Curriculum
of
Master of Science (M.S.)
in Nutrition and Food Science

Institute of Nutrition and Food Science
University of Dhaka

Session: 2020-21 and onwards

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The Institute of Nutrition and Food Science (INFS), University of Dhaka, is a pioneering organization of research and teaching in the field of Nutrition and Food Science in Bangladesh. It was established in 1969 as a follow up of the 1962-64 National Nutrition Survey. INFS is devoted to the study of nutritional issues of the country to inform policies targeting the food and nutrition security of the Bangladeshi population. As part of capacity building and strengthening, INFS offers undergraduate (B.S. (Honors) program) and graduate (M.S. M.Phil., and Ph.D. program) and conducts specialized training for professionals. The INFS has a group of highly qualified and experienced faculty members. The primary focus of academics and research are: (i) Nutritional Biochemistry, (ii) Clinical Nutrition and Diet Therapy, (iii) Community and Public Health Nutrition, and (iv) Food Science and Technology (including Food Microbiology). Major research areas are food analysis, analysis of food toxins, the role of functional food in health and diseases, nutrition survey and surveillance, livelihood and food security, food, and nutrition policy, food hygiene and safety, and the role of diet in the disease process. Over the years, INFS has conducted several national surveys (1975-76, 1981-82, 1995-96, 2001-2003 and 2011-2012), and managed, updated and published Food Composition Tables (FCTs) and Database for Bangladesh. The Institute has a rich seminar library with an extensive collection of reference books and journals. It possesses several research laboratories with modern equipment, facilities, and service systems. The faculty and the researchers of this Institute have been regularly publishing their research findings in high impact national and international journals. The Institute has already earned a place as a center of excellence in the field of Nutrition and Food Science research in Bangladesh. The Institute has a strong collaboration with various national and international research groups.

Title of the Program: Master of Science (M.S.) in Nutrition and Food Science

Duration of the Program: OneYear

Level: Postgraduate

Medium of Instruction: English

Eligibility for Admission:
Students are admitted to the M.S.Degree program as per the existing Ordinance and regulations of the University of Dhaka and the rules of the Faculty of Biological Sciences and INFS, University of Dhaka. The Institute may re-fix the minimum requirement for admission to the program from time to time with approval from the authority.

Course Information:
The M.S. in Nutrition and Food Science program has provision for two groups – Group A (Non-Thesis Group) and Group B (Thesis Group). Students admitted into this program can study in the'Thesis Group' subject to the fulfillment of the requirements specified by the academic committee of the Institute.

Courses and Credit Distribution:
Each 3-credit course will carry 75 marks (45 hours), and each 2-credit course will take 50 marks (30 hours). For general group (Group A) Course No. NFS-510 will constitute 'practical' and for Thesis group (Group B) Course No. NFS-510 will form'Thesis". The remaining courses of the syllabus will be the same for both groups.Each student in either group must take a total of 36 credit hours.The layout of the M.S. in Nutrition and Food Science program is given below:

	Course Number	**Name of Course**	**Credits**
Theory:	**NFS-501**	Advances in Nutritional Sciences	**3**
	NFS-502	Nutrition and Chronic Diseases	**3**
	NFS-503	Medical Nutrition Therapy	**3**
	NFS-504	Community and Public Health Nutrition	**3**
	NFS-505	Food Quality Control and Quality Assurance	**3**
	NFS-506	Food Biotechnology	**2**
	NFS-507	Advanced Research Methods	**3**
	NFS-508	Advanced Data Management and Analysis	**3**
	NFS-509	Nutritional Epidemiology	**3**
Sub-total			**26**
	NFS-510	Thesis / Practical	**6**
	NFS-511	Seminar	**2**
	NFS-521	Viva Voce	**2**
Total			**36**

DETAIL CURRICULUM AND SYLLABUS OF M.S. IN NUTRITION AND FOOD SCIENCE

Course No. NFS- 501 Advances in Nutritional Sciences 3 Credits

Course Overview:
This is an advanced course in nutrition which deals withthe effects of food and its constituents on living organisms, with emphasis on humans.This course integrates nutrition with biochemistry and physiology. The focus of the course will be on metabolism, examining its regulation from cellular to whole-body perspective.

Learning Outcomes:
Upon completion of this course, the students should be able to

- Understand the integrated metabolism of food
- Understand the role of antioxidants and Phyto-protectants and heavy metals and their toxicityin our body
- Understand recombinant DNA, nutrient-gene interactions, and nutrient- nutrient interactions
- Understand and analyze the metabolism of dietary lipids in the human body
- Critique the scientific literature on lipids
- Understand the role of system biology in nutrition

Content:

1. Integrated metabolism of food, organ-specific metabolism
2. Antioxidants: Free radicals and oxidative stress. Roles of antioxidant nutrients in health and disease. Phyto protectants and functional foods and their role in nutrition.
3. Biochemical aspects of heavy metals and their toxicity
4. Recombinant DNA and its application in nutrition
5. Nutrient-gene interactions.
6. Nutrient-nutrient interactions.
7. Recent development of alpha-linolenic acid in the prevention of cardiovascular diseases. Relation between ω-3 PUFA's, inflammations, and immunity. Effect of ω-3 PUFA on bone metabolism and osteoporosis. PUFA metabolism during lactation.
8. Critical analysis of popular diets and dietary supplements
9. Nutritional regulation of the immune response
10. Systems biology as it relates to nutrition

Learning and Teaching method:

Formal lectures using available visual aids, e.g., Blackboard, whiteboard, PowerPoint slides, and practical demonstrations where possible

Assessment:
Regular attendance (graded), in-course assessment (graded), quiz (non-graded), assignment (non-graded), and final examination (graded). A student's grade will be calculated based on a combination of class participation (5%), in-course examination (35%) and a final exam (60%).

References:

1. Advanced Nutrition and Human Metabolism (7th edition) by Sareen S. Gropper, Jack L. Smith and Timothy P. Carr
2. Present Knowledge in Nutrition (11th edition) – edited by Bernadette Marriott, Diane F. Birt, Virginia Stalling, and Allison Yates
3. Modern Nutrition in Health and Disease – M.E. Shils, T.A. Olson,M. Shike.
4. Recombinant DNA (2nd edition) –Watson and Gilman
5. Nutrient– Gene Interactions in Health and Disease by NaïmaMoustaïd-Moussa and Carolyn D. Berdanier
6. Handbook of Nutraceuticals and Functional Foods by Robert E. C. Wildman
7. Fatty Acids and Lipids – New findings. T. Hamnazaki and H. Okuyama. Vol-88.
8. Textbook of Human Nutrition – M.S. Bamji; N.P. Rao and V. Reddy (eds).
9. Advanced Human Nutrition, Robert E.C. by Wildman and Denis M. Medeiros

Course No. NFS – 502 Nutrition and Chronic Diseases 3 Credits

Course Overview:
The course covers the current knowledge of chronic diseases and the role of nutrition in these diseases.

Learning Outcomes:
Upon completion of this course, the students should be able to

- Understand and analyze current research in obesity classification, guidelines, development, prevention, treatment, and current knowledge in obesity research.
- Understand and analyze current research in diabetes definition, classification, diagnosis, development, prevention, treatment, and current knowledge in diabetes research.
- Understand and analyze current research in cardiovascular disease (CVD) definition, classification, diagnosis, development, prevention, treatment, and current knowledge in CVD research.
- Understand and analyze current research in cancer disease definition, classification, diagnosis, development, prevention, treatment, and current knowledge in cancer research.

Content:
1. Emergence of chronic diseases in developing countries
2. **Obesity:** Overview of obesity and obesity resources; socioeconomic model; Updates on recentobesity guidelines; overview of metabolism; adipose tissue biology-obesity. The brain, the gut and food intake. Obesity prevention and treatment; Obesity and related disorders

3. **Diabetes:**Clinical Guidelines, Diabetes prevention and treatment; Insulin action; Diabetes and related disorders.Policy & Community education—the Extension model Diabetes treatments; Diabetes Complications
4. **Nutrition and Cardiovascular Disease:** Definition, CVD statistics, Coronary heart disease (CHD), risk factors for CVD; Stroke; Atherosclerosis; Relevance of nutrition and atherosclerosis; Mechanism of atherosclerosis; Inflammation and atherosclerosis; Macrophage and atherosclerosis; Inflammation in plaque rupture and thrombosis; Inflammatory biomarkers for CVD. Cholesterol and lipoprotein metabolism; Statin, PCSK9, and atherosclerosis
5. **Nutrition and Cancer:** Definition, Different kinds of cancer, Cancer statistics, population based cancer studies; Biology of cancer—the cell cycle, cell differentiation, apoptosis, Tumor suppressor genes, Oncogenes; genes and cancer; Proto-oncogenes and normal cell growth; DNA repairs genes; Mutations and cancer; Genomes of cancer cells; Cell signaling pathway, tumor growth, invasion and metastasis; Malignant vs Benign tumors. Causes of cancer; Cancer prevention; nutrition factors in cancer prevention. Carcinogenesis—definition, Classification of Chemical Carcinogens; Mechanism of Action of Chemical Carcinogens; Stages in Carcinogenesis; Methods for Evaluating Carcinogens

Learning and Teaching method:

Formal lectures using available visual aids, e.g., Blackboard, whiteboard, PowerPoint slides, and practical demonstrations where possible

Assessment:
Regular attendance (graded), in-course assessment (graded), quiz (non-graded), assignment (non-graded), and final examination (graded). A student's grade will be calculated based on a combination of class participation (5%), in-course examination (35%) and a final exam (60%).

References:

1. Nutritional aspects and clinical management of chronic disorders and diseases (edited by Felix Bronner)
2. Diet, nutrition, and the prevention of chronic diseases: report of a joint WHO FAO expert consultation (WHO Technical report 916)
3. Pediatric and adult nutrition in standard, chronic diseases, and intellectual and developmental disabilities: prevention, assessment, and treatment (3rd edition) by Shirley W. Ekvall and Valli K. Ekvall
4. Modern Nutrition in Health and Disease – M.E. Shils, T.A. Olson,M. Shike

Course No. NFS-503 Medical Nutrition Therapy 3 Credits

Course Overview:
This course covers the pathophysiology of selected disease states and their associated medical problems. Specific attention will be directed to the medical nutrition needs of patients in the treatment of each disease state.

Learning Outcomes:
Upon completion of this course, the students should be able to
- Demonstrate how to locate, interpret, evaluate, and use professional literature to make ethical, evidence-basedpractice decisions
- Demonstrate effective and professional oral and written communication and documentation
- Use the nutrition care process to make decisions, to identify nutrition-related problems and determine and evaluate nutrition interventions, including medical nutrition therapy, disease prevention, and health promotion

Content:
1. The Nutrition Care Process (NCP): Steps of NCP—Nutrition assessment, nutrition diagnosis, nutrition intervention, nutrition monitoring and evaluation; Enteral and Parenteral Nutrition Support: Indication, access, equipment, nutritional substrates, monitoring and evaluation; Pre- and post-operative condition diet; Documentation of the nutrition care process
2. Estimating energy and protein needs: Total Energy Expenditure—basal energy expenditure, thermic effect of food, activity; Basal Energy Expenditure (BEE) measurement—Direct calorimetry, Indirect calorimetry, Equation-based estimates; Estimating protein requirements based on usual body weight
3. Obesity and weight management

4. CardiovascularDisease: Atherosclerosis and Ischemic heart disease—Definition, pathophysiology, risk factors, clinical manifestation and diagnosis, MNT for atherosclerosis and Ischemic heart disease
5. Chronic kidney diseases (CKD): Role of the kidney; Stages of chronic kidney disease (CKD) Diagnostic and lab tests; some causes of kidney failure; Signs & symptoms of kidney failure Medical nutrition therapy for CKD patients (CKD-predialysis, Hemodialysis, Peritoneal dialysis, Kidney transplant)
6. Hepatic disease: Liver function, hepatitis, acute hepatitis, chronic hepatitis, cirrhosis. Stages of liver damage; Lab tests for diagnosis of hepatic abnormalities; Etiology of liver disease; Hepatitis; Cirrhosis; Jaundice; Signs & symptoms of cirrhosis; Management and MNT
7. Irritable Bowel Syndrome (IBS): Definition, pathophysiology, etiology, treatment; MNT for IBS
8. Burns: Classification; Effects of burns on the Body system, Burn management; Nutritional Support
9. Geriatric nutritional problems (osteoporosis): Diagnosis, epidemiology, health and economic impact of fractures, etiology, prevention,medical management
10. Nutrition and AIDS

Learning and Teaching method:
Formal lectures using available visual aids, e.g., Blackboard, whiteboard, PowerPoint slides, and practical demonstrations where possible

Assessment:
Regular attendance (graded), in-course assessment (graded), quiz (non-graded), assignment (non-graded), and final examination (graded). A student's grade will be calculated based on a combination of class participation (5%), in-course examination (35%) and a final exam (60%).

References:

1. Practical Handbook of Nutrition in Clinical Practice by Donald F. Kirby and Stanley J. Dudrick
2. Nutrition Therapy and Pathophysiology-Marcia Nelms, Kathryn P. Sucher & Karen lacey
3. Lutz's Nutrition and Diet Therapy-Nancy Litch
4. Krauses's Food and Nutrition Therapy-L. Kathleen Mahan & Sylvia Escott-Stump
5. The Essential Pocket Guide for Clinical Nutrition-Mary Width & Tonia Reinhard
6. Manual of Nutrition and Diet Therapy - N.J.Gills & M.V. Bosscher
7. Clinical Dietetics & Nutrition - F.P. Antia&P.Abraham
8. Nutrition & Physical Fitness - Bogert, Briggs &Callowey
9. Food and Nutrition - M. Swaminathan
10. Applied Nutrition - R. Rajalakshmi

Course No. NFS-504 Community and Public Health Nutrition 3 Credits

Course Overview:
This is an advanced course that comprises various topics related to community and public health nutrition. This course combines theory, critical appraisal, and understanding of community and

public health nutrition issues with approaches for implementing community nutrition interventions.

Learning Outcomes:
Upon completion of this course, students should be able to:

- Demonstrate knowledge and understanding of public health/community nutrition.
- Understand programs that have been developed to address community nutrition issues and serve different target populations
- Use current research to make decisions about community nutrition programming
- Critically appraise public health/community nutrition issues
- Write a community nutrition proposal

Content:

1. **Dynamics of Community Nutrition:** The concept of community, public health, and community interventions, Concept of health, Health promotion, Health objectives; Social-Ecological Models of health behavior; Entrepreneurship in community nutrition
2. **Theories of behavior change and their application to public health nutrition:** Behavior change theories and models—the Transtheoretical Models (TTM), Motivational Interviewing, Health Belief Model (HBM), the Theory of Planned Behavior (TPB), Social–Cognitive Theory (SCT). Strategies to use dietary behaviors and food intake (individual and upstream approaches)
3. **Community Needs Assessment:** Basic principles of needs assessment, methods of obtaining data about the target population, issues in data collection.
4. **Program Planning:** Factors that trigger program planning; Steps in program planning; Logic Model
    a. **Nutrition projects and programs:**The project concept, aspects of project preparation and analysis, the project cycles, agricultural project analysis, and nutrition, identifying project costs and benefits, feeding programs and food-related income transfers
    b. **Monitoring of nutrition projects**: Project monitoring, indicators, characteristics
    c. **Evaluation of public health nutrition Interventions and Policies:** Evaluation design (Process evaluation, impact evaluation, outcome evaluation, Economic evaluation); Data collection tools and their validation; data analysis and statistics; ethical issues; Recommendations
    d. **Managing Nutrition Programs:** Functions of Management, Management issues in nutrition program
    e. **Nutrition projects and programs in Bangladesh:** Food for work, Vulnerable group development program, Food for Education, Public food distribution system, Bangladesh Integrated Nutrition Program, National Nutrition Program, National Nutrition Services, Community Clinic ServicesNutritional Blindness program, salt iodization program
5. **Developing Strategies in the Community**: Group or Population approaches-national regulation, disincentives at the national level, Nudging. Community programs to improve nutrition behavior of children and adults—Individual approaches, Omics approaches
6. **Agriculture – Nutrition linkages:** Food systems for improved health, agricultural diversification, biofortification, nutritional effects of agricultural advances

7. **Nutrition and Cardiovascular Disease:** Macronutrients and CVD; Micronutrients, antioxidants, and CVD; Dietary patterns and composite dietary interventions; Implications for Policy
8. **Telehealth, Telemedicine, eHealth, and mHealth in Nutrition Programs:** Definition of Telemedicine, eHealth, and mHealth; Barriers to Telemedicine/eHealth/mHealth; assessing and implementing telemedicine, eHealth, and mHealth programs
9. **Nutritional Needs of Children and School Lunch Programs:** Energy and nutrient concerns during childhood; improving nutrition in childhood worldwide with school-based interventions; school meals program in Bangladesh
10. **Global and National Public Health Nutrition Approaches:** Global nutrition challenges; the world Health assembly; the Committee for food security; The United Nations General assembly; The second International Conference on Nutrition; The united nation Conference on Climate Change; Developing national Nutrition Policies and Program

Learning and Teaching method:
Formal lectures using available visual aids, e.g., Blackboard, whiteboard, PowerPoint slides, and practical demonstrations where possible

Assessment:
Regular attendance (graded), in-course assessment (graded), quiz (non-graded), assignment (non-graded), and final examination (graded). A student's grade will be calculated based on a combination of class participation (5%), in-course examination (35%) and a final exam (60%).

References:

1. Community Nutrition in Action, An Entrepreneurial Approach-Marie A. Boyle
2. Public Health Nutrition, 2nd Edition- Edited by Judith L. Buttriss, Ailsa A. Welch, John M. Kearney, Susan A. Lanham-New
3. Public Health Nutrition, Principles and Practices in Community and Global Health-Natalie Stein
4. Economic analysis of agricultural projects – J.P. Gittinger
5. Global Health 101-Richard Skolnik

6. Leading Issues in Economic Development - G. M. Meier
7. Human Nutrition in the Developing World – M.C. Latham

Course No. NFS- 505Food Quality Control and Quality Assurance 3 Credits

Course Overview:
This course covers the basis behind food quality control/assurance along with its application to various food systems to control/improve the quality and safety of food supply.

Learning Outcomes:
Upon completion of this course, students should be able to:

- Describe principles of quality control (Q.C.) and quality assurance (Q.A.)
- Describe methods of quality control
- Evaluate the quality of foods
- Develop standards and specifications
- Setup, use, and assess GAPs, GMPs, SOPs, SSOPs, HACCP, QACCP, and SPC procedures

Content:
1. Definition of food quality and nutritive quality, general principles of quality control (Q.C.) and quality assurance (Q.A.)
2. Quality management systems and the ISO standards; total quality management (TQM), pre-shipment inspection and inspection at the port of destination and certification and quality marks.
3. Quality evaluation methods (subjective method, objective method, and microscopic method).
4. Good manufacturing practices (GMP), quality control of raw materials, intermediate and finished foods; quality control of packaging materials; Quality control documentation; commissioning test; pest control in food processing area. Quality assurance of therapeutic, functional, nutraceutical and novel foods.
5. Indices of food quality and authenticity: meat and meat products, fish and fish products, milk and dairy products, vegetables, fruits and their products, grain, pulses and oil seeds, coffee, tea and spices.
6. Quality factors for consumer safety, food safety standards.
7. Evaluation of quality of common foods by food indices available in the market
8. Evaluate GAPs, GMPs, SOPs, SSOPs, HACCP, QACCP, and SPC procedures

Learning and Teaching method:

Formal lectures using available visual aids, e.g., Blackboard, whiteboard, PowerPoint slides, and practical demonstrations where possible.

Assessment:
Regular attendance (graded), in-course assessment (graded), quiz (non-graded), assignment (non-graded), and final examination (graded). A student's grade will be calculated based on a combination of classparticipation (5%), in-course examination (35%) and a final exam (60%).

References:

1. Vasconcellos, J. Andres. 2004. Quality Assurance for the Food Industry. A Practical Approach. CRC Press LLC. ISBN 0-8493-1912-9.
2. Rekha S. Singhal, Pushpa R Kulkarni, Dinanath V. Rege(1997). Indices of Food Quality and Authenticity, Woodhead Publishing Limited, Abington Hall, Abington, Cambridge CBI 6AH, 1997, England.
3. Amy C. Brown: Understanding Food Principles and Preparation, 6th ed., 20 channel Center Street, Boston, MA 02210, USA, 2017.
4. Early, R. (2006) Guide to Quality Management Systems for the Food Industry, Blackie, Academic and professional, London.
5. Gould, W.A and Gould, R.W. (2005) Total Quality Assurance for the Food Industries, CTI Publications Inc. Baltimore.
6. Bryan, F.L. (2007) Hazard Analysis Critical Control Point Evaluations A Guide to Identifying Hazards and Assessing Risks Associated with Food Preparation and Storage. World Health Organization, Geneva.
7. Hubbard, Merton R., 2003. Statistical Quality Control for the Food Industry. 3rd Edition. Chapman and Hall, New York.

Course No. NFS-506 Food Biotechnology 2 Credits

Course Overview:
This course employs the genetic manipulation of microorganisms for food production. This course encompasses the sciences of molecular biology, biomedicine, as well as the genomic, proteomic, transcriptomics, and metagenomics applications.

Learning Outcomes:
Upon completion of this course, students will be able to:

- Describe the main foods resulting from fermentation and the action of microorganisms responsible for food fermentations
- Analyze the "modern" food biotechnology
- State the genetic processes that are responsible for the biological functions but also how these processes lead to product development
- Identify key genetically modified foods

Content:
1. **Fundamentals of Biotechnology and Food Biotechnology:** An introduction to Biotechnology and Food Biotechnology, Microbial genetics of bacteria, fungi and viruses,

Protein engineering. Concept about the principals involved in the operation of microbial processes on an industrial scale.

2. **Genetically modified crop production:** Selection of plants, breeding, isolation of the desired gene, insertion of gene, selection of transformants, Production of genetically engineered high yield and submergene tolerantrice varieties, Algal technology in rice cultivation, Genetic transformation in wheat, making nitrogen available to plants / crops, Available G.M. foods and their acceptance, Controversy about G.M. food, Molecular marker, gene transfer, Gene transfer regulatory and legislative aspects of G.M. food.
3. **Microbial Enzyme production:** Source of microbial enzyme, Production of microbial enzyme (amylase, invertase, renin, protease, pectinase, lactases, lipase, glucose isomerase, glucoamylase, penicillin acylase), Basic principle of G.E. microbial enzyme production. Stabilization of enzymes and cell. Uses of immunization enzymes and cells. Application of microbial enzymes.
4. **Yeast and algal Biotechnology:** Yeast genetic engineering, strain improvement, development, commercial yeast production, application of G.M. yeast in beverage and other industries, Spirulina processing- nutritive value and uses.
5. **Single-cell protein: (SCP):** Definition microorganism used for SCP production, raw materials, condition for growth and production, Production of SCP from alkane (petroleum), wood carbohydrates, methane, and sewage. Genetic improvement of SCP, Importance of SCP in third world country. Fats from microorganism. Mycoprotein production.
6. **Fermented products:** Solid substrate fermentation, different types of fermented foods, fermentation for flavor production.

Learning and Teaching method:
Formal lectures using available visual aids, e.g., Blackboard, whiteboard, PowerPoint slides, and practical demonstrations where possible

Assessment:
Regular attendance (graded), in-course assessment (graded), quiz (non-graded), assignment (non-graded), and final examination (graded). A student's grade will be calculated based on a combination of class participation (5%), in-course examination (35%) and a final exam (60%).

References:
1. Principles to Biotechnology- Smith
2. Plant Breeding: B.D. Singh

Course No. NFS-507 Advanced Research Methods 3 Credits

Course Overview:
The advanced course is intended to have both theoretical as well as practical exposure on different aspects of research methodology with specific emphasis on understanding which designs are most compatible and effective with particular research situations, and, in turn, which analytic procedures are most appropriate to those designs. Other concepts such as critical review of the literature, ethical conduct of research, and the human subjects research (IRB) approval process essential to the proper conduct and dissemination of nutrition research will be covered. Further, this course will cover topics such as systematic review and meta-analysis, survey

research, qualitative research, and implementation research., research and grant proposal writing, dissertation/thesis, and article writing.

Learning Outcomes:
Upon completion of this course, students should be able to:

- Understand designs/analysis procedures for nutrition research
- know of ethical issues in nutrition research & obtain relevant ethical research certification
- Understand systematic review and meta-analysis, survey research, qualitative research, and implementation research methods.
- Prepare a research proposal
- Communicate their research in small and large group settings

Content:

1. **Research:**Definition, the purpose of research, types of research. The ethical aspect of research; Regulatory protections of human subjects in research
2. **Research process:**Problem formulation; Formulating research objectives, hypothesis, and research questions; Review of the literature
3. **Research methods**: Types/Classification. Design of observational nutrition studies (Ecological, cross-sectional, case-control, and cohort); Design in experimental settings (Single-arm studies, parallel studies, Crossover studies)
4. **Sampling methods and sample size calculation**
5. **Data collection**: Questionnaire design process; Paper-based *vs.* tablet-based data collection
6. **Systematic review and meta-analysis:** Types of review, steps of systematic review; methodology of meta-analysis in nutrition research; presentation and interpretation of results
7. **Survey research:** Types of surveys, survey planning, survey item construction, survey instrument, pilot testing; choosing meaningful survey questions, issues in survey research
8. **Qualitative research:** Research design/strategy (Ethnography, Grounded theory, Phenomenology, Case study, Narrative inquiry, Mixed method Delphi methods), data collection (Individual interview, Focus group discussion, Key informant interview, Online interview, document review), data analysis (Coding, categorizing, concepts); Qualitative analysis techniques (Generic approach, constant-comparison method, content analysis, discourse analysis, narrative analysis) and interpretation; Computer-assisted qualitative data analysis
9. **Implementation research (I.R.):** Concept, definition, classification of I.R.; Characteristics, components, and the cycle of I.R.; Conceptual framework for I.R. outcome; I.R. and community engagement; Integrating implementation research into the health system; Concepts, frameworks, and principles for implementation science (I.S.) in nutrition; Success factors for implementation research in nutrition
10. **Writing research/grant proposals:** Background and significance; Causal model, fact-hypothesis matrix; Objectives; Hypotheses/ research questions; Methodology—Variable indicator method matrix, study design, population under survey; Sample size and sampling procedure; Measurement methods, Plans for data analysis; Ethical considerations; Operational planning—time schedule, human resources, equipment and material, Budget, Risk management plan;Funding sources of nutrition research
11. **Writing and Publishing:**
    a. Writing thesis/dissertation chapters

b.Writing research articles: Abstract, introduction, methodology, results, discussion,references

Learning and Teaching method:
Formal lectures using available visual aids, e.g., Blackboard, whiteboard, PowerPoint slides, and practical demonstrations where possible

Assessment:
Regular attendance (graded), in-course assessment (graded), quiz (non-graded), assignment (non-graded), and final examination (graded). A student's grade will be calculated based on a combination of class participation (5%), in-course examination (35%), and a final exam (60%).

References:

1. Introduction Research and Medical Literature—J. Glenn Forister& J. Dennis Blessing
2. Analysis in Nutrition research-Edited by George Pounis
3. Qualitative Research in Education: A User's Guide—Marilyn V. Lichtman
4. Research Methodology-M.A. Salam Akanda
5. Writing dissertation and grant proposal—Lisa C. Ray
6. How to Write a Better Thesis-David Evans, Paul Gruba, and Justin Zobel

Course No. NFS- 508 Advanced Data Management and Analysis 3 Credits

Course Overview:
The goal of this course is to develop an understanding of basic as well as advanced statistical concepts and data management techniques. Upon completion, the student should feel comfortable applying simple statistical methods, be familiar with more specialized/advanced analysis techniques.

Learning Outcomes:
Upon completion of this course, students will be
- Fluent in simple statistical analysis techniques
- Aware of more specialized/advanced statistical analysis techniques
- Able to use SPSS/STATA for data management and analysis
- Able to analyze a dataset and interpret results and present them in tables, figures, and text
- Able to apply data management and statistical analysis techniques to pre-selected data sets from nutrition and public health research projects.

Content:
1. **Introduction:**Concept of data management; Steps in data management; Data management issues—dataselection, data collection, data analysis, data handling, data reporting and publishing, and data ownership
2. **Data management in SPSS/STATA:** Graphical user interface, types of files, basic command syntax; Enter and edit data, import, and export data, Merge Files, variable and value labels, Data Cleaning. Data transformation—Recoding variables, Computing Variables, Count Values within cases, Ranking. Data manipulation—Selecting cases,

Splitting files, Weight cases, Aggregate

3. **Statistical analysis of retrospective health and nutrition data:** Hypothesis testing; Descriptive statistics; Assessment of normality; Confidence interval; Pearson Chi-Square test; *t* test; One way ANOVA; Pearson Correlation Coefficient; Non parametric tests; Simple linear regression analysis; Multiple linear regression analysis; Logistic regression analysis (Odds Ratio, Simple binary logistic regression analysis, Multiple binary logistic regression analysis);Strategies for model fitting.
4. **Statistical analysis of prospective health and nutrition data:** Descriptive statistics, Measures to calculate Incidence, Relative risk. Survival analysis—Basic concepts, Kaplan-Meier analysis, Log-rank test, Cox regression analysis. Contingency Tables - Mantel-Haenszel test, Confounding, interaction
5. **Collection and management of dietary data:** dietary information; Data management and dietary analysis—Portion sizes, Estimation of the nutrient content of foods, handling of food group data. Data manipulation—validation, reproducibility, calibration, and biomarkers. Measurement error, misreporting, and outliers; Energy adjustment
6. **Analysis of dietary pattern (Priori, posteriori, and hybrid):**Principal components/Factor analysis; Cluster analysis; Score-based approaches
7. **Data presentation:** Graphical, Tabular
8. **Secondary data analysis:** Advantage and disadvantage of secondary data analysis; locating appropriate secondary data; research uses of secondary data analysis; Secondary data Analysis process; Challenges of secondary data analysis
9. **Exercises:**Practical exercises in anthropometric and socioeconomic data management and analysis using SPSS/STATA, Anthro, AnthroPlus, and other related software packages

Learning and Teaching method:
Formal lectures using available visual aids, e.g., Blackboard, whiteboard, PowerPoint slides, and practical demonstrations where possible

Assessment:
Regular attendance (graded), in-course assessment (graded), quiz (non-graded), assignment (non-graded), and final examination (graded). A student's grade will be calculated based on a combination of class participation (5%), in-course examination (35%) and a final exam (60%).

References:

1. Medical statistics: A guide to data analysis and critical appraisal. Peat, J. and Barton, B.
2. Analysis in Nutrition Research-Edited by George Pounis
3. Biostatistics: A guide to design, Analysis, and Discovery—Forthofer, R. N., Lee, E. S., & Hernandez, M. (2006).
4. Fundamentally of Biostatistics—B. Rosner.
5. Medical Statistics—Kirkwood and Strne
6. Research Methodology-M.A. Salam Akanda
7. WHO Anthro & AnthroPlus Manual
8. SPSS, EPI Info, Anthro, Excel, Access and other related Packages

Course No. NFS- 509 Nutritional Epidemiology 2 Credits

Course Overview:
This course will examine methodologies used in nutritional epidemiological studies and critically review the current state of knowledge regarding diet and other nutrition and lifestyle-related indicators as factors in disease.

Learning Outcomes:

- Identify the different methods used to measure diet and related variables in nutritional epidemiologic studies and describe the strengths and limitations of each method
- Explain the statistical methods commonly used in nutritional epidemiology to analyze diet-disease associations.
- Describe research strategies/methodologies that can be used to evaluate or adjust for other dietary and lifestyle factors that may explain or influence relationships of diet and disease.
- Describe the current state of epidemiological evidence for relationships of diet to the development of selected diseases and discuss issues of interpretation and potential impact on policy and public health.
- Critically evaluate nutritional epidemiology research studies, publications, and multimedia representations of science.

Content:

1. Introduction to nutritional epidemiology
2. Design of epidemiology studies: Observational, and Experimental studies; Special exposure groups; Migrant studies
3. Statistical tools to evaluate relationships of diet to disease: Associations; P-value; CI; regression
4. Extraneous variables: Confounding and effect modification; Validity and Bias
5. Measuring nutrition exposures: Measures of dietary intake; Analysis of dietary data; Biochemical indicators of dietary intake; Anthropometric measure and body composition; Assessment of physical activity; Validation and calibration of diet assessment methods; Measurement error and implications
6. Integrative approaches to nutrition exposures: Combining diet assessment techniques; Principal components/Factor analysis; Cluster analysis; reduced rank regression; score-based approaches
7. National nutrition monitoring: Food and nutrition surveys; Uses of nutrition monitoring data; major population surveys in Bangladesh; advantages and limitations of these surveys
8. Interpreting epidemiological literature: a) Dietary fat and Breast cancer b) Diet and coronary heart disease.
9. Issues in analysis and presentation of dietary data
10. Policy applications: translation of nutritional science into policy; types of nutritional policy; Comprehensive national nutrition policies; Evaluation of nutritional policies
11. Presentation of a chronic disease journal article

Learning and Teaching method:
Formal lectures using available visual aids, e.g., Blackboard, whiteboard, PowerPoint slides, and

practical demonstrations where possible.

Assessment:
Regular attendance (graded), in course assessment (graded), quiz (non-graded), assignment (non-graded), and final examination (graded). A student's grade will be calculated based on a combination of class participation (5%), in course examination (35%) and a final exam (60%).

References:

1. Nutritional Epidemiology (Vol. 40). Oxford University Press. Willett, W., 2012.
2. Basic epidemiology. World Health Organization.Bonita, R., Beaglehole, R., and Kjellström, T., 2006.
3. Nutritional Epidemiology; ILSI monograph.

Course No. NFS- 510 Thesis 6 Credits

Course Overview:
Students will be facilitated, under supervision, in all stages of conducting research. Students will preferably use their research idea, but can also work on an existing research grant/project within the Institute. They will learn how to conduct a literature review, develop a focussed research question and formulate research hypotheses, devise a study design, collect data, analyze data, and
interpret findings.

Learning Outcomes:
1. Formulate a focussed and realistic research question with specific aims, objectives, and hypothesis, based on a literature review
2. Design an appropriate research method to investigate the research question and to test
3. hypotheses
4. Collect, code, enter and manage data
5. Conduct appropriate analyses using software
6. Discuss and interpret study findings and draw sound conclusions
7. Apply results to the wider field of nutrition and food science, and suggestrecommendations

Assessment:
Marks – 150: 60% Thesis Evaluation; 40% Thesis presentation

Course No. NFS- 510 Non-Thesis (Practical) 6 Credits

Course Overview:
The practical course willenable the non-thesis students to learn practical knowledge and skills in three areas: a) Clinical nutrition and diet therapy, b) Applied nutrition, and c) Biochemistry, food science, and food microbiology.

1. Clinical Nutrition and Diet Therapy 2 Credits

1. **Case Study**

a. **Hospital visits** - 7 days

In-patient examination & classes by the teachers/staff of relevant organizations.

The Subjects:

i) Common nutritional disorders: PEM, Vitamin, and mineral deficiencies.
ii) Common infectious diseases: Diarrhea, Dysentery, ARI
iii) Hospital management and rehabilitation of severely malnourished: Children.

b. Viva :

Short cases: (deficiency disorder)

Learning and Teaching method:

Formal lectures using available visual aids, e.g. Blackboard, whiteboard, PowerPoint slides, and hospital visits, practical demonstrations and laboratory works where applicable

Assessment:

Marks – 50: 40% Continuous Assessment; 60% Final Examination

2. Applied Nutrition **2 Credits**

2.1 Assessment of Nutritional Situation of a Community

2.1.1 Basic health information: Mortality and morbidity rates of nutritional diseases

2.1.2 Measuring malnutrition: Anthropometric survey of a nutritionally vulnerable group and development of indicators of malnutrition:

- Indicator(s) of chronic malnutrition
- Indicator(s) of acute malnutrition
- Indicator(s) of composite malnutrition

2.1.3 Interpretation of survey: Distribution of malnutrition within the population and analysis of the contextual factors

2.2 Assessment of Food Security of a Community

2.2.1 Using existing data: Evaluating INFS survey data and comparison withBSS data

2.2.2Collection of primary data:

- Profile of community socio-economic-demographic characteristics
- Profile of community food resources
- Assessment of household food security
- Assessment of food resource accessibility
- Assessment of food availability and affordability
- Assessment of community food production

2.2.3 Analysis and interpretation

2.3.4 Dietary assessment Practical

2.3 Presentation of the study findings

Learning and Teaching method:
Formal lectures using available visual aids, e.g. Blackboard, whiteboard, PowerPoint slides, and assignments, practical demonstrations where applicable

Assessment:
Marks – 50: 40% Continuous Assessment; 60% Final Examination

3. Biochemistry, Food Science and Food Microbiology 2 Credits

A. Biochemistry

1. Estimation of minerals in plant and animal products by AtomicAbsorption Spectrophotometer.
2. Estimation of carotene in food stuffs (green leafy vegetables, yellow fruits).
3. Estimation of vitamin C in food stuffs and biological samples (serum/tissue).
4. Determination of urinary iodine excretion as an index of iodine status.
5. Determination of Hb, serum iron and serum TIBC.
6. Determination of serum lipid profile-total cholesterol, LDL and HDL.
7. Determination of vitamin A and E in biological samples (serum/tissue) by HPLC.
8. Analysis of chemical additives in foods.

B. Food Science and Food Microbiology:

1. Determination of BOD (Biological Oxygen Demand) of untreated water and industrial effluents.
2. Determination (enumeration) of viable microorganisms (bacteria) with special reference to coliforms in water and drink samples by MPN (Most probable Number) method using multiple tube technique.
3. Detection of microbial toxins in foods.
4. Phosphatase test of pasteurized milk and adulteration tests of raw milk.
5. Measurement of water activity (aw)/RH, (relative humidity P.H. and acidity of food substrates concerning the growth of microorganisms.

Learning and Teaching method:
Formal lectures using available visual aids, e.g., Blackboard, whiteboard, PowerPoint slides, and practical demonstrations and laboratory works where applicable

Assessment:
Marks – 50: 40% Continuous Assessment; 60% Final Examination

Course No. NFS- 511 Seminar 2 Credits

Course Overview:
This graduate seminar will provide the opportunity to present a selected and approved topic in front of a scientific audience and to explore topics in detail. This course also focusses on writing narrative review and principles of presentation.

Learning Outcomes:
Upon completion of this course, students should be able to:

- Conduct a comprehensive literature search using all available resources of seminal and

recent research in a specified topic
- Write a critical review of published work relevant to the topic of their research
- Analyze, synthesize and summarise information critically, including published research or Reports
- Learn how to present scientific information including work by others effectively

Content:
1. Guideline and overview of seminar presentation
2. Discussion on the review paper
3. Literature search (PubMed/Google scholar/ EMBASE etc.)
4. Writing research question; Boolean operator, search string, MESH heading,
5. Critiquing research article
6. Group critique of a recently published nutrition article
7. Principles of presentation
8. Preparation of PowerPoint presentations
9. Discussion on writing a good literature review paper; Outline of a review paper; Annotated bibliography; Plagiarism
10. Individual presentation on a selected original research article or a review article

Seminar presentation guidelines:
The course comprises of two sections: A. written and B. Oral presentation including questions and answers

A. Written
1. This part should be limited to 2000 (minimum) to 2500(maximum) words (single-spaced), excluding references and figures. The article and references require the use of either of Arial or Times New Roman, a font size of 11 or 12 points, and one-inch margins. There are no limitations to the number of references, but you have to include at least 20 references.
2. Articles should be from peer-reviewed journals and published within the last ten years.
3. It should contain the following sections: Title, Abstract/summary, Introduction, Materials, or methods (conceptual framework), Results and Discussion, Conclusions, References (at least 20)
4. Harvard Reference Style should have to be followed
5. You have to turn in 5 hard copies of the review paper
6. Plagiarized work will not be accepted and will be graded poorly (submitting work of others)

B. Oral presentation:
PowerPoint presentation; 10-15 slides; Total 20 minutes: 15 minutes for oral presentation and 5 minutes for questions and answers

Assessment:
Total marks 50:Class participation-5%, Written review paper-35% marks and Oral presentation-60%

References:
1. Forister, J.G. and Blessing, J.D. eds., 2015. Introduction to research and medical literature for health professionals. Jones & Bartlett Publishers.

2. How to Prepare an Annotated Bibliography: The Annotated Bibliography
3. Purdue online writing Club.

Course No. NFS- 521 **VivaVoce** **2 Credits**

The oral examination is designed to assess the student's aptitude and potential to perform as an independent nutritionist and food scientist professional ultimately.

Assessment: Total Marks – 50