- Human physiology
10- Nutritional biochemistry
11- Functional foods & nutraceuticals

12- Nutrition through life span

13- Nutrition wellness & fitness

14- Therapeutic nutrition

15- Research method in nutrition

Courses on Nutrition (Available on mooc.org (edx))

1. Nutrition & cancer- Wageningen X
2. Nutrition, Heart Disease & Diabetes- Wageningen X
3. Plant Based diet: Food of a sustainable future- Wageningen X
4. Nutrition and Health: Human Micro biome- Wageningen X
5. Nutrition and Health- Food Safety- Wageningen X
6. Nutrition and Health: Micronutrient & Malnutrition- Wageningen X
7. Nutrition and Health: Macronutrient & Over Nutrition- Wageningen X
8. Nutrition Exercise & Sports- Wageningen X
9. Feeding a hungry planet: Agriculture, nutrition & sustainability- SDG Academy X
10. Introduction to Food & Health- Stanford online
11. Mental health and nutrition- UCX
12. Sustainable food security: food Access- Wageningen X
13. Staying fit- Stanford online
14. Lifestyle management treatment of chronic disease- Part1- Doane X
15. Lifestyle management treatment of chronic disease- Part2- Doane X
16. The health effect of clinic change- Harvard X
17. Global Public Health- SDG Academy X
18. Sustainable food system: A Mediterranean perspective- SDG Academy X
19. Early childhood development: global strategies for implementation- Harvard X
20. Beer- the science of brewing- KULeuvenX
21. Fitness corporative
22. Sustainable global food systems

Courses on Nutrition (Available on IGNOU portal)

1. Diploma in nutrition & Health education
2. Certificate in nutrition & childcare
3. Certificate in Foods & Nutrition

Suggested Institutions / areas for Internship in Nutrition

1. Sports Authority of India (SAI)
2. Agricultural & Processed Food Products Export Development Authority (APEDA)

3. Food Safety & Standards Authority of India (FSSAI)
4. Centre For Health Research & Development, Society For Applied Studies
5. Defense Institute of Physiology & Allied Sciences (DIPAS)
6. Public Health Foundation of India (PHFI)
7. WHO, Internship Programme (WHO)
8. Hospitals- AIIMS, Apollo, Max, Fortis, Medanta, Etc.
9. Food Industries- Britannia, Perfetti, Pepsico India, Coca Cola, Haldirams, Bikaner
10. World Bank- Young Professional Programme (WBG)

ACKNOWLEDGEMENT

New Education Policy 2020 has brought about several changes in education system and to bring those in action plan is a challenging task. I thankfully acknowledged D.G. ICAR, New Delhi, for showing confidence in me by making me the member of VI Dean's Committee and giving me responsibility for restructuring the programme Food Nutrition and Dietetics as per NEP-2020 guidelines. Thorough discussions with the members of VI Deans' Committee during several meetings, has crystallized the frame work for restructuring. Further modifications are made in consultations from Deans of Home Science/ Community Science colleges, head of departments of foods and nutrition, senior faculty members of foods and nutrition, meetings with stake holders like students, industry partners, government officials, dieticians. After several rounds of consultations keeping in mind NEP-2020 guidelines and proceedings of Deans' Committee meeting, the courses in the domains of Nutrition Science, Food Science, Dietetics, Basic Supporting and Others, Interactive Practical Exposure, Food Service Management & Quality Control have been developed.

I thankfully acknowledge contributions made by the followings during virtual meetings and one to one consultation in formulations of courses:

- Dr Alka Goel, Dean, College of Home Science, G.B.P.U.A.T., Pantnagar
- Dr Anupama, Prof Foods and Nutrition, Palampur
- Dr Anuradha Dutta, Professor and Head Foods and Nutrition, G.B.P.U.A.T., Pant Nagar
- Dr Archana Kushwaha, Professor Foods and Nutrition, G.B.P.U.A.T., Pant Nagar
- Dr Chiranjeev Chaudhari, Professor Foods and Nutrition, HAU Hisar
- Dr. B.G. Patel, I/C Principal, College Home Science and Professor, Nutrition
- Dr Deepa Joshi, Young Professional, G.B.P.U.A.T., Pantnagar
- Dr. Deepa Vinay, Professor, Family Resource Management, G.B.P.U.A.T., Pantnagar
- Dr Deepali Dhawan, Professor Extension, former Dean Home Science, SKUAT Bikaner
- Dr Diksha Singh, Research Scholar, G.B.P.U.A.T., Pantnagar
- Dr Hemlatha, Professor Foods and Nutrition, TNAU Madurai
- Dr Jaya Bangale, Dean, MAU Parbhani
- Dr Kiran Bains, Prof HOD Foods and Nutrition, PAU, Ludhiana
- Dr Lakshmi J, Assoc Dean, Home Science and Professor Foods and Nutrition, ANGRU, Guntur Andhra Pradesh
- Dr M. Saikia, Professor Foods and Nutrition, AAU, Jorhat
- Dr Manisha Chaudhari, Associate Professor Foods and Nutrition, AAU, Jorhat, Assam
- Dr. Namita Singh, Dean, Home Science and Prof, Food Science and Nutrition, C.A.U., Tura, Meghalaya
- Dr Neetu Dobhal, Assistant Professor Foods and Nutrition, G.B.P.U.A.T., Pant Nagar
- Dr Nidhi Joshi, Research Scholar, G.B.P.U.A.T., Pantnagar
- Dr Pranati Das, Professor Foods and Nutrition, AAU, Jorhat, Assam

- Dr Rajani Mudgil, Prof and Head Foods and Nutrition, Palampur
- Dr Rashmi Singh, Associate Professor, C.S.U.A.T., Kanpur
- Dr Renu Mogra, Professor Foods and Nutrition, M.P.U.A.T. Udaipur
- Dr Ruma Bhattacharya, Dean College of Home Science, AAU
- Dr S. Amrutha, Dean (Foods and Nutrition), TNAU Madurai
- Dr Sadhana Singh, Professor and Head, Foods and Nutrition, N.D.U.A.T. Ayodhya
- Dr Sangeeta Chahal, Professor and Head, Foods and Nutrition, HAU Hisar
- Dr. Supraja Thoomati, Professor, FN, ANGRU, Guntur, Andhra Pradesh
- Dr V. Vijaylakshmi, Retd Dean, PJTSAU, Hyderabad, Professor, Foods and Nutrition, ANGRU, Hyderabad
- Dr Vijaya Khadar. Ex. Dean H.Sc. (Retd), ANGRU, Hyderabad
- Dr Vishakha Singh, Professor and Head, Foods and Nutrition, M.P.U.A.T. Udaipur
- Dr Ankita Dobhal, Research Scholar, G.B.P.U.A.T., Pantnagar
- Ms. Apurva, Senior Research Fellow, G.B.P.U.A.T., Pantnagar

In addition, I would like to thank all those faculty members and research scholars of different Universities who have contributed in formulating courses at the behest of their head of the departments and Dean of the Colleges. I am extremely thankful to Dr Nidhi Joshi and Dr Diksha Singh, who were there with me always for researching new advancements in subject, fact checking, discussing, and bringing the document in shape for presentation, during their peak time of thesis writing and thereafter.

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Date: April 27,2024