

## COURSE PROFILE – (2018-2019 M.SC FOOD AND NUTRITION)

### SEMESTER I

Sem ester	Paper code	Title of the paper	Hours/ Week	Credits	CA	End Semester	Total
I	13SP18/1C/NUB	<b>Paper 1-</b> (Core 1) Nutritional Biochemistry	6	4	40	60	100
I	13SP18/1C/MT1	<b>Paper 2-</b> (Core 2) Medical Nutrition Therapy I	6	4	40	60	100
I	13SP18/1E/NTC	<b>Paper 3-</b> (Elective1) Nutraceuticals	5	3	40	60	100
I	13SP18/1E/PHY	<b>Paper 4-</b> (Elective2) Applied Physiology	5	3	40	60	100
I	13SP18/1C/PR1*	<b>Practical 1-</b> (Core 3) Analytical Techniques in Nutrition	6	-	-	-	-
I		<b>Soft Skill 1</b> Personality Enrichment for Women	2	2	-	50	50
	<b>TOTAL</b>		<b>28+2</b>	<b>C+E+S</b> <b>8+6+2</b>			
<p><b>*Practical examination (13SP18/1C/PR1) - Practical will be conducted in the second semester.</b></p>							

## SEMESTER II

Semester	Paper code	Title of the paper	Hours/Week	Credits	CA	End Semester	Total
II	13SP18/2C/AFS	<b>Paper 1-</b> (Core 4 ) Advanced Food Science	5	4	40	60	100
II	13SP18/2C/SRM	<b>Paper 2-</b> (Core 5) Applied Statistics and Research Methodology	5	4	40	60	100
II	13SP18/2C/MT2	<b>Paper 3-</b> (Core 6) Medical Nutrition Therapy II	4	4	40	60	100
II	13SP18/2E/NSN	<b>Paper 4-</b> (Elective3) Nutrition in Special Needs	4	3	40	60	100
II	13SP18/2E/FPN	<b>Paper 5-</b> (Elective4) (Interdisciplinary) Food Preservation	4	3	40	60	100
I	13SP18/1C/PR1*	<b>Practical 1-</b> (Core 3) Analytical Techniques in Nutrition	-	4	40	60	100
II	13SP18/2C/PR2	<b>Practical 2-</b> (Core 7) Advanced Food Science Practical	6	4	40	60	100
II		<b>Soft Skill 2</b> The Communication skills in English/ French for Beginners/ German for Beginners	2	2	-	50	50
	<b>TOTAL</b>		<b>28+2</b>	<b>C+E+S 20+6+ 2</b>			

**\*Practical examination (13SP18/1C/PR1) - Practical will be conducted in the second semester.**

### SEMESTER III

Semester	Paper code	Title of the paper	Hours/Week	Credits	CA	End Semester	Total
III	13SP18/3C/CAL	<b>Paper 1-</b> (Core 8) Advanced Studies in Carbohydrates and Lipids	5	4	40	60	100
III	13SP18/3C/MIV	<b>Paper 2-</b> (Core 9) Advanced Studies in Minerals and Vitamins	5	4	40	60	100
III	13SP18/3C/CLB	<b>Paper 3-</b> (Core 10) Clinical Biochemistry	4	4	40	60	100
III	13SP18/3E/FDI	<b>Paper 4-</b> (Elective 5) Food and Drug Interaction	4	3	40	60	100
III	13SP18/3E/NPF	<b>Paper 5-</b> (Elective 6) (Interdisciplinary) Nutrition and Physical Fitness	4	3	40	60	100
III	13SP18/3C/PR3*	<b>Practical 3-</b> (Core 11) Innovative Food Product Development	6	-	-	-	-
III	13SP18/3S/CSS	<b>Soft skill 3</b> Computing skills	2	2	-	50	50
	<b>TOTAL</b>		<b>28+2</b>	<b>C+E+S</b> <b>12+6+2</b>			

**\*Practical examination (13SP18/3C/PR3) - Practical will be conducted in the fourth semester.**

## SEMESTER IV

Semester	Paper code	Title of the paper	Hours/Week	Credits	CA	End Semester	Total
IV	13SP18/4C/EPR	<b>Paper 1-</b> (Core 12) Advanced Studies in Energy and Protein	6	4	40	60	100
IV	13SP18/4C/PHN	<b>Paper 2-</b> (Core 13) Public Health Nutrition	6	4	40	60	100
IV	13SP18/4C/PRO	<b>Paper 3-</b> (Core 14) Project	6	4	40	60	100
IV	13SP18/4E/ FMI	<b>Paper 4-</b> (Elective 7) Food Microbiology	4	3	40	60	100
III	13SP18/3C/PR3*	<b>Practical 3-</b> (Core 11) Innovative Food Product Development	-	4	40	60	100
IV	13SP18/4C/PR4	<b>Practical 4-</b> (Core 15) Public Health Nutrition Practical	6	4	40	60	100
IV	13SP18/4S/SWS	<b>Soft skill 4</b> Scientific Writing and Presentation Skills	2	2	-	50	50
IV		<b>Internship (1 month)</b>	-	2	50	-	50
		<b>TOTAL</b>	<b>28+2</b>	<b>C+E+S+I 20+3+2+2</b>			
<p><b>*Practical examination (13SP18/3C/PR3) - Practical will be conducted in the fourth semester.</b></p>							

**SEMESTER I**  
**MEDICAL NUTRITION THERAPY - I**

**TOTAL HOURS: 90 hours**

**COURSE CODE: 13SP18/1C/MT1**

**CREDITS: 4**

**L-T-P: 4-2-0**

**COURSE OBJECTIVES**

- ✓ To impart knowledge on pathophysiology of diseases.
- ✓ To introduce the current protocol and guidelines of nutrition care process
- ✓ To study the various feeding methods for patients.
- ✓ To enable them to learn the evidence based dietary and behavioral therapy for eating disorders, infections, gastrointestinal and liver disorders and pancreas and gall bladder diseases.

**COURSE OUTLINE**

- UNIT I:** Food service in hospitals: Layout and design of dietary kitchen and service. Centralized & decentralized service and Tray service  
Routine diets in hospitals  
Use of RDA and Guidelines for planning balanced diets  
Nutritional support for critically ill patients: Enteral and Parenteral feeds- types, indication and contraindications and calculation of requirements for different therapeutic conditions, Commercial and home formulas (15 HOURS)
- UNIT II:** Pediatric Nutrition- Assessment of infant development through anthropometry. Problems of infants-VLBW, LBW, SGA babies, premature babies, stunting, and wasting;  
Weaning, Commercial baby foods- Types and available infant formulas in market(Assignment)  
Nutrition in eating disorders – etiology, types, diagnostic criteria, nutritional assessment, psychological management, nutritional care and nutrition education (15 HOURS)
- UNIT III:** Nutrition and infection:  
Fever – Etiology, patho-physiology Classification, nutritional implication metabolism, dietary considerations in influenza, typhoid, tuberculosis, Malaria, Dengue, Leptospirosis and swine flu.  
Diet in HIV & AIDS – Etiology, classification, manifestation and stages of HIV infection, opportunistic infections, medical management, medical nutrition therapy, complications and nutritional implications  
Diet in Food intolerance and Allergy –definition, immunological aspects, classification, manifestation, common food allergies, diagnosis and dietetic treatment  
Diet in Respiratory diseases: Etiology, Patho-physiology, nutritional implication and dietary considerations in Pneumonia, COPD and Chronic Bronchitis. (25 HOURS)

**UNIT IV:** Nutrition in Gastro intestinal disorders

Diet in diseases of the esophagus, stomach and duodenum: Etiology, diagnostic tests, symptoms, clinical findings, treatment and dietary modification in esophagitis, GERD, hiatus hernia, gastritis and peptic ulcer.

Diet in diseases of the small intestine and colon: Etiology, types, symptoms, clinical findings, dietary considerations and nutritional consequences of drug therapy in adults and children in diarrhea, constipation, Crohn's disease, diverticulosis, ulcerative colitis and malabsorption syndrome-lactose intolerance, gluten enteropathy, tropical sprue.

Diet in diseases of the Liver, Gall Bladder and Pancreas: Etiology, pathophysiology, types, symptoms, clinical findings, nutritional implications and dietary considerations in Hepatitis, Alcoholic liver disease, Cirrhosis, Hepatic encephalopathy, Cholecystitis – acute and chronic, Cholelithiasis and Pancreatitis- acute and chronic. (25 HOURS)

**UNIT V** Nutrition Care Process (NCP):

NCP: Assessment, Planning, intervention and evaluation; Role of dietitian in health care; Diet Counseling- Importance and steps in diet counseling; Need for Nutrition Education. (10 HOURS)

**RECOMMENDED TEXTBOOKS**

1. Mahan LK, Stump SE and Raymond JL, *Krause's Food and Nutrition Care Process*, 13<sup>th</sup> Edition, Elsevier Saunders, Missouri, 2012
2. Kane K and Prelack K, *Advanced Medical Nutrition Therapy*, First Edition, Jones and Barlett learning, Burlington, 2019

**REFERENCE BOOKS**

1. Verma P, *Food, Nutrition & Dietetics*, 1<sup>st</sup> edition, CBS publishers & distributors PVT Ltd, New Delhi, 2015
2. Edelstein S, *Lifecycle Nutrition- An evidence based approach*, 2<sup>nd</sup> edition, Jones & Bartlett learning publications, 2015,
3. Elia M, Ljungqvist O, Stratton RJ, Lanham SA, *Clinical Nutrition (The Nutrition Society Textbook)*, 2<sup>nd</sup> edition, Wiley Blackwell Publishers, 2013
4. Stump SE, *Nutrition and diagnosis related care*, 7<sup>th</sup> edition, Lippincott Williams and Wilkins, Canada, 2012
5. Srilakshmi B, *Dietetics*, sixth edition, New age Publishing Press, New Delhi, 2011.
6. **Skipper A, *Advanced Medical Nutrition Therapy Practice***, Jones and Barlett Learning, MA, 2008
7. Marian M et al., *Clinical Nutrition for surgical patients*, Jones and Bartlett Publishers, Canada, 2008
8. Joshi Y.K, *Basics of Clinical Nutrition*, 2<sup>nd</sup> edition, JP Medical Publishers Pvt Ltd, New Delhi, 2008
9. Stacy N, *William's Basic Nutrition and Diet Therapy*, 12<sup>th</sup> edition, Elsevier publications, UK, 2005

1. Gibney MJ, Elia M, Ljungqvist O, *Clinical Nutrition (The Nutrition Society Textbook)* Wiley Blackwell Publishers, 2005
2. Whitney EN and Rolfes SR, *Understanding Nutrition*, 9<sup>th</sup> edition, West/Wordsworth, 2002
3. Williams SR, *Nutrition & Diet Therapy*, CV. Mosby St. Louis, 2001
4. Garrow JS, James WPT, Ralph A, *Human Nutrition and Dietetics* 10<sup>th</sup> edition, Churchill Livingstone, NY, 2000
5. Shils ME, Olson JA, Shike M, *Modern Nutrition in Health and Disease*, Eighth edition, Volume I and II, Lea and Febiger Philadelphia, A Waverly Company, 2000
6. Cataldo, DeBruyne and Whitney, *Nutrition and Diet therapy– Principles and Practice* 5<sup>th</sup> edition, West/ Wadsworth, London. 1999
7. Antia, F.P. and Abraham P, *Clinical Dietetics and Nutrition*, 4<sup>th</sup> edition, Oxford University Press, Delhi,
8. Carroll AL & Rutherford K, *Nutrition and Diet Therapy* 2<sup>nd</sup> edition, F.A. Davis Company, Philadelphia
9. Ruth A., Townsend CE, *Nutrition and Diet Therapy* 8<sup>th</sup> edition, Thomson Delmar Learning

## **JOURNALS**

1. International journal of Clinical Nutrition and Dietetics
2. International journal of Food, Nutrition and Dietetics
3. Food and nutrition bulletin

## **E- LEARNING RESOURCES:**

1. <https://www.youtube.com/watch?v=8vC7Jro4HRQ>
2. <https://www.youtube.com/watch?v=IxfNM6v3Ef4>
3. [https://www.youtube.com/watch?v=yD6UF3ogn\\_U](https://www.youtube.com/watch?v=yD6UF3ogn_U)
4. <https://www.youtube.com/watch?v=jmF12JYPgoQ>
5. <https://www.youtube.com/watch?v=Haz8k8Rh6UQ>
6. <https://www.youtube.com/watch?v=Rcb6I7gsl-Y>
7. <https://www.youtube.com/watch?v=P9hBjrjMcSw>
8. <https://www.youtube.com/watch?v=y-shOXdsJeA>
9. <https://www.youtube.com/watch?v=iefghc2g91M>
10. <https://www.youtube.com/watch?v=chSyQPKsNk4>
11. <https://www.youtube.com/watch?v=Ueqs7p15OAY>
12. <https://www.youtube.com/watch?v=XJQn8MXnTWg>
13. <https://www.youtube.com/watch?v=f-FxIsb2dtQ&t=169s>
14. <https://www.youtube.com/watch?v=Hwi9dsFBuhg>
15. <https://www.youtube.com/watch?v=PGB6dN1KlwQ>
16. <https://www.youtube.com/watch?v=bFdTgty0T0I>
17. <https://www.youtube.com/watch?v=LcNQdo15IF8>
18. <https://www.youtube.com/watch?v=st7G2vyLSiY>
19. [https://www.youtube.com/watch?v=gE5gSU\\_8oHs](https://www.youtube.com/watch?v=gE5gSU_8oHs)

## SEMESTER I

### NUTRACEUTICALS

**TOTAL HOURS: 75 hours**

**COURSE CODE: 13SP18/1E/NTC**

**CREDITS: 3**

**L-T-P: 3-2-0**

#### COURSE OBJECTIVES

1. Understand the history, concepts of nutraceuticals.
2. Classify the nutraceuticals based on origin, chemical composition and mechanism of action.
1. Learn the health benefits of nutraceuticals from various sources.
2. Learn the various aspects of food as preventive drug or supplement.
3. Discuss the concepts of technologies in functional food industry.

#### COURSE OUTLINE

- UNIT I:** Nutraceuticals - History, Evolution, and Definition, Concept, Classification and General Mechanism of Action. (15 HOURS)
- UNIT II:** Functional foods – Definition, Development of functional foods, bioactive compounds as biomarkers to indicate efficacy of functional ingredients (15 HOURS)
- UNIT III:** Nutraceuticals with potential health benefits from plant phytochemicals, animal products, Novel sources & dietary fiber. Role of Prebiotics & Probiotics as Nutraceuticals and commercial availability (15 HOURS)
- UNIT IV:** Significance of Nutraceuticals and Functional foods in diseases- anticancer agent, anti-inflammatory, antioxidant, anti-diabetic, hypocholesterolemic, and osteogenetic (15 HOURS)
- UNIT V:** Nutrigenomics – Relationship between Nutritional supplementation, gene expression and disease prevention. Application of technologies in Functional food Industry. (15 HOURS)

#### RECOMMENDED TEXTBOOKS

1. Wildman, R.E.C, *Handbook of Nutraceuticals and Functional Foods*, Second Edition, CRC Press.
2. Mahan LK, Stump SE and Raymond JL, *Krause's Food and Nutrition Care Process*, 13<sup>th</sup> Edition, Elsevier Saunders, Missouri, 2012



## REFERENCE BOOKS

1. Kramer K, Hoppe PP, Packer L, *Nutraceuticals in Health and Disease Prevention*, 1<sup>st</sup> edition, CRC Press, 2001
2. Groff JL, Gropper SS, *Advanced Nutrition and Human Metabolism* 3<sup>rd</sup> edition, West Wadsworth, UK. 2000
3. Gibson GR & Williams CM, *Functional foods : Designer Foods*, Pharma Foods, 2004
4. Flohe, J & Joost HG, *Nutritional Genomics : Impact on Health and Disease*, Wiley VCH
5. Cupp & Tracy TS, *Dietary Supplements: Toxicology and Clinical Pharmacology*, Humana Press

## JOURNALS

1. Journal of nutraceuticals and food science
2. Annual review of Nutrition

## E-LEARNING RESOURCES

1. <https://www.nutraceuticalsworld.com>
2. <https://divisnutraceuticals.com>
3. <https://fssai.gov.in/cms/health-supplements.php>
4. <https://www.nutraceuticalseurope.com>
5. <http://www.chemistryindustry.biz/nutraceuticals.html>
6. <https://www.nutraingredients-asia.com>

## SEMESTER I

### ANALYTICAL TECHNIQUES IN NUTRITION

#### Practical – 1

#### CORE -3

**TOTAL HOURS: 90 hours**

**COURSE CODE: 13SP18/1C/PR1**

**CREDITS: 4**

**L-T-P: 0-0-6**

#### COURSE OBJECTIVES

To enable the students to

1. To learn skills in weighing and processing of samples
2. To learn skills in reagent preparation, technique and instrumentation
3. To analyse the nutritive value of food samples
4. To determine the biochemical parameters in blood/ serum & urine sample
5. Quantitative estimation by applying standardized procedures and systematic formula

#### COURSE OUTLINE

##### PRACTICAL:

- |   |            |
|---|------------|
| 1. Estimation of proteins using macrokjeldhal method  | (10 HOURS) |
| 2. Estimation of fat content in egg yolk using soxhlet extraction method<br>Estimation of saponification value,<br>Estimation of Iodine value in oil/fat<br>Estimation of Acid value in oil/fat | (14 HOURS) |
| 3. Mineral Estimation in foods:<br>Estimation of calcium (titrimetric)<br>Estimation of Iron (spectrophotometry)<br>Estimation of Phosphorous (colorimetry)                                     | (10 HOURS) |
| 4. Vitamin estimation in foods:<br>Estimation of Vitamin C (dye method),<br>Estimation of Beta carotene (Column Chromatography)   | (10 HOURS) |
| 5. Estimation of urinary calcium,<br>Estimation of urinary creatinine   | (12 HOURS) |
| 6. Estimation of hemoglobin in blood,<br>Estimation of blood glucose using colorimetry and glucometer   | (8 HOURS)  |
| 7. Estimation of protein in serum using Biuret reagent  | (10 HOURS) |
| 8. Estimation of serum sodium ,<br>Estimation of serum potassium  | (10 HOURS) |
| 9. Demonstration on food analysis using HPLC  | (6 HOURS)  |

## **RECOMMENDED TEXTBOOKS**

1. Nielson S, *Food Analysis Laboratory Manual*, 3<sup>rd</sup> edition, Springer International Publishing, 2017
2. Cheung PCK and Mehta BM (Eds), *Handbook of Food chemistry*, 1<sup>st</sup> edition, Springer-Verlag Berlin Heidelberg, 2015
3. James CS, *Analytical chemistry of Foods*, 1<sup>st</sup> edition Springer US, 1995

## **JOURNALS**

1. Food analytical methods
2. Journal of food composition and analysis

## **E-LEARNING RESOURCES:**

1. [https://www.youtube.com/results?search\\_query=analytical+techniques+swayam](https://www.youtube.com/results?search_query=analytical+techniques+swayam)
2. <https://www.youtube.com/watch?v=-GR8Z3UerE0>
3. <https://www.youtube.com/watch?v=tXVDY1HvrVU>
4. <https://www.youtube.com/watch?v=FX-NiPVsYPM>

## ADVANCED FOOD SCIENCE

### CORE - 4

**TOTAL HOURS: 75 hours**

**COURSE CODE: 13SP18/2C/AFS**

**CREDITS: 4**

**L-T-P: 3-2-0**

### COURSE OBJECTIVES

To enable students to

1. understand the composition, nutritive value and the effect of cooking on various food components
2. Gain knowledge on food labelling , food quality and standards
3. Develop skills on subjective and objective evaluation
4. Learn the emerging trends in food science.
5. Acquire knowledge on post harvest technology and food processing techniques

### COURSE OUTLINE

#### UNIT I:Cereals and Pulses:

Cereals: Structure, composition and processing of rice, wheat, maize, sorghum and barley. Composition and nutritive value of Ragi, Bajra, foxtail millet and kodo millet; Cereal Cookery: Gelatinization, factors affecting gelatinization, gel formation, Retrogradation, Syneresis and Dextrinisation; Gluten formation. Cereal products: Products of rice, wheat, maize and other cereal products and baked products; Modified starch

Pulses:Composition, nutritive value, processing, toxic constituents, effect of cooking on pulses. (15 HOURS)

**UNIT II: Vegetables and Fruits:** Composition, nutritive value, effect of cooking on pigments and polyphenols and vegetables and fruit preserves.

#### **Fats and Sugars:**

Fat: Types, composition, processing and changes during cooking and storage; Rancidity of fats; Modified Fats; Functions of fats and oils in food, Emulsion – Types.

Sugar and Jaggery: Types, nutritive value, manufacture, sugar cookery- crystallization and stages.

Browning of foods: Enzymatic and Non-enzymatic browning of foods (15 HOURS)

#### UNIT III: Milk and Meat:

Milk: Composition, nutritive value, processing, physical and functional properties of milk. Milk Cookery, Milk products-types and processing. Egg: Structure, composition, nutritive value of egg; Egg quality; Egg Foams and Egg cookery.

Meat: Composition and nutritive value of meat, classes, cuts and grades of meat, post mortem changes in meat, tenderizing meat and meat cookery. Gelatin

Poultry: Classification, composition, nutritive value and processing

Fish: Classification, composition, nutritive value, selection, preservation and processing and fish cookery. (25 HOURS)

**UNIT IV: Food Quality and Food Labeling:**

Evaluation of Food Quality: Sensory evaluation and Objective evaluation

Adulteration- definition, types and methods of detection;

Food Labeling: Definition, requirements and use of food labeling.

Food standards – National and international standards – FSSAI, HACCP, ISO series (10 HOURS)

**UNIT V: Emerging trends in Food Science:**

Recent trends in post-harvest technology in foods- cereals, pulses, vegetables and fruits; Food Composition Databases, Organic foods, processed and convenience foods; GM foods; Food fortification and Food Enrichment;

Enzymes in food Industry: Classification, properties, Enzyme applications and new developments. (10 HOURS)

**RECOMMENDED TEXTBOOKS**

1. Manay S and Swamy S, *Food Facts and Principles*, New Age International (P) Ltd Publishers, New Delhi, 2001
2. Potter NM and Hotchkiss JH, *Food Science*, C.B.S. Publishers, New Delhi, 1995

**REFERENCE BOOKS**

1. Reddy SM, *Basic Food science and Technology*, New Age Publishers, New Delhi, 2015
2. Lowe B, *Experimental cookery from chemical and physical stand point*, Forgotten books, UK, 2015
3. Srilakshmi B, *Food Science*, Sixth Edition, New Age International Ltd Publishers, New Delhi, 2015
4. Roday S, *Food science and Nutrition*, Oxford university press, New Delhi, 2007
5. KhetarPaul N; Grewal, R and Jood, S, *Bakery Science and Cereal Technology*, Dia publishing house, Delhi. 2005
6. McCance and Widdowson, *Composition of food*, 6<sup>th</sup> Edition, Food Standards Agency, 2004
7. Swaminathan .N, *Food Science and Experimental Foods*, Ganesh Publications, Madras, 2004
8. Vaclavik, V, *Dimensions of Food*, 5<sup>th</sup> Edition CRC press USA, 2002
9. Aylward, F, *Food technology Processing and laboratory control*, Agrobios Publishing, Jodhpur, 2001
10. Subramani A, *Concise Food Science*, Soundarya Publications, 1998
11. Meyers, L.M., *Food Chemistry*; Van Nonstrand Reinhold Co., New York,

## **JOURNALS**

1. Journal of food science
2. Journal of food science and technology
3. Journal of nutrition and food science
4. International journal of food science and nutrition

## **E-LEARNING RESOURCES**

1. [https://en.wikipedia.org/wiki/Food\\_quality](https://en.wikipedia.org/wiki/Food_quality)
2. [https://www.science\\_direct.com](https://www.science_direct.com)
3. [https://www.eufic.org/food\\_production/processed-food](https://www.eufic.org/food_production/processed-food)

**SEMESTER II**  
**APPLIED STATISTICS AND RESEARCH METHODOLOGY**  
**CORE - 5**

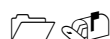
**TOTAL HOURS: 75 hours**

**COURSE CODE: 13SP18/2C/SRM**

**CREDITS: 4**

**L-T-P: 3-2-0**

**COURSE OBJECTIVES**



To define the principles of research and recall the methodologies in conducting a research



To demonstrate their understanding of facts and principles to formulate research designs



To identify the basic theories and techniques of research methodology



To analyze and examine numerical data applying statistical procedures appropriate to the area of research



To evaluate and discuss the results obtained and draw inferences to provide solutions to problems related to the field of nutrition

✓ To compile the data and discover new facts and theories from the research undertaken

**COURSE OUTLINE**

**UNIT I:** Meaning of research, Purposes of research, Types of research; Selecting a research problem and preparing a research proposal-The academic research problem, using the library, sending related literature, Note taking; Preparation of a research proposal for getting funds for the research; Ethical Issues- Ethical importance of consent in research, Regulations and Guidelines for research on human subjects; Intellectual Property Rights Experimental and quasi experimental research- Principles of experimental research experimental and control groups, variables, controlling extraneous variables, experimental validity, experimental designs, pre, post, true and quasi experimental design, Factorial design, Theory and hypothesis, experimental control (10 HOURS)

**UNIT II:** Sampling and Sample Designs-Census and sample methods-Theoretical basis of sampling, law of statistical regularity, law of inertia of large numbers, essentials of sampling. Sampling from infinite population-concept of sampling distribution and standard error, relationship between sample size and standard error; Standard errors of sample mean. Sample variance, sample standard deviation and sample mean, sample standard deviation and sample proportion and the differences in these values Methods of sampling Non-probability sampling methods, advantages, Limitation of probability sampling; Probability sampling methods –Types, Selection of appropriate method of sampling, size of sample, merits and limitations of sampling, sampling and non-sampling errors. (10 HOURS)

**UNIT III:** Collection of Data-Primary and secondary data, sources, published and unpublished sources, Editing primary and secondary data, and precautions in the use of secondary data.  
Organization of data collection –Limitations and sources of error, Tools of research- Quantitative and Qualitative studies.Observation, Questionnaire, Opinionnaire- various methods and techniques; Reliability and validity of research tools  
Classification and tabulation of Data-Meaning and objectives of classification, objects of classification, Types of classification, formation of frequency distribution, typesymmetric and asymmetric distribution considerations in the construction of frequency distribution  
Tabulation of data-Difference between classification and tabulation of data, Role of tabulation Parts of the table, general rules of tabulation Review of a table types of tables, machine tabulation. Editing and coding of data records. Diagrammatic and graphicalrepresentation Significance of diagrams and graphs, comparison of tabular and diagrammatic presentation types of diagrams. Graphs-Techniques of constructing graphs, graphs of time series or line graphs Rules for constructing the line graph or natural scale, types of graphs, graphs of frequency distribution-Histogram, frequency polygon, smoothed frequency curve, cumulative frequency curves or gives, limitations of diagrams and graphs. (10 HOURS)

**UNIT IV:** Meaning of statistics, scope and limitations of statistic as a tool for decision making under uncertainty  
Measures of central tendency –mean, median, mode and their relative merits finding combined mean, weighted mean, finding median and mode graphically.  
Measures of variation-absolute and relative measures-range standard deviation of mean, combined standard deviation given the SD's of two distribution, coefficient of variation, percentiles and their applications  
Correlationmethods-meaning, product moment, coefficient of correlation, rank correlation, scatter diagram and regression lines and their uses. Concepts of partial and multiple correlations  
Test of significance-hypothesis testing, tests involving normal distribution, tests for large and small samplest tests-A tests to compare means of population and sample means of two independent samples c means of two dependent samples ,F tests-comparison of SD's of two samples ,analysis of variance , non-parametric tests-chi square test. (35 HOURS)

**UNIT V:** Report Writing -style manual, format of the research report ,The thesis or dissertation- style of writing, typing a report, reference form (Bibliography)- Pagination, tables, figures-Evaluating a research report-Foot notes plagiarism, Technical and popular reports (10 HOURS)



### **RECOMMENDED TEXTBOOKS**

1. Gupta. S.P, *Statistical Methods*, S Chand & Sons,, New Delhi, 2008
2. Kothari, C. and Garg, G, *Research methodology Methods and Techniques* 3<sup>rd</sup> edition, New Delhi: New Age International (P) Ltd, 2014

### **REFERENCE BOOKS**

1. Singh, Y.K, *Fundamental of Research Methodology and Statistic*. New Age International (P) Ltd., Publishers. New Delhi, 2015
2. Saravanavel, P, *Research Methodology*, KitabMahal Agencies, New Delhi, 2005
3. Elhance .D.N, Veenaand and Agarwal .B.M, *Fundamental of statistics*,48<sup>th</sup>Edition, KitabMahal, Allahabad, 2005
4. Best JW and Kahn JV, *Research in Education*, Prentice Hall of India Pvt. Ltd., New Delhi, 1996
5. Koul L, *Methodology of Educational Research*,3<sup>rd</sup> edition Vikas publishing House Pvt.Ltd,New Delhi
6. William Giles Campbell, *Form and style in Thesis writing*, Houghton Mifflin Company, Boston.
7. Sadhu A.N andSingh A,*Research Methodology in Social Sciences*, Himalaya Publishing House, Mumbai,

### **JOURNALS**

1. International journal of social research methodology
2. Journal of research practice

## SEMESTER II

### MEDICAL NUTRITION THERAPY – II CORE - 6

**TOTAL HOURS: 60 hours**

**COURSE CODE: 13SP18/2C/MT2**

**CREDITS: 3**

**L-T-P: 3-1-0**

#### COURSE OBJECTIVES



To impart knowledge on weight management.



To introduce the current protocol for nutrition care process in renal diseases, trauma, burns and surgery



To enable the students to learn the evidence-based diet therapy and lifestyle modification for non-communicable diseases like obesity, diabetes mellitus, cardiovascular disorders and cancer

#### COURSE OUTLINE

##### UNIT I:

Nutrition for weight management:

Etiology, Regulation of body weight, factors regulating energy intake and body weight, assessment, and health risks, management of obesity in adults and children- lifestyle modification, dietary modification, pharmaceutical management, Role of Leptin, Ghrelin and Glycemic load, surgical procedures.

Nutrition for Leanness:

Etiology, assessment, management, high energy diets for weight gain (10HOURS)

##### UNIT II:

Diet in Cardiovascular diseases:

Etiology, symptoms, role of specific nutrients in cardiac efficiency, clinical findings related to nutritional care and medical nutrition therapy of Atherosclerosis, Hyperlipidemia, hypertension, myocardial infarction and congestive heart failure. (10 HOURS)

##### UNIT III:

Diet in Diabetes Mellitus:

Incidence and predisposing factors, types, symptoms and tests for detection, metabolism and treatment – oral hypoglycemic drugs, insulin, & exercise, dietary guidelines and rationale for dietary modifications. Acute and chronic complications, age related issues – children and adolescents, pregnancy.

Hypoglycemia: types, diagnostic criteria and management.

Diet in Cancer: Etiology, types, metabolic effects, nutritional implications in different types of cancers and alternative nutritional therapies. (15 HOURS)

**UNIT IV:** Diet in Renal disorders:  
Basic renal function, Etiology, symptoms, metabolic and nutritional implications and dietary treatment of Acute and chronic glomerulonephritis, Nephrotic syndrome, Acute kidney disease and End stage renal disease in adults and children.  
Nephrolithiasis: Risk factors, composition of renal stones, diagnosis, medical nutrition therapy. (10 HOURS)

**UNIT V:** Diet in Burns: Types, Metabolic alterations, Rule of nine and Medical nutritional therapy.  
Diet in Surgery: Pre-operative nutritional assessment.  
Pre and post nutritional care in gastro intestinal surgery and Bariatric Surgery  
Pre and post nutritional care in Liver transplantation, Cardiac transplantation and Kidney transplantation (15 HOURS)

### RECOMMENDED TEXTBOOKS

- a) Mahan LK, Stump SE and Raymond JL, *Krause's Food and Nutrition Care Process*, 13<sup>th</sup> Edition, Elsevier Saunders, Missouri, 2012
- b) Kane K and Prelack K, *Advanced Medical Nutrition Therapy*, First Edition, Jones and Barlett learning, Burlington, 2019.

### REFERENCES

1. Verma P, *Food, Nutrition & Dietetics*, 1<sup>st</sup> edition, CBS publishers & distributors PVT Ltd, New Delhi, 2015
2. Edelstein S, *Lifecycle Nutrition- An evidence based approach*, 2<sup>nd</sup> edition, Jones & Bartlett learning publications, 2015,
3. Elia M, Ljungqvist O, Stratton RJ, Lanham SA, *Clinical Nutrition (The Nutrition Society Textbook)*, 2<sup>nd</sup> edition, Wiley Blackwell Publishers, 2013
4. Stump SE, *Nutrition and diagnosis related care*, 7<sup>th</sup> edition, Lippincott Williams and Wilkins, Canada, 2012
5. Srilakshmi B, *Dietetics*, sixth edition, New age Publishing Press, New Delhi, 2011.
6. **Skipper A, *Advanced Medical Nutrition Therapy Practice***, Jones and Barlett Learning, MA, 2008
7. Marian M et al., *Clinical Nutrition for surgical patients*, Jones and Bartlett Publishers, Canada, 2008
8. Joshi Y.K, *Basics of Clinical Nutrition*, 2<sup>nd</sup> edition, JP Medical Publishers Pvt Ltd, New Delhi, 2008
9. Stacy N, *William's Basic Nutrition and Diet Therapy*, 12<sup>th</sup> edition, Elsevier publications, UK, 2005
10. Gibney MJ, Elia M, Ljungqvist O, *Clinical Nutrition (The Nutrition Society Textbook)* Wiley Blackwell Publishers, 2005
11. Whitney EN and Rolfes SR, *Understanding Nutrition*, 9<sup>th</sup> edition, West/Wordsworth, 2002

1. Williams SR, *Nutrition & Diet Therapy*, CV. Mosby St. Louis, 2001
2. Garrow JS, James WPT, Ralph A, *Human Nutrition and Dietetics* 10<sup>th</sup> edition, Churchill Livingstone, NY, 2000
3. Shils ME, Olson JA, Shike M, *Modern Nutrition in Health and Disease*, Eighth edition, Volume I and II, Lea and Febiger Philadelphia, A Waverly Company, 2000
4. Cataldo, DeBruyne and Whitney, *Nutrition and Diet therapy– Principles and Practice* 5<sup>th</sup> edition, West/ Wadsworth, London. 1999
5. Antia, F.P. and Abraham P, *Clinical Dietetics and Nutrition*, 4<sup>th</sup> edition, Oxford University Press, Delhi,
6. Carroll AL & Rutherford K, *Nutrition and Diet Therapy* 2<sup>nd</sup> edition, F.A. Davis Company, Philadelphia
7. Ruth A., Townsend CE, *Nutrition and Diet Therapy* 8<sup>th</sup> edition, Thomson Delmar Learning

## **JOURNALS**

1. International journal of Clinical Nutrition
2. International journal of Food and Nutrition

## **E-LEARNING RESOURCES**

- <https://www.youtube.com/watch?v=2dbCmdCccGk>
- <https://www.youtube.com/watch?v=1nuSSsAnRVM>
- [https://www.youtube.com/watch?v=ZGPa\\_4FN9M4](https://www.youtube.com/watch?v=ZGPa_4FN9M4)
- <https://www.youtube.com/watch?v=Lf5R9yqpun8>
- <https://www.youtube.com/watch?v=MOe1Svj3Tg8>
- <https://www.youtube.com/watch?v=v67BwDQcFOM>
- [https://www.youtube.com/watch?v=fQwar\\_-QdiQ](https://www.youtube.com/watch?v=fQwar_-QdiQ)
- <https://www.youtube.com/watch?v=vKIRWY-LMYc>
- <https://www.youtube.com/watch?v=7m2WG91HZy8>
- <https://www.youtube.com/watch?v=1mo80kTZgW4>

## SEMESTER II

### NUTRITION IN SPECIAL NEEDS

Elective - 3

**TOTAL HOURS: 60 hours**

**COURSE CODE: 13SP18/2E/NSN**

**CREDITS: 3**

**L-T-P: 3-1-0**

To understand the importance of nutrients for special children, astronauts, soldiers, high altitude, arctic and Antarctic travelers and during disaster

- b) To learn the dietary modification for children with special conditions
- c) To study the nutritional requirements for age related problems

#### COURSE OUTLINE

##### UNIT I:

Nutrition in children with feeding problems – cleft lip, cleft palate, Underweight, failure to thrive, overweight and swallowing problems

Nutrition for Special children: ADHD, Autism, Cerebral Palsy, Epilepsy or Seizure Disorder, Muscular Dystrophy, Mental Retardation, Down Syndrome, PraderWilli (PW) Syndrome, Spina Bifida, Cystic Fibrosis, Rett Syndrome (15 HOURS)

##### UNIT II:

Space nutrition – Classification, Types of foods, selection of food, microgravity, planning, food preparation and serving (10 HOURS)

##### UNIT III:

Nutrition during emergency situations like Tsunami, earthquake, draught, famine and cyclone. Role of National and international agencies in emergency feeding (10 HOURS)

##### UNIT IV:

Nutrition in high Altitudes, Nutrition in Arctic and Antarctic regions & Military foods (10 HOURS)

##### UNIT V:

Nutrition in Geriatrics:  
Nutritional requirements in age related problems- Alzheimer's disease, Parkinson's disease, changes in the gastrointestinal tract, age-related renal impairment, reduced immunity, weight loss, cognitive impairment and vascular risk factors and hospitalized elderly patient. (15 HOURS)

#### RECOMMENDED TEXTBOOKS

- a) Mahan LK, Stump SE and Raymond JL, *Krause's Food and Nutrition Care Process*, 13<sup>th</sup> Edition, Elsevier Saunders, Missouri, 2012.

1. Lane HW and Smith SM., 'Nutrition in Space", In: *Modern Nutrition in Health and Disease*, 9th edition, eds. Shils ME, Olson JA, Shike M, and A. C. Ross. Baltimore: Williams & Wilkins

## REFERENCE BOOKS

1. Abraham S, *Nutrition Through Lifecycle*, 1<sup>st</sup> edition, New age international publishers, New Delhi, 2016
2. Edelstein S, *Lifecycle Nutrition- An evidence based approach*, 2<sup>nd</sup> edition, Jones & Bartlett learning publications, 2015,
3. Stump SE, *Nutrition and diagnosis related care*, 7<sup>th</sup> edition, Lippincott, 2012
4. A Report on Toolkit for Addressing Nutrition in Emergency Situations, June 2008, [www.motherchild.org](http://www.motherchild.org)
5. Stacy N, *William's Basic Nutrition and Diet Therapy*, 12<sup>th</sup> edition, Elsevier publications, UK, 2005
6. Whitney EN and Rolfes SR, *Understanding Nutrition*, 9<sup>th</sup> edition, West/Wordsworth, 2002
7. Wildman RE, *Handbook of Nutraceuticals and Functional foods*, Culinary and Hospitality industry publication services, 2001
8. Garrow JS, James WPT, Ralph A, *Human Nutrition and Dietetics* 10<sup>th</sup> edition, Churchill Livingstone, NY, 2000
9. Cataldo, DeBruyne and Whitney, *Nutrition and Diet therapy– Principles and Practice* 5<sup>th</sup> edition, West/ Wadsworth, London, 1999
10. Swaminathan M, *Principles of Nutrition and Dietetics*, Bappeo, Bangalore, 1995
11. Space Food and Nutrition – An Educators guide with activities in Science and Mathematics, NASA, <http://spacelink.nasa.gov/products>
12. Public Health Guide for Emergencies, [www.jshsh.edu](http://www.jshsh.edu)

## JOURNALS

1. International journal of Clinical Nutrition and Dietetics
2. International journal of Food, Nutrition and Dietetics

## SEMESTER II

### FOOD PRESERVATION (INTERDISCIPLINARY) ELECTIVE -4

**TOTAL HOURS: 60 hours**

**COURSE CODE: 13SP18/2E/FPN**

**CREDITS: 3**

**L-T-P: 4-0-0**

#### **COURSE OBJECTIVES**

To enable students :

1. To understand the role of biological agents (microorganisms) in preservation of foods
2. To learn science behind the various preservation/ processing technologies.
3. To impart knowledge on the need, importance of food preservation.
4. To obtain knowledge on current trends in food packaging.
5. To familiarize with food safety management systems and food regulations.

#### **COURSE OUTLINE**

- UNIT I: Importance, Principles of preservation & Spoilage:**  
Importance and principles of preservation; Preservation of various foods cereals, pulses, fruits & vegetables, milk & milk products, flesh foods; Food spoilage – causes of spoilage, spoilage of various foods & food product (15 HOURS)
- UNIT II: Methods of food preservation:**  
Traditional methods of preservation; Preservation as sugar concentrates- Jams, Jelly, Marmalades and Preserves; Fruit Juice Beverages– Preparation and preservation; Chemical preservation - advantages and disadvantages (15 HOURS)
- UNIT III: Role of Temperature in Food Preservation:**  
Use of High temperatures – Drying, sterilizations, canning, pasteurization, Blanching, Irradiation  
Use of low temperatures – Refrigeration & freezing. (15 HOURS)
- UNIT IV: Packaging:**  
Functions of Packaging, packing materials and forms, special packaging– military & space foods, safety & package tests (15 HOURS)
- UNIT V: Food additives and food standards:**  
Food Additives and Food Standards (15 HOURS)

#### **RECOMMENDED TEXTBOOKS**

1. *Khetarpaul N, Food Processing & Preservation, 2<sup>nd</sup> Edition, Daya Publishing House, 2012.*
2. *Jood S and Khetarpaul N, Food Preservation, Agro Tech Publishing Academy, Udaipur, 2002*

## REFERENCE BOOKS

1. Sivasankar B, *Food Processing and Preservation*, Prentice Hall of India (P) Ltd, New Delhi, 2008
2. Manay SN, Swamy MS, *Food Facts and Principles*, 3<sup>rd</sup> edition, New Age International Ltd, New Delhi, 2008
3. Khetarpaul N, *Food Processing and Preservation*, Daya Publishing House, New Delhi, 2005
4. Hausner A, *Preserved Foods and Sweetmeats*, Biotech Books, New Delhi, 2005
5. Subbulakshmi G, Udipi SA, *Food Processing and Preservation*, New Age International Ltd, Publishers, New Delhi, 2001
6. NIIR BOARD, *Manual of Modern Technology on Food Preservation*, Asia Pacific Business Press Inc, New Delhi.
7. *Desroisier, Technology of Food Preservation, 1<sup>st</sup> Edition, CBS Publishers, 1998*

## JOURNALS

1. Food Science Research Journal
2. Current Research in Nutrition & Food Science Journal
3. Journal of Experimental food chemistry

## E-LEARNING RESOURCES

- [www.nchfp.uga.edu](http://www.nchfp.uga.edu)
- <https://preservingfoodathome.com>
- <https://www.buecher.de>
- <https://www.barnesandnoble.com>
- <https://www.crcpress.com>



**SEMESTER II**  
**ADVANCED FOOD SCIENCE PRACTICAL**

**Practical -2**

**CORE – 7**

**TOTAL HOURS: 90 hours**

**CREDITS: 4**

**COURSE OBJECTIVES**

**To enable the students to**



Acquire in depth-knowledge of food science to analyse, discriminate and interpret the results



Evaluate the sensory and objective quality of food products



Assess the effect of cooking and processing on various food components



Estimate pectin strength ,smoking temperature and discuss the factors affecting foam formation and crystallization of sugar



Equip with skills of preparation of various recipes

**COURSE OUTLINE**

1. Evaluation of Food quality:  
Sensory methods: Threshold, Aroma recognition and difference tests. (5 HOURS)  
Objective Methods: Ink print, line spread, specific gravity, seed displacement and percent sag (5 HOURS)
2. Convenience & Traditional Foods and Fermented Foods: (20 HOURS)
3. Gelatin, Pectin and Browning: (15 HOURS)
  1. Factors affecting gelatin
  2. Testing pectin strength in fruit and vegetable extract
  3. Enzymatic Browning and its prevention in fruits and vegetables
  4. Vegetable and fruit preserve preparation – Jam , Jelly and Marmalade
  5. Marshmallows, Lemon chiffon pie, Coffee panacotte
4. Fats, Oils, Emulsions and Foams: (15 HOURS)
  - a) Determination of smoking temperature of fats and oils
  - b) Types of Emulsions: Permanent emulsions – preparation of mayonnaise using different variations; Temporary emulsions
  - c) Egg Foaming: Factors affecting foam formation.
5. Sugar cookery: (10 HOURS)
  - a) Crystallization of sugar
  - b) Factors affecting crystallization of sugar
  - c) Recipes
    - a) Estimation of gluten content
    - b) Recipes: Breads, Buns, Biscuits and Cakes

7. Adulteration:

(10 HOURS)

- a) Easy methods of detection of adulterants

### **RECOMMENDED TEXTBOOKS**

1. Lowe B, *Experimental cookery from chemical and physical stand point*, Forgotten books, UK, 2015
2. Swaminathan .N, *Food Science and Experimental Foods*, Ganesh Publications, Madras, 2004

### **REFERENCE BOOKS**

1. KhetarPaul N; Grewal, R and Jood, S, *Bakery Science and Cereal Technology*, Dia publishing house, Delhi. 2005
2. McCance and Widdowson, *Composition of food*, 6<sup>th</sup> Edition, Food Standards Agency, 2004

### **JOURNALS**

1. Food Science Research Journal
2. Current Research in Nutrition & Food Science Journal
3. Journal of Experimental food chemistry
4. International journal of Food Science & Technology
5. International journal of Food Properties
6. International Journal of Agriculture & food Science technology
7. Journal Of Food Science & Technology
8. Asian Journal of dairy and Food research
9. Rice Research
10. Research & Review; Journal of Food Science & Technology
11. Journal of applied research in Food Science & Nutrition

## SEMESTER III

### FOOD AND DRUG INTERACTION ELECTIVE - 5

**TOTAL HOURS: 60 hours**

**COURSE CODE: 13SP18/3E/FDI**

**CREDITS: 3**

**L-T-P: 3-1-0**

#### **COURSE OBJECTIVES**

- To enable students to gain an insight on basic concepts in pharmacology.
- Learn the mechanism of pharmacokinetics and pharmacodynamics.
- To help students understand the drug therapy.
- To assess the dietary modification during drug therapy for various disease condition
- To analyse the effect of drug on nutrient intake
- To assess the impact of food on drug absorption

#### **COURSE OUTLINE**

##### **UNIT I:**

General Pharmacology:

- a) Drug – Definition, Sources of drugs, Routes of drug administration- Enteral (Oral ingestion), Parenteral (Injections, Inhalation, Transdermal, Transmucosal) and special drug delivery system.
- b) Pharmacokinetics and drug dosage – Definition, drug passage through the biological membranes: Passive & Active transfer, Absorption of drug, Factors influencing absorption, Bioavailability, Distribution, Metabolism of drugs, Inhibition of drug metabolism and Excretion of drugs – routes of excretion.
- c) Drug Dosage: Definition of Minimum dose, Maximum dose, Toxic dose, Lethal dose, Fixed dose, individualizing dose and Loading dose (10 HOURS)

##### **UNIT II:**

Pharmacodynamics:

- a) Definition, Principles and mechanism of drug action (physical, chemical, through enzymes), stimulation and inhibition of drug action. Receptors- Definition and functions of receptors.
- b) Antagonism (physical, chemical, physiological and receptor mediated), Factors modifying drug action – body size, age, sex, route of administration, diet & environment, psychological factors, pathological state, genetic factors and dose (10 HOURS)

##### **UNIT III:**

Drug therapy & Dietary modifications

- a) Drugs acting on Gastro intestinal system: Drugs used in peptic ulcer, Drugs used for Constipation and Drugs used for the treatment of Diarrhea. Dietary modifications during ingestion of drugs

- b) Drugs in Renal diseases: Diuretics and Anti diuretics: Examples, adverse effects, Precautions taken by dietitian
- c) Cardiovascular drugs: Drugs used in Congestive cardiac failure, Angina pectoris, Myocardial infarction, Lipid lowering drugs, and hypertension. Dietary modifications during ingestion of drugs
- d) Coagulants & Anti-coagulants: definition, classification – Coumarin derivatives, warfarin and heparin, Dietary modifications during ingestion of drugs. (15 HOURS)

#### **UNIT IV:**

##### **Drug Therapy& Dietary modifications**

- a) Hypoglycemic drugs: definition, classification – insulin, oral hypoglycemic drugs (Sulphonyl urea derivative and Biguanides), plant source, mechanism of action. Dietary modification during ingestion of drugs.
- b) Chemotherapy in Cancer: General principles in the treatment of cancer. Common adverse effects to anticancer drugs, Dietary modifications during ingestion of drugs
- c) Drugs in Asthma, Allergies and infections: Drugs used in bronchial asthma, NSAIDs- mechanism of action, adverse effects, Dietary modifications
- d) Drugs in Gout and Rheumatism: Anti gout drugs and Anti rheumatics, Dietary modifications.
- e) Drugs in Seizures, Mood disorders and Sleep disorders: definition of hypnotics, sedatives, Anticonvulsants, Antipsychotics, antianxiety drugs, antidepressants and tranquillizers. Dietary modifications. (15 HOURS)

#### **UNIT V:**

##### **Food and drug interactions:**

- a) Effect of drugs on food and nutrition- nutrient absorption, nutrient metabolism, and nutrient excretion
- b) Effect of food on drug therapy- drug absorption, drug distribution, drug Metabolism, drug excretion.
- c) Modification of drug action
- d) Effects of drugs on nutritional status – alterations in oral taste and smell perceptions, gastro intestinal system, appetite, glucose levels, organ system toxicity. (10 HOURS)

#### **RECOMMENDED TEXTBOOKS**

1. Ashutoshkar, SC, Mehta, *Essentials of Pharmacology, 1<sup>st</sup> Edition, New Age International Publications, New Delhi, 2013*
2. Mahan LK, Stump SE and Raymond JL, *Krause's Food and Nutrition Care Process, 13<sup>th</sup> Edition, Elsevier Saunders, Missouri, 2012*

#### **REFERENCE BOOKS**

1. Muruges N, *A Concise Text Book of Pharmacology*, 6<sup>th</sup> publishers, edition, Sathya Madurai, 2011

2. Udaykumar P, *Pharmacology for Nurses*, 2<sup>nd</sup> edition reprint, Jaypee Brothers Medical Publishers, New Delhi, 2010

3. Raje VN, *Pharmacology and toxicology*, 1<sup>st</sup> New edition reprint, CBS publishers, Delhi, 2011.

4. Grover JK, Malik M, *Drug Interaction, 1<sup>st</sup> Edition, Pee Pee Publication, 2005*  
5. Katzung B, Masters S, Trevor A, *Basic and Clinical Pharmacology, 13<sup>th</sup> edition,* Mcgraw hill education, 2015

## **JOURNALS**

1. The Journal of Nutrition
2. British Journal of Nutrition
3. Advances in Nutrition
4. Nutrition Reviews
5. Journal of Human Nutrition & Dietetics

## **E-LEARNING RESOURCES**

- <http://evolve.elsevier.com>
- [www.foodmedinteractions.com](http://www.foodmedinteractions.com)
- [www.nih.gov/ccc/patient\\_education](http://www.nih.gov/ccc/patient_education)
- <https://www.fda.gov>
- <https://www.food.actapol.net>

**SEMESTER III**  
**NUTRITION AND PHYSICAL FITNESS**  
**(INTERDISCIPLINARY)**  
**ELECTIVE – 6**

**TOTAL HOURS: 60 hours**

**COURSE CODE: 13SP18/3E/NPF**

**CREDITS: 3**

**L-T-P: 4-0-0**

1. To impart knowledge on the balanced diet, menu planning and classification of food.
2. To understand the need of consuming nutritionally balanced diet
3. To introduce the sources, functions and deficiencies of macronutrients and micronutrients
4. To learn the importance of fitness in daily life
5. To study the nutritional requirements for athletes

**COURSE OUTLINE**

- UNIT I:** Introduction to nutrition - Definition of terms - Food, Nutrient and Health.  
Food and our body -RDA - Factors affecting RDA, reference man, reference woman, RDA for adolescents and adults; Basic 5 food group system (ICMR), factors involved in food selection;  
Definition of menu planning; principles of menu planning;  
Planning balanced diet for adults and adolescents.(15 HOURS)
- UNIT II:** Basic nutrients - Proximate principles - CHO, fats and proteins. Carbohydrates - Classification, Functions, Sources, Deficiency; Proteins - Classification, Functions, Sources and Deficiency; Fats - Classification, Functions and Sources;  
Energy - Definition of energy, Kilo Calories, energy from CHO, proteins and fats,  
Physiological fuel value, gross fuel value, BMR - factors affecting BMR (15 HOURS)
- UNIT III:** Vitamins: Fat soluble vitamins (A,D,E,K) - sources, functions, deficiency. Water soluble vitamins (Thiamine, Riboflavin, Pyridoxine, Niacin, Vitamin B12) - sources, functions, deficiency.  
Minerals (Calcium, Iron, Phosphorus, Sodium, Potassium, Iodine, Zinc) - sources, functions, deficiency. Water - functions, sources, requirements, water balance, dehydration, water intoxication (10 HOURS)
- UNIT IV:** Fitness -Definition of fitness, benefits of fitness. Components of fitness, aerobic and anaerobic activities (10 HOURS)



**UNIT V:** Diet for athletes -Requirement for CHO, protein, fat, vitamin, mineral and fluids for an athlete. Pre event and post event meal (10 HOURS)

### **RECOMMENDED TEXTBOOKS**

1. Srilakshmi B, *Nutritional Science*, 3<sup>rd</sup> edition, New age Publishing Press, New Delhi, 2002
2. Mudambi, S.R. and Rajagopal, M.V., *Fundamentals of food and nutrition*, Wiley Eastern Limited, 2003

### **REFERENCE BOOKS**

1. Sharma M, *Textbook of Nutrition*, 1<sup>st</sup> edition, CBS publishers & distributors PVT Ltd, New Delhi, 2017
2. Abraham S, *Nutrition Through Lifecycle*, 1<sup>st</sup> edition, New age international publishers, New Delhi, 2016
3. Verma P, *Food, Nutrition & Dietetics*, 1<sup>st</sup> edition, CBS publishers & distributors PVT Ltd, New Delhi, 2015
4. Edelstein S, *Lifecycle Nutrition- An evidence based approach*, 2<sup>nd</sup> edition, Jones & Bartlett learning publications, 2015,
5. Mahan LK, Stump SE and Raymond JL, *Krause's Food and Nutrition Care Process*, 13<sup>th</sup> Edition, Elsevier Saunders, Missouri, 2012
6. Stump SE, *Nutrition and diagnosis related care*, 7<sup>th</sup> edition, Lippincott, 2012
7. Mullick P, *Textbook of Home Science*, Kalyani Publishers, India, 2006
8. Joshi S., *Nutrition and Dietetics*, 2<sup>nd</sup> Edition, Tata McGraw Hill Publishing Company, New Delhi. 2002
9. Stacy N, *William's Basic Nutrition and Diet Therapy*, 12<sup>th</sup> edition, Elsevier publications, UK, 2005
10. Whitney EN and Rolfes SR, *Understanding Nutrition*, 9<sup>th</sup> edition, West/Wordsworth, 2002
11. Bean A., *The Complete guide to sports Nutrition*, 3<sup>rd</sup> Edition, A&C Black Publishers Ltd, 2000
12. Garrow JS, James WPT, Ralph A, *Human Nutrition and Dietetics* 10<sup>th</sup> edition, Churchill Livingstone, NY, 2000
13. Cataldo, DeBruyne and Whitney, *Nutrition and Diet therapy– Principles and Practice* 5<sup>th</sup> edition, West/ Wadsworth, London, 1999
14. Gordon WM, *Perspectives in Nutrition*, 4<sup>th</sup> edition, McGraw Hill, 1999
15. Swaminathan M, *Principles of Nutrition and Dietetics*, Bappeo, Bangalore, 1995

### **JOURNALS**

1. International Journal of Sports Nutrition
2. Journal of nutrition science research

### **E-LEARNING RESOURCES**

- [www.nal.usda.gov/fnic/food comp](http://www.nal.usda.gov/fnic/food comp)
- [www.niddk.nih.gov/health/nutrit/nutrit.htm](http://www.niddk.nih.gov/health/nutrit/nutrit.htm)

- [www.sportsci.org](http://www.sportsci.org)
- [www.nal.usda.gov/fnic/fpyr/pyramid.html](http://www.nal.usda.gov/fnic/fpyr/pyramid.html)
- <http://evolve.elsevier.com>
- <http://www.choosemyplate.gov>
- <http://www.healthypeople.gov>
- <https://gradireland.com/institution/ulster-university>
- <https://weblink.lakehealth.org/WLP2/#!/classes/info/C10002GC>

## SEMESTER III

### INNOVATIVE FOOD PRODUCT DEVELOPMENT Practical – 3- CORE -11

**TOTAL HOURS: 90 hours**

**COURSE CODE: 13SP18/3C/PR3**

**CREDITS: 4**

**L-T-P: 0-0-6**

#### **COURSE OBJECTIVES**

- ✓ Learn to develop an innovative product
- ✓ To enhance their entrepreneurship skills
- ✓ To understand the importance of getting patent for the product
- ✓ To gain knowledge on product life cycle and standardization.
- ✓ To advertise and market the products

#### **COURSE OUTLINE**

1. Market survey on innovative ingredients and products available(5 HOURS)
2. Consumer oriented product development (5 HOURS)
3. Product life cycle – optimization, Scale up, production (10 HOURS)
4. Theme/ concept based product formulation (6 HOURS)
5. Ingredient combinations (6 HOURS)
6. Processing technique (6 HOURS)
7. Standardization of the product (6 HOURS)
8. Subjective and objective evaluation of the standardized product (6 HOURS)
9. Nutrient analysis (8 HOURS)
10. Packaging and labeling (6 HOURS)
11. Shelf life analysis (6 HOURS)
12. Cost benefit analysis (4 HOURS)
13. Advertising and sale of the developed innovative product (4 HOURS)
14. Documentation (6 HOURS)
15. Report submission (6 HOURS)

#### **RECOMMENDED TEXTBOOKS**

1. Earle M, Earle R and Anderson A. Food and product development; maximising success, Woodhead publishing ltd, food series, No.64, 2001.
2. Paine FA, Paine HY(Eds) . A handbook of food packaging. Second ed, Blackie Academic and professional. 1992.

#### **JOURNALS**

1. International journal of Food Engineering
2. Food Marketing and Technology
3. Journal of Agriculture and Food Economics

## SEMESTER III

### SOFT SKILL-3

#### COMPUTING SKILLS

**TOTAL HOURS: 30 hours**

**COURSE CODE: 13SP18/3S/CSS**

**CREDITS: 2**

**L-T-P: 2-0-0**

#### COURSE OBJECTIVES

- ✓ To understand the use of Nutrition Care Process Model.
- ✓ To introduce the current nutrition assessment and screening techniques
- ✓ To study the protein quality of different food items
- ✓ To calculate energy expenditure and physical activity level for an individual using different methods

#### COURSE OUTLINE

- UNIT I:** Nutritional Care process  
Nutritional assessment: use of SOAP(Subjective data, Objective data, Assessment and Plan), MNA (Mini Nutritional Assessment), SGA (Subjective Global Assessment) and MUST (Malnutrition Universal Screening Tool) – assessment, diagnosis and intervention
- UNIT II:** Energy requirement:  
Estimation of energy content is using bomb calorimeter, energy requirement of an individual on a working and non-working day using Sathyanarayana and factorial method.  
Software available in the market for calculating the energy requirement and expenditure
- UNIT III:** Development of energy and protein rich recipes by calculating the chemical score and Net Dietary Protein calorie Percentage

#### RECOMMENDED TEXTBOOKS

1. Mahan LK, Stump SE and Raymond JL, *Krause's Food and Nutrition Care Process*, 13<sup>th</sup> Edition, Elsevier Saunders, Missouri, 2012
2. Garrow JS, James WPT, Ralph A, *Human Nutrition and Dietetics* 10<sup>th</sup> edition, Churchill Livingstone, NY, 2000

#### REFERENCE BOOKS

1. Gordon WM, *Perspectives in Nutrition*, 4<sup>th</sup> edition, McGraw Hill, 1999
2. Swaminathan M, *Principles of Nutrition and Dietetics*, Bappeo, Bangalore, 1995

## **JOURNALS**

1. International Journal of community nutrition
2. Journal of nutrition science research

## SEMESTER IV

### PUBLIC HEALTH NUTRITION CORE - 13

**TOTAL HOURS: 90 hours**

**COURSE CODE: 13SP18/4C/PHN**

**CREDITS: 4**

**L-T-P: 4-2-0**

#### **COURSE OBJECTIVES**

To enable students

1. To understand the role of nutritional epidemiology in public health.
2. To outline the issues related to maternal and child nutrition.
3. To recognise the solutions to overcome the problems of malnutrition.
4. To create awareness on the interventional strategies for preventing micronutrient deficiencies in India.
5. To understand the concept of food and nutrition security and management of nutrition in emergency situations.

#### **COURSE OUTLINE**

##### **UNIT I:**

Nutritional Epidemiology:

Application of Epidemiological study in Nutrition- cross sectional studies, ecological studies, cohort studies, case control studies, randomized controlled trials: prophylactic, therapeutic and community trials; Sampling and Sample size; From research to programs- Applying knowledge to improve nutrition outcomes. (20 HOURS)

##### **UNIT II:**

Maternal and Child Nutrition:

Nutrition burden in women: Maternal Nutritional status; Factors associated with deterioration of maternal nutritional status; Interventions to improve nutritional status in women. Under nutrition in children: Stunting, underweight and wasting- an overview of the global situation; determinants of under nutrition, Prevention of under nutrition in children-a lifecycle approach; Over nutrition in children: The epidemic of obesity in children, consequences and prevention of overweight and Obesity. Policies and programmes for reducing malnutrition in the Indian context. Integration of breastfeeding and complementary feeding practices into National programme. (20 HOURS)

##### **UNIT III:**

Vitamin A Deficiency (VAD): Consequences of Vitamin A deficiency; Epidemiology of vitamin A deficiency; Vitamin A deficiency status in India; Intervention strategies for preventing VAD; Policies and programmes in the Indian context. Iodine: Importance of iodine for human population; Requirements, Controlling of IDD- a three prong strategy; Elimination of IDD- international focus; Fortification –

Universal Salt Iodization; Policies and programmes in the Indian context. (15 HOURS)

**UNIT IV:** Iron deficiency anemia & Nutritional anemia: Prevalence, causes, Approaches for the prevention and control of anemia; Policies and programmes in the Indian context.  
Zinc: Zinc epidemiology, Requirements, Evidence from Zinc supplementation studies on child health and Zinc intervention strategies. (15 HOURS)

**UNIT V:** Food and Nutrition Security:  
a) Food and Nutrition Security – Basic concepts; Food insecurity and vulnerability; Factors underlying the current state of Food and Nutrition security- food pricing, climate, agriculture, biofuels, agricultural commodities, impact of green revolution, food supply in India, land fragmentation, poverty, hidden hunger and purchasing power; Food and Nutrition Situation in India; Sustainable diets and Sustainable development goals  
b) Food and Nutrition in Natural and Manmade Disasters: Food insecurity and malnutrition- identification and measurement, Nutritional Requirements & intervention, Disaster management in India. (20 HOURS)

### RECOMMENDED TEXTBOOKS

1. ChanderVir S, *Public Health Nutrition In Developing Countries*, Part I, 1<sup>st</sup> edition, Woodhead Publishing, New Delhi, 2011
2. ChanderVir S, *Public Health Nutrition In Developing Countries*, Part II, 1<sup>st</sup> edition, Woodhead Publishing, New Delhi, 2011
3. Park K, *Park's Textbook of preventive medicine*, 2005

### REFERENCE BOOKS

1. Gopalan C., Ramanathan, P.V. Balasubramanian, S.C., *Nutritive value of Indian foods*, NIN, Hyderabad, 2010
2. Bamji M, *Textbook of Human Nutrition*, Oxford publishers, New Delhi, 2010
3. Bhatt VB, *Protein Energy Malnutrition*, PeePee Publishers, New Delhi, 2008
4. Sharma N, *Child Nutrition*, 1<sup>st</sup> edition, Murarilal & sons, New Delhi, 2006
5. Gupte S, *Textbook of Pediatric Nutrition*, Pawaninder P Vij Publishers, New Delhi, 2006
6. Gibney MJ, Margetts BM, Kearney JM, Arab L (Ed), *Public Health Nutrition (The Nutrition Society Textbook)*, 1<sup>st</sup> edition, Wiley black well, 2004
7. WHO, *The Management of Nutrition in Major Emergencies*, AITBS Publishers, New Delhi, 2000
8. Sachdev HPS, Choudhary P, *Nutrition In Children – Developing Country Concerns*, BI publications, New Delhi, 1994
9. Swaminathan M, *Principles of Nutrition and Dietetics*, Bappeo, Bangalore, 1993

10. Young H, *Nutrition in Emergencies* (Practical Health Guides), 1<sup>st</sup> edition, Oxfam, 1991
11. Robert H. Fletcher, Suzanne W. Fletcher and Edward H. Wagner, *Clinical Epidemiology- the essentials*, 2<sup>nd</sup> edition, Williams & Wilkins, Baltimore
12. Nutrition foundation of India series, scientific reports
13. Hindu survey of Indian agriculture, latest edition

#### **JOURNALS**

1. International journal of Community Nutrition
2. Indian journal of community health

#### **E-LEARNING RESOURCES**

1. <http://www.hsc.wvu.edu/library/U-links/community-nutrition.htm>
2. [www.asns.rg/njun04a.pdf](http://www.asns.rg/njun04a.pdf)
3. [www.fns.usda.gov/fsec/FILES/safetyNet.pdf](http://www.fns.usda.gov/fsec/FILES/safetyNet.pdf)
4. [www.ext.vt.edu/action\\_for\\_healthykids/assistance/lesson5background.pdf](http://www.ext.vt.edu/action_for_healthykids/assistance/lesson5background.pdf)
5. <https://www.aaas.org/sites/default/files/migrate/uploads/EnvironmentalHealth.pdf>
6. [https://www.rand.org/content/dam/rand/pubs/research\\_reports/.../RAND\\_RR1084.pdf](https://www.rand.org/content/dam/rand/pubs/research_reports/.../RAND_RR1084.pdf)
7. <https://www.nih.gov/health-information>



## SEMESTER IV

### PROJECT CORE - 14

**TOTAL HOURS: 90 hours**

**COURSE CODE: 13SP18/4C/PRO**

**CREDITS: 4**

**L-T-P: 0-6-0**

#### **COURSE OBJECTIVES**

To enable students

- ✓ To gain knowledge in the area of research
- ✓ To contribute to the community or to the existing research base

#### **COURSE OUTLINE**

The project should be based on individual study and carry the following format:

1. Title page – Title, author's name
2. Certificate of originality by the guide
3. Declaration by the author
4. Table of contents
5. List of tables
6. List of figures
7. Acknowledgement
8. Abstract.
9. Introduction: statement of the problem,significance,need for the study,objectives, and operational definitions.
10. Review of literature
11. Methodology – Sampling and tools for data collection,procedures,hypothesis
12. Results and Discussion–Tables and figures, statistical presentations,hypothesis testing.
13. Summary and Conclusion
14. References.
15. Appendices

#### **RECOMMENDED TEXTBOOKS**

1. Singh, Y.K, *Fundamental of Research Methodology and Statistic*. New Age International (P) Ltd., Publishers. New Delhi, 2015
2. Kothari, C. and Garg, G, *Research methodology Methods and Techniques* 3<sup>rd</sup> edition, New Delhi: New Age International (P) Ltd, 2014
3. Gupta. S.P, *Statistical Methods*, S Chand & Sons,, New Delhi, 2008
4. Saravanavel, P, *Research Methodology*, KitabMahal Agencies, New Delhi, 2005
5. Elhance .D.N, Veenaand and Agarwal .B.M, *Fundamental of statistics*,48<sup>th</sup> Edition, KitabMahal, Allahabad, 2005
6. Best JW and Kahn JV, *Research in Education*, Prentice Hall of India Pvt. Ltd., New Delhi, 1996

7. Koul L, *Methodology of Educational Research*, 3<sup>rd</sup> edition Vikas publishing House Pvt. Ltd ,New Delhi
8. William Giles Campbell, *Form and style in Thesis writing*, Houghton Mifflin Company, Boston.
9. Sadhu A.N and Singh A, *Research Methodology in Social Sciences*, Himalaya Publishing House, Mumbai,

## **JOURNALS**

1. International journal of Nutrition and Dietetics
2. International journal of Clinical Nutrition and Dietetics
3. International journal of Food Microbiology
4. International journal of Food Engineering
5. International journal of Food Properties
6. Food and Nutrition Bulletin
7. Annual review of Nutrition
8. Food Science Research Journal
9. Journal of Agriculture and Food Economics
10. Current Research in Nutrition & Food Science Journal

## SEMESTER IV

### PUBLIC HEALTH NUTRITION PRACTICAL Practical -4 (CORE – 15)

**TOTAL HOURS: 90 hours**

**COURSE CODE: 13SP18/4C/PR4**

**CREDITS: 4**

**L-T-P: 0-0-6**

#### COURSE OBJECTIVES

1. To create awareness of various national agencies involved in health and nutrition
2. To learn various health indices and assessment techniques for the community.
3. To plan and conduct nutrition and health education programme for the community balancing the socio-cultural environment.
4. To formulate and prepare low cost recipes for the vulnerable group.
5. To overcome the nutrition and health problems faced by the community.

#### COURSE OUTLINE

1. Visit to various organizations concerned with food and nutrition –ICMR, FNB, WVS, ICDS, FCI, PDS, DMS, MSSRF, Agricultural department, Social welfare Board. (10 HOURS)
2. Identification of Vulnerable group and Assessment of nutritional Status of vulnerable group (20 HOURS)
3. Formulation, and preparation of low cost recipes – weaning, pregnancy, lactation, Vitamin A, Iron and Iodine (20 HOURS)
4. Planning and implementation of Nutrition–Health Education (NHE) for a vulnerable group (20 HOURS)
5. Preparation of teaching aids for Nutrition- Health Education. (20 HOURS)

#### REFERENCE BOOKS

1. ChanderVir S, *Public Health Nutrition In Developing Countries*, Part I, 1<sup>st</sup> edition, Woodhead Publishing, New Delhi, 2011
2. ChanderVir S, *Public Health Nutrition In Developing Countries*, Part II, 1<sup>st</sup> edition, Woodhead Publishing, New Delhi, 2011
3. Gopalan C., Ramanathan, P.V. Balasubramanian, S.C., *Nutritive value of Indian foods*, NIN, Hyderabad, 2010
4. Bamji M, *Textbook of Human Nutrition*, Oxford publishers, New Delhi, 2010
5. Bhatt VB, *Protein Energy Malnutrition*, PeePee Publishers, New Delhi, 2008
6. Sharma N, *Child Nutrition*, 1<sup>st</sup> edition, Murarilal& sons, New Delhi, 2006
7. Gupte S, *Textbook of Pediatric Nutrition*, Pawaninder P Vij Publishers, New Delhi, 2006
8. Park K, *Park's Textbook of preventive medicine*, 2005

#### JOURNALS

1. International journal of Community Nutrition
2. Journal of community health nursing

## **E-LEARNING RESOURCES**

- [http://www2.mfa.gr/inf/files/radC4CD6Health-Nutrition%20Orgs%20\(2008\).pdf](http://www2.mfa.gr/inf/files/radC4CD6Health-Nutrition%20Orgs%20(2008).pdf)
- <http://www.jmedscindmc.com/article.asp?issn=1011-4564;year=2014;volume=34;issue=5;spage=211;epage=213;aulast=Shrivastava>
- <https://www.indiastudychannel.com/resources/120148-Teaching-Aids-Their-Needs-Types-and-Importance-Of-Teaching-Aids-In-Teaching-Learning-Process.aspx>
- <http://www.yourarticlelibrary.com/nutrition/nutrition-education-of-community-importance-methods-and-other-details/64428>
- <http://vikaspedia.in/health/nutrition/nutritive-value-of-foods/low-cost-nutritious-supplements>

## SEMESTER IV

### SOFT SKILL-4

#### SCIENTIFIC WRITING AND PRESENTATION SKILLS

**TOTAL HOURS: 30 hours**

**COURSE CODE: 13SP18/4S/SWS**

**CREDITS: 2**

**L-T-P: 2-0-0**

#### COURSE OBJECTIVES

1. To gain knowledge in scientific writing and presentation skill.
2. To understand the principles for oral presentations.
3. To gain in depth knowledge on research paper publication

#### COURSE OUTLINE

**UNIT I:** Scientific writing - abstract, full paper, clinical update, manuscripts. Process of copy editing journals

**UNIT II:** Presentation skills – Thematic, poster, oral, principles to be followed for presentation

**UNIT III:** Computer application for research  
Use of Internet in Research – Websites, search Engines, E-journal and E-Library – INFLIBNET, SHODHGANGA  
Plagiarism – Citation and acknowledgement – reproducibility and accountability, Soft wares available in the market for plagiarism

#### RECOMMENDED TEXTBOOKS

1. Best JW and Kahn JV, *Research in Education*, 7<sup>th</sup> Edition, Prentice Hall of India Pvt.Ltd., New Delhi, 2000.
2. Campbell WG, *Form and style in Thesis writing*, Houghton Mifflin Company, Boston.

#### REFERENCE BOOKS

1. Koul L, *Methodology of Educational Research*, 3<sup>rd</sup> edition, Vikas Publishing House Pvt.Ltd., New Delhi
2. John W. Best and James V. Kahn, *Research in Education*, 7<sup>th</sup> Eed, Prentice Hall of India Pvt. Ltd, New Delhi, 2000.
3. Elhance. D. N Veena and Elhance and Agarwal . B.M, *Fundamentals of Statistics*, 48<sup>th</sup> ed, Kitab mahal, Allahabad, 2005.
4. Sadhu AN, Amarjit Singh, *Research methodology in Social Sciences*. Himalaya Publishing House, gurgoan, Mumbai, 1992.

