

MAHARAJA GANGASINGH UNIVERSITY, BIKANER

SYLLABUS

**SCHEME OF EXAMINATION AND
COURSES OF STUDY**

**FACULTY OF SCIENCE
M.Sc. Food & Nutrition
Previous Examination 2017-18
Final 2018-2019**



MAHARAJA GANGASINGH UNIVERSITY, BIKANER

EDITION : 2017-18

SCHEME OF EXAMINATION

1. The number of paper and the maximum marks for each paper practical shall be shown in the syllabus for the subject concerned. It will be necessary for a candidate to pass in the theory part as well as in the practical part (Whenever Prescribed) of a subject/Paper separately.
2. A candidate for a pass at each of the Previous and the Final Examination shall be required to obtain (i) atleast 36% marks in the aggregate of all the paper prescribed for the examination and (ii) atleast 36% marks in practical (s) whenever prescribed the examination, provided that if a candidate fails to atleast 25% marks in each individual paper work. Wherever prescribed, he shall be deemed to have failed at the examination not with standing his having obtained the minimum percentage of marks required in the aggregate for the examination. No division will be awarded at the Previous Examination, Division shall be awarded at the end of the Final Examination combined marks obtained at the Previous and the Final Examination taken together, as noted below:

First Division	60%	of the aggregate marks taken together
Second Division	48%	of the Previous and the final examination
3. If a candidate clears any paper (s) Practical(s)/Dissertation Prescribed at the Previous and or/final examination after a continuous period of three years, then for the purpose of working out his division the minimum pass marks only viz 25% (36% in the case of practical) shall be taken into account in respect of such paper(s) Practical(s) Dissertation are cleared after the expert of the aforesaid period of three year, provided that in case where a candidate require more than 25% marks in order to reach the minimum aggregate as many marks out of those actually secured by him will be taken into account as would enable him to make the deficiency in the requisite minimum aggregate.
4. The case study report/survey report/field work shall be hand written and shall not be of more than 100 pages and is to be submitted in triplicate so as to reach the office of the registrar at least 3 weeks before the commencement of the theory examination. Only such candidate who shall be permitted to offer

case study/survey report/field work (if provided in the scheme of examination) in lieu of a paper as those who have secured at least 55% marks in the aggregate, irrespective of the number of paper in which a candidate actually appeared at the examination.

N.B. (i) Non-collegiate candidate shall not be eligible to offer case study/survey report.

M.Sc. (Previous) FOOD AND NUTRITION
Programme of Study and Examination Scheme (2017-18)

Paper No.	Nomenclature of Paper	Marks	
		Theory	Practical
I	Research Methodology, Statistics and Computer Application	75	-
II	Applied Physiology	75	25
III	Advanced Nutritional Biochemistry	75	25
IV	Advanced Nutrition & Food Microbiology	75	(25+25)=50
	Total	300	100
	Grand Total of M. Sc. Previous (400+100)	400	

M.Sc. (Final) FOOD AND NUTRITION
Programme of Study and Examination Scheme (2018-19)

Paper No.	Nomenclature of Paper	Marks	
		Theory	Practical
V	Institutional Food Service Management	50	50
VI	Food Science	50	50
VII	Public Nutrition Food Safety and Quality Control	50	50
VIII	Clinical and Therapeutic Nutrition	50	50
IX	Case study in relevant area	100	-
	Total	300	200
	Grand Total of M. Sc. Final (500+200)	500	
	Grand Total Of M.Sc. (Previous & Final) 500+ 700	900	

PAPER I

RESEARCH METHODOLOGY

Duration of Examination : 3 hrs.

Max. Marks : 75

Note:-

The question paper shall contain three sections. **Section A** contains 10 questions two from each unit of 2 marks each. The candidate is required to answer all the questions. The answers should not exceed 50 words. **Section B** shall contain 5 questions one from each unit with internal choice. Each question shall be of 5 marks. The answers should not exceed 200 words. The candidate is required to answer all the questions. **Section C** shall contain 5 questions of 10 marks each, one from each unit. The candidate is required to answer 3 questions. The answer shall not exceed 500 words.

Objectives: To enable the student to:

1. Understand the significance of statistics and research methodology in Home Science research.
2. To understand the types, tools and methods of research and develop the ability to construct data gathering instruments appropriate to the research design.
3. To understand and apply the appropriate statistical technique for the measurement/scale and design.

Contents:

Unit - I

1. Science, Scientific methods, scientific approach. Objectives of research.
2. (a) An overview of the research process, Criteria of good research, common problems encountered during research studies. Qualities of a good researcher.
(b) Types of Research: Historical, descriptive, experimental, case study, social research, and participatory research.
3. Definition and identification of a Research problem
 - Selection of research problem

- Justification
- Theory, hypothesis, basic assumptions, limitations and delimitations of the problem

4. Variables

Types of variables independent and dependent variables, qualitative and quantitative, discrete and continuous. Error producing variables intervening, extraneous and attribute variables, methods of controlling variables.

5. Theory of probability

- Population and sample
- Probability sampling, simple random, systematic random sampling. two stage and multi stage sampling, cluster sampling
- Non-Probability sampling: purposive, quota and volunteer sampling snowball sampling.

Unit - II

6. Basic Principles of Research Design

Purposes of research design: Fundamental, applied and action, exploratory and descriptive, Experimental, Survey and case study, Ex-post facto.

- Longitudinal and cross sectional correlational

7. (a) Qualitative research methods:

- Theory and design in quantitative research.
- Definition and types of qualitative research
- Methods and techniques of data collection

(b) Data gathering instruments: Observation, questionnaire, interview, sealing methods, case study, reliability and validity of measuring instruments.

8. Quantitative research:

- (a) Design strategies in Research - Descriptive studies, Brief overview of types of descriptive studies
 - Co-relational studies (Populations/individuals)
 - Case reports and case studies
 - Cross sectional surveys
- (b) Use of descriptive studies in research. Hypothesis formulation form discipline studies. Issues in the design and conduct of descriptive studies.

Unit - III

- 9. Selecting a problem and writing a research proposal
 - Selection of problem area, topic and defining the problem.
 - Literature search - reviewing related literature, referencing abstracting computer searches bibliography.
 - Developing the research proposal - title, statement of the problem and its scope. defining concepts, objectives, basic assumption. Delimitations and limitations of the problems.
 - Statement of hypothesis
 - Data collection procedures - Designing study, treatment of data.
- 10. Analyses / presentation and reporting of Data
 - (a) Data processing and analysis. Categorization, Editing, coding, tabulation and statistical testing.
 - (b) Presentation of data-General guidelines for presenting data. Use of tables, graphs, diagrams, in presentations. Types and characteristics of good tables. diagrams. Graphs and other illustration.
 - (c) Interpretation of findings.
- 11. Scientific writing as a means of communication.
 - Different forms of scientific writing
 - Articles in journals, Research notes and reports, Review articles, monographs, Dissertations, Bibliographies.

12. Writing Dissertation / Research report/Article
 - (a) Preliminaries - title page, acknowledgement index, List of tables list of figures, plates photographs. Etc.
 - (b)
 - (i) Text, Footnotes quotations
 - (ii) Spacing, Margins, Pagination indentations.
 - (c) Writing
 - (i) Introduction Scope, Objective, Hypothesis
 - (ii) Review of related literature
 - (iii) Methodology
 - (iv) Results and discussions
 - (v) Summary, conclusions and recommendations
 - (vi) Bibliography
 - (vii) Abstract

Checking content, Continuity, clarity, validity internal consistency and objectivity during writing each of the above parts.

Unit - IV

13. Meaning and scope of statistics, role of statistics in research limitation of statistics.
14. Conceptual understanding of statistical measures. Classification and tabulation of data. Measurement of central tendency, Measures of variation.
15. Frequency distribution, Histogram, Frequency. Polygons Ogive.
16. Application of Student's 't' test for small samples. Difference in proportion for means and difference in means

Unit – V

17. Correlation, Coefficient of Correlation, Rank Correlation
18. Regression and Prediction.
19. Analysis of Variance - one way and two - way classification.
20. Experimental Designs

- (a) Completely randomized design
 - (b) Randomized block design
 - (c) Latin square design
 - (d) Factorial design
 - (e) Trend analysis
21. The computers its role in research. World Processing. Use of computers in Data processing Analysis and Presentations.

References :

1. Kothari C.R. (1990), Research Methodology - Methods and techniques (2nd Ed) Wishwa Prakashan, C.A. Division of wiley Easten Ltd. New Delhi.
2. Baumgartnea, T.A. and Strong C.H. (1994) Concluding and reading Research in Health and Human performance Brown and benchmark (A Division of Wm. C. Brown Communication Inc.)
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4. Gupta, S. (199) Research Methodology and Statistical Techniques, Deep and Deep Publication, New Delhi.
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11. Walker, R. (1983) : Applied Qualitative Research. Gower, London
12. Morgan, D. (1988) : Focus Groups as Qualitative Research Sage Publications, London.
13. Creswell, J. (1994) : Research Design Qualitative and Quantitative Approaches, Thousand Oaks. CA. Sage Publication.
14. Morgan, D. (1993) : Successful Focus Groups, Sage publications.

15. Mischler, E.G. (1986) : Research interviewing Context and Narrative, Harvard University Press. Cambridge.
16. Denzin, N.K. And Lincoln, Y.S. (1994) Hand book of qualitative Research. Sage Publications.
17. Janesick, V.J. (1998) : Stretching exercise for Qualitative Researches. Sage Publication.
18. Mienert, C.L. (1986) Clinical Trials Design Conduct and Analysis Oxford New York.
19. Schlesselman J.J. (1982) : Case Control Studies : Design, Conduct and Analysis Oxford New York.
20. Bryman. A and Cramer, D. (1994) : Quantitative Data/Analysis for Social Scientists.
21. Bryman, A and Cramer D. (1996) : Quantitative Data Analysis with Minitab's. Rutledge, London.
22. Cameron, M.E. and Van Staveren, W.A. (1988) : Manual on Methodology for food consumption studies. Oxford University press, Oxford
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29. Minium EW, ; King BM. And Bear G. (1995) : Statistical Reasoning In Psychology and Education (4th Ed). John wiley and Sons.

30. Samples Ml. : Statistics for Life Science. Deller Publicity Company & Coller Mc. Million Publishers.
31. Daniel WW : Biostatistics : A found action for analysis in the health sciences (3rd Ed) John Wiley and Sons.
32. Gomer, KA. And Gomer A.A. : Statistical Procedures for agriculture research (2nd Ed) A Wiley interscience publication John Wiley and Sons.
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PAPER II

Applied Physiology

Duration of Examination : 3 hrs.

Max. Marks : 75

Note:-

The question paper shall contain three sections. **Section A** contains 10 questions two from each unit of 2 marks each. The candidate is required to answer all the questions. The answers should not exceed 50 words. **Section B** shall contain 5 questions one from each unit with internal choice. Each question shall be of 5 marks. The answers should not exceed 200 words. The candidate is required to answer all the questions. **Section C** shall contain 5 questions of 10 marks each, one from each unit. The candidate is required to answer 3 questions. The answer shall not exceed 500 words.

Objectives :

This Course will enable Students to :

1. Advance their understanding of some of the relevant issues and topics of human physiology
2. Enable the students to understand the integrated function of all system and the grounding of nutritional science in physiology.
3. Understand alternation of Structure and function in various organs and Systems in disease conditions.

Unit - I

1. Ultra structure and functions of cell and cell organelles. Structure of Cell membrane, active transport of nutrients and metabolites, intercellular communications.
2. The Circulatory System: Structure and function of the heart and blood vessels. Regulation of cardiac output. Cardiac cycle. Blood pressure and factors affecting it, Heart failure.
3. Blood Formation: Composition, blood clotting and homeostasis functions of blood, composition of blood, Blood cells, Normal Constituents of Blood, Plasma and Serum, Formation and Functions of hemoglobin, erythropoiesis and anemia. Leucocytes-genesis and functions. Regulation of pH of blood and body fluids blood groups and histocompatibility blood indices. Use of Blood for investigation and diagnosis of specific disorders blood coagulation- mechanism, Conditions causing excessive bleeding, anticoagulants.

4. Regulation of body temperature, thermogenesis, thermolysis, pyrexia, hypothermia.

Unit - II

5. Digestive system: Review of structure and functions of various organs of gastrointestinal tract. Secretory, Digestive and Absorptive Functions. Role of Liver, Pancreas, Gall bladder and their dysfunction. Motility and Regulation of the GIT.
6. Respiratory Systems: Review of Structures and Functions. Pulmonary ventilation Role of Lungs in the exchange of gases. Transport of O₂ and CO₂ in the lungs. Blood and tissues. Role of hemoglobin and buffer systems. Cardio-respiratory response to exercise and physiological effects of training. Regulation of reparation. Aviation high altitude and space physiology.

Unit - III

7. Excretory System: Physiology of kidneys. Structure and function of nephron. Urine formation Normal and abnormal constituents of urine. Role of kidney in maintaining pH of blood, water, electrolytes, acid-base balance diuretics.
8. Musculo-Skeletal System - structure and function of bone, cartilage and connective tissue. Disorders of the skeletal system. Types of muscles, structure and function.
9. Immune system: Structure and functions of thymus and spleen. Activation of WBC and production of antibodies. Role of inflammation and defense. Allergy and hypersensitivity. Nutritional immunity and infection-interactions

Unit – IV

10. Nervous system: Review of structure and function of neuron, Conduction of nerve impulse, Synapses. The resting Potential, the action potential and its characteristics. Mechanism of Synaptic. Transmission. Reflex action. Role of neurotransmitters. Organization of the central nervous System Structure and function of brain and spinal cord, afferent and efferent

nerves, Blood brain barrier, CSF Hypothalamus and its role in various Body functions - obesity, Sleep and memory.

11. Endocrine System: Endocrine Glands- Structure, function, Chemistry, Storage, Secretion, Regulation of hormonal secretion. Mechanism of action of hormones. The Neuro endocrine axis. Emphasis on Physiological of Diabetes and stress hormones. Physiological functions and abnormalities in secretion of pituitary, Thyroid, Parathyroid hormones, adrenocortical and reproductive hormones. Disorders of endocrine glands.
12. Sense Organs: Review of structure and functions. Role of skin, Eye, ear, Nose and tongue in perception of stimuli. Physiology of vision, hearing taste and smell.

Unit - V

13. Techniques of assessment of nutritional status of individual and populations.
14. Direct and indirect methods, advantages and limitations of methods.

PRACTICAL

Hours of instruction per week : 1

Max. Marks : 25

Contents:

1. Estimation of hemoglobin.
2. Identification of blood groups.
3. Preparation of blood slide.
4. Identification and counting of blood cells.
5. Haematocrit and sedimentation rate.
6. Measurement of blood pressure.
7. Examination of abnormal constituents of urine.
8. Estimation of glucose and cholesterol in blood.
9. Survey to pathological laboratories to obtain information about blood/serum analysis.

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PAPER III

ADVANCED NUTRITIONAL BIOCHEMISTRY

Duration of Examination : 3 hrs.

Max. Marks : 75

Note:-

The question paper shall contain three sections. **Section A** contains 10 questions two from each unit of 2 marks each. The candidate is required to answer all the questions. The answers should not exceed 50 words. **Section B** shall contain 5 questions one from each unit with internal choice. Each question shall be of 5 marks. The answers should not exceed 200 words. The candidate is required to answer all the questions. **Section C** shall contain 5 questions of 10 marks each, one from each unit. The candidate is required to answer 3 questions. The answer shall not exceed 500 words.

Objectives :

To enable the students to:

1. Understand the biochemical basis for nutrition and health.
2. Understand the mechanisms adopted by the human body for regulation of metabolic pathways.
3. Get an insight into interrelationships between various metabolic pathways.
4. Become proficient for specialization in nutrition.
5. Understand integration on the cellular level metabolic events to nutritional disorders and imbalances.

UNIT - I

1. Carbohydrates-and type of polysaccharides. Important reactions of monosaccharides. Carbohydrates - Utilization function, Hormonal control of Carbohydrate Homeostasis, Dietary fiber-Composition, Physiological effects, Recommended levels of dietary fiber consumption.
2. Lipids-Classification of lipids and fatty acids, chemical properties of lipids-hydrolysis, saponification, hydrogenation, hydrogenation and acetylation. Characteristics of fats. Saponification number, acid number, Reichert-Meissel number, UV absorption. Rancidity of fats & oils. Lipids - Utilization & function, essential fatty acids, role of n_3 and n_6 fatty acids, triglycerides, Phospholipids, Sterols, Lipoprotein classification & their importance.

UNIT - II

3. Proteins-classification of amino acids, reactions, methods of separation of amino acids-chromatography, micro-biological, electrophoretic methods. Peptide bonds, Structure of Proteins, Denaturation of proteins. Plasma proteins-nature, properties, functions. Structures of Insulin, Myoglobin and Haemoglobin. Proteins - Utilization & function, transport & assimilation of protein turnover, Hormonal control of protein metabolism, Evaluation of protein quality,
4. Nucleic Acid-Synthesis and breakdown of purines and pyrimidines. Structures of DNA and RNA. DNA replication and transcription. Genetic code. DNA repair systems. Recombinant DNA technology. Genetic mutation, regulation of gene expression and protein biosynthesis.

UNIT-III

5. Vitamins-structure, metabolism and biochemical role. (Fat Soluble and water soluble)
6. Minerals-functions of all essential minerals in nutrition with special emphasis on the biological role of Trace elements. (Macro Elements, Trace Elements, Ultra Trace Elements)
7. Hormones-biochemical role of adrenocorticotrophic hormone, follicle stimulating hormone, leutinising hormone, human chorionic gonadotropin, growth hormone, thyroxine, thyroid stimulating hormone, Insulin, Glucagon, hormone of the Adrenal cortex, male and female sex hormones. Mechanism of action of hormones.

UNIT - IV

8. Enzymes-classification, general properties, catalysis, coenzymes, specificity, isolation and purification, intracellular distribution of enzymes, allosteric enzymes, Isoenzymes. Kinetics-effect of time, temperature, pH on velocity of enzyme catalyzed reactions, inhibition of enzymes, importance in clinical diagnosis.
9. Biological oxidation-concept of free energy, redox potential oxido-reductases, oxidases, dehydrogenases, hydroperoxidases and oxygenases. Oxidative phosphorylation and mitochondrial transport system.

UNIT - V

10. Intermediary Metabolism.
 - (a) Overview of intermediary metabolism.
 - (b) Carbohydrate: Glycolysis, Glycogenolysis, Glycogenesis.
Gluconeogenesis, Citric Acid Cycle, Hexose monophosphate shunt.
 - (c) Lipids: β -oxidation of odd and even numbered saturated fatty acids, mitochondrial and extramitochondrial system for de novo synthesis, microsomal system for chain elongation. Biosynthesis of cholesterol formation and metabolism of Ketone bodies. Ketosis. Biosynthesis of triacyl glycerols and phospholipids, mono acylglycerol pathway. Essential fatty acids.
 - (d) Interrelationship between carbohydrate and lipid metabolism at organ level, enzymatic level hormonal level and regulatory level.
 - (e) Protein: Urea cycle. creatine and creatinine and creatinine synthesis, deamination of amino acids, metabolism of non protein amino acids. Biologically active peptides and polypeptides.
11. Inborn Errors of Metabolism: incidence, clinical changes and treatment of phenylketonuria, maple syrup urine disease, homocystinuria, leucine induced hypoglycemia, galactosemia, hereditary fructose intolerance, Wilson's disease and familial hypercholesterolemia.

PAPER – III
ADVANCE NUTRITIONAL BIOCHEMISTRY

PRACTICAL

Hours of Instruction/week : 2

Max. Marks : 25

Contents :

1. Qualitative analysis of carbohydrates.
2. Qualitative analysis of amino acids.
3. Qualitative analysis of proteins.
4. Determination of acid value, saponification value and iodine number.
5. Demonstration on estimation of nitrogen by kjeldhal method.
6. Demonstration on estimation of soxhelet method.
7. Determination of P^H
8. Demonstration of chromatography and electrophoresis techniques.

References :

1. West, E.S., Todd, W.R., Nelson, H.S. and Vanbrugger, T.T. : Textbook of Biochemistry Oxford and IBH Publishing Corp.
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PAPER IV

ADVANCED NUTRITION AND FOOD MICROBIOLOGY

Duration of Examination : 3 hrs.

Max. Marks : 75

Note:-

The question paper shall contain three sections. **Section A** contains 10 questions two from each unit of 2 marks each. The candidate is required to answer all the questions. The answers should not exceed 50 words. **Section B** shall contain 5 questions one from each unit with internal choice. Each question shall be of 5 marks. The answers should not exceed 200 words. The candidate is required to answer all the questions. **Section C** shall contain 5 questions of 10 marks each, one from each unit. The candidate is required to answer 3 questions. The answer shall not exceed 500 words.

Objectives :

To enable the students to:

1. Understand the body composition and pattern of growth and development as influenced by nutrition.
2. Be aware of the current trends in the area of human nutrition requirements - the methods of determining nutrient requirements and current figures of nutritional requirements.
3. Interpret and critically evaluate parameters of nutritional status assessment.
4. Know advances in the field of energy, carbohydrate, lipid and protein nutrition.
5. Know recent developments in the field of vitamins and minerals.
6. Understand the importance of vegetarian diet.

UNIT - I

1. Body composition - Normal body composition methods used for measuring body composition, compositional changes during the life cycle -
 - (a) Human foetal development
 - (b) Maternal weight gain-distribution and composition
 - (c) Compositional changes between birth and maturity
 - (d) Compositional changes with weight changes-obesity and leanness
 - (e) Effect of physical activity and disease.

2. Nutritional assessment - Interpretation and critical evaluation (with respect to sensitivity, specificity and accuracy) of various parameters and indices for the assessment of nutritional status of individuals -(a) Direct parameters- anthropometry, clinical examination, biochemical, biophysical, dietary surveys (2) Indirect parameters - vital statistics (3) Ecological - cultural influences, food production, socioeconomic factors, health and education services.

UNIT - II

3. Nutrient needs and recommended dietary allowances-
general principles of deriving RDA, RDA recommendations by nutrition expert groups by nutrition expert groups for energy and nutrients.
 - (a) Energy - Assessment of energy requirements, reference man and woman, factorial approach for estimating energy requirements, energy requirements during life cycle. Guidelines for the use of RDA of energy, variability in energy requirements and their implication for assessing energy deficiency.
 - (b) Protein - Protein quality, protein requirements during life cycle, protein calorie ratio of diets.
 - (c) Fat-Fat intake, invisible fat and their significance in Indian diet, quality of fat, EFA requirements, fat requirements for various age groups, upper limit of fat.
 - (d) Minerals & Vitamins - Sodium, Potassium, trace elements, iron, vitamin A, thiamine C and Vitamin D.
4. Energy : Energy content of food, Physiological fuel value-review, measurement of energy expenditure : BMR, RMR, thermic effect of feeding & physical activity, methods of measurement, Regulation of energy metabolism - control of food intake, digestion, absorption & body weight.
5. Diet in work and exercise - fueling muscles, using Glucose as a muscle fuel, performance, fueling muscles using fat. The body response to exercise, Power food : What should an athlete eat, principle for meeting overall nutrition needs in the training diet.
6. Vegetarianism

UNIT - III

7. Introduction to food preservations, role of bacteria and fungi, sources, taxonomy, morphology, cultural and physiological characteristics and biochemical activities.
8. Factors Affecting Growth of Microorganisms-intrinsic and extrinsic factors like pH, water activity, oxidation reduction potential, nutritional requirements, temperature, relative humidity, gaseous, environment, biological structure of food and inhibitory substances.
9. Methods of isolation and Detection of Microorganisms of their products in food.
 - (a) Conventional methods.
 - (b) Rapid method (Newer techniques)
 - (c) Immunological methods-fluorescent, antibody, radio immune assay, ELISA etc.
 - (d) Chemical methods-Thermostable, nuclear, ATP measurement and PCR (Polymer chain reactions)-only principles in brief.

Unit – IV

10. Sources of contamination of food-Water, air, soil, sauage, animals, during handing and processing.
11. General principles underlying spoilage.
 - (a) Chemical changes due to microbial spoilage.
 - (b) Spoilage of different groups of foods-cereal and cereal products, vegetables and fruits, meat and meat product, egg and poultry, fish and other sea foods, sugar, milk and milk products, canned food.
12. Role of microbes in fermented food and genetically modified foods oriented fermented foods, malt, bread, beverages, vinegar fermented vegetables, fermented daily products, tea and coffee. Single cell protein, fats, amino acids and enzymes from microorganisms.

Unit - V

13. Food Preservation-Physical methods. Chemical preservatives and natural antimicrobial compounds. Food Borne Diseases-infections and intoxications.

Bacterial and viral food borne disorders. Food borne important animal parasites
Mycotoxins.

14. Food Sanitation-microbiology in food plant sanitation, bacteriology of water, sewage and waste treatment and disposal. Microbiology of the food product. Indicators of food safety and quality-microbiological criteria of foods and their significance.
15. HACCP system and food safety used in controlling microbiological hazards. Food control and enforcement agencies. Microbiological standards of food and water.

PRACTICAL

PART A

Hours of Instruction/week : 3

Max. Marks : 25

Objectives :

The aim of the course is to :

1. Familiarize students with basic techniques used in studies and research in nutritional sciences.
2. Acquaint students with the methods of estimating nutrient requirements.
3. Orient students towards planning of metabolic studies.

Contents :

1. Estimation of protein quality using different methods - PEF, BV, NPU, NDP - Cal %
2. Assessment of nutritional status of 0-5 years old children using standard growth chart-weight for age, height for age. weight for height, skin fold thickness, head & chest circumference & various other indices.
3. Field Observation on some nutritional problems-case study (assessing the nutritional status using anthropometry, clinical assessment, biochemical estimations & dietary survey.

PART B

25 Marks

Contents :

1. Cleaning and sterilization procedures for glassware.
2. Preparation and sterilization of laboratory media.
3. Staining of bacteria-gram's staining, use of oil immersion lens, micrometry, microscopic enumeration.
4. Spread plating, pour plating, streaking techniques.
5. Study of environment around us as sources of transmission of microorganisms in food-assessment of surface sanitation of food preparation units swab and rinse techniques.
6. Microbiological analysis of fruits and vegetables using selected standards methods.

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- Periodicals :
1. Nutrition Abstract & Rev.
 2. Wild, Rev. Nutrition Dies.
 3. Journal of Nutrition Education.
 4. American Journal of Clinical Nutrition.
 5. Journal of Biological Chemistry.
 6. JAMA
 7. Journal of Chronical Diseases.
 8. UMR
 9. American Journal of Physiology
 10. Ecology of Foods and Nutrition.
 11. Metabolism
 12. Circulation.
 13. Proc. Nutr. Soc. India.
 14. Indian Journal of Nutrition and Dietetics.
 15. NFI Balletin-Bulletin of Nutrition Foundation of India.
 16. Lancet.
 17. Br. J. Nutrition.

M.Sc. Final (2018-19)

PAPER V

INSTITUTIONAL FOOD SERVICE MANAGEMENT

Duration of Examination : 3 hrs.

Max. Marks : 50

Note:-

The question paper shall contain three sections. **Section A** contains 5 questions two from each unit of 2 marks each. The candidate is required to answer all the questions. The answers should not exceed 50 words. **Section B** shall contain 5 questions one from each unit with internal choice. Each question shall be of 4 marks. The answers should not exceed 200 words. The candidate is required to answer any 4 questions. **Section C** shall contain 5 questions of 8 marks each, one from each unit. The candidate is required to answer 3 questions. The answer shall not exceed 350 words.

Objectives :

To enable the students to understand the process of planning, organizing and controlling the management of food and other resources in institutions.

Unit I

1. Types of Food Service Institutions.
2. Definition of Catering Management.
3. Principles of Management.
4. Functions and Tools of management in food service institutions.

Unit II

5. Personnel Management.
Selection and training, desirable qualities.
6. Menu Planning.
Types and writing of menu.
7. Food Service.
Styles of service.

Unit III

8. Meal service management.
Quantity food production.

9. Standardization of recipes.
10. Quality control, use of left over foods.

Unit IV

11. Financial Management –
Terms used, budgeting.
12. Account Keeping – books records and record keeping.
13. Cost Control – Calculation and methods of controlling food cost.

Unit V

14. Planning of layout for food service institutions.
15. Selection and care of equipments.
16. Sanitation and hygiene in handling foods.
17. Preventive measures to control the common accidents.

PRACTICAL

Hours of Instruction/week : 2

Max. Marks : 50

Contents :

1. Standardization of recipes.
2. Planning, preparation and modification in basic recipes.
3. Quantity food production and cost calculations.
4. Preparation of menu cards of various types.
5. Menu planning and table setting.
6. Maintenance of account and record keeping.
7. Visit to different types of food service, institutions and study the following:
Organization, physical plan and layout, menu cards, serving style, table setting, personnel work schedule, hygiene and sanitation, safety measures.
8. Practical experience in organization and management of a college cafeteria/ hostel/ hotels.
9. Planning and preparations for special occasions birthday, festivals, packed lunches.

Reference:

1. Fuller, J. 1966. Chefs Manual and Kitchen Management, B.T. Badts Ford Ltd., London.
2. Sethi, M and Malhan, S. 1993. Catering Management – An integral approach, Wiley Eastern Limited, New Delhi.
3. West BB, Wood, L. Harger, V.F. and Shugert, G.S. 1977, Food Service in Institutions. John Wiley and Sons, NewYork.
4. Kotschevar, L.H. 1961, Food Service, Layout and Equipment Planning, John Wiley and Sons. Inc., USA.

PAPER VI

FOOD SCIENCE

Duration of Examination : 3 hrs.

Max. Marks : 50

Note:-

The question paper shall contain three sections. **Section A** contains 5 questions two from each unit of 2 marks each. The candidate is required to answer all the questions. The answers should not exceed 50 words. **Section B** shall contain 5 questions one from each unit with internal choice. Each question shall be of 4 marks. The answers should not exceed 200 words. The candidate is required to answer any 4 questions. **Section C** shall contain 5 questions of 8 marks each, one from each unit. The candidate is required to answer 3 questions. The answer shall not exceed 350 words.

Objectives :

This course is designed to help student to :

1. Gain knowledge regarding the physical and chemical properties of the food constituents.
2. Understand the chemical reactions and physical changes which occur during the production, processing, storage and handling of foods and their applications.
3. Be familiar with the recent advances and research in the field.
4. Be familiar with effects of reactions on the quality and safety of food. Content.

UNIT - I

1. Introduction to Food Science : Evaluation of the food industry. Emergence of Food Science as a discipline.
2. Basic physio-chemical concepts of importance in food system-Hydrogen ion concentration (pH), Osmotic pressure, Isoelectric points of proteins, Solutions, Colloidal Systems - Properties of Colloidal Systems, Types of Colloidal dispersion existing in food system - Soles, gels, foams and emulsions, browning reactions in food - enzymatic and non - enzymatic.

UNIT - II

3. Functional properties of food constituents in terms of their chemical and physiochemical properties-

- (a) Polysaccharides. Sugars and Sweeteners -
 - (i) Starch : Structure, Functional properties of Starch - Gelatinization, Gelatin. Retrogradation . Dextrinization. modified food starches.
 - (ii) Non-starch polysaccharides: Cellulose, Hemi-cellulose, Pectic substances. Gums and Lignins.
 - (iii) Sugars and Sweeteners Functional properties of Sugars - Sweeteners. Hygroscopicity, Solubility, Hydrolysis, Degradation, Caramelization, the Maillard reaction. Crystallization. Fermentation, Food applications - Crystalline candies. Amorphous candies. Types of sweetener.

UNIT - III

- 4. Functional properties of proteins in different foods during processing-
 - (a) Cereals and Cereal products - Flours and flour quality, Gluten, Factors affecting hydration of gluten. roles of ingredients in baking process. Cereal produces - Extruded foods, breakfast cereals, wheat germ, bulgar, puffed and flaked cereals.
 - (b) Milk and Milk Products - Milk proteins, effect of heat, enzymes, acid and salt on milk protein. Processing of milk (pasteurization, Homogenization, Evaporation, Drying and Fermentation). Milk products - milk, butter, cream, cheese, whey and ice cream.
 - (c) Eggs and Egg Products - Egg proteins, Processing of egg - Drying, Freezing, Functional properties of egg - Coloring, Emulsification, Denaturation and Coagulation, Foaming.
 - (d) Meat and Poultry - Meat proteins, Factors affecting quality - Maturity postmortem changes, Effect of cookery - Heat, pH, Salt, Tenderizers.
- 5. Fats and Oils - identification of Natural fats and oils, Flavour changes in fats and oils, the Technology of Edible oils and fats, Functional roles of fat Colour, Flour, Texture, Tenderness, Emulsifier, Cooking medium.

UNIT - IV

- 6. Additional Food Constituent - Their role in improving functional properties.

- (i) Enzymes - Enzymes in food Processing, Carbohydrates, Proteases, Lipases, Oxidoreductase, Immobilized enzymes.
- (ii) Pigments - Pigments in food processing - Chlorophylls, Myoglobin, Anthocyanins, Flavonoids, Tannins, Betalins, Quinones, and Xanthenes, Carotenoids.
- (iii) Flavour Compounds - Terpenoids, Flavonoids, Sulphur compounds, Volatile flavour compounds.
- (iv) Minerals - Role minerals in food processing.
- (v) Water - Water contents of food, significance of water, bound water, water activity.

UNIT - V

- 7. Chemical, Physical and Nutritional alterations occurring in food products during.
 - (b) Freezing - Changes in food during refrigerated storage, Immersion freezing with cryogenic liquids.
 - (c) Thermal processing.
 - (d) Dehydration - Effect of food properties on dehydration.
 - (e) Irradiation - Food irradiation, direct and indirect effect, safety and wholesomeness of irradiated food.
 - (f) Microwave heating - Properties of microwaves, microwave food application.
 - (g) Ohmic heating.

Reference:

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4. Early, R. The technology of dairy products. VCH publishers, INC.
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17. Mathindru. S.N. (2000) Food Additives - Characteristics - Detection and Estimation Tata McGraw Hill Publishing Co. Ltd.
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21. FAO food and Nutrition Paper: Manual of Food Quality Control - Parts 14 1 (1979) to (1986), FAO of the United Nations Rome.

PRACTICAL

Hours of Instruction/Week : 3

Max Marks : 50

Objectives :

1. Be familiar with tests used for various food components.
2. Know the tests used for detection and/or estimation of various substances naturally present/added to foods.
3. Understand the effect of cooking and processing on foods in terms of colour flavour, texture, consistency and overall acceptability.
4. Apply this knowledge for ensuring quality of food products and minimizing or eliminating adverse effects associated with cooking & Processing.

Contents :

1. Starch cookery -
 - (a) Study the microscopic structure of different starches before & after cooking.
 - (b) Study the gelatinization properties of food starches and various factors affecting the gelatinization properties & setting quality of food starches.
2. Sugar cookery -
 - (a) Study the effect of temperature on solubility of sugar and determine the concentrations at which solutions become saturated.
 - (b) Study the effect of sugar on the boiling point of water.
 - (c) Determine the effect of heat on sugar solutions and observe their behaviour corresponding to thread & cold water test.
 - (d) Demonstrate the process of sugar recrystallization through the preparation of fondant, fudge and shakarpara.
 - (e) Study the process of inversion, melting and caramelization in sucrose.
3. Milk cookery - determine the relative density of milk at different temperatures. effect of heat and acid on the proteins of milk.
4. Egg cookery - study the effect of cooking time on the colour. texture & acceptability of whole egg. observe the effect of method of cooking the coagulation property of eggs.
5. Visits to commercial food manufacturing packaging units where food products are developed and tested.

References for Practical:

1. Sharma. S. Practical biochemistry, classic publishing house, Jaipur, 1993.

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PAPER VII

PUBLIC NUTRITION, FOOD SAFETY AND QUALITY CONTROL

Duration of Examination : 3 hrs.

Max. Marks : 50

Note:-

The question paper shall contain three sections. **Section A** contains 5 questions two from each unit of 2 marks each. The candidate is required to answer all the questions. The answers should not exceed 50 words. **Section B** shall contain 5 questions one from each unit with internal choice. Each question shall be of 4 marks. The answers should not exceed 200 words. The candidate is required to answer any 4 questions. **Section C** shall contain 5 questions of 8 marks each, one from each unit. The candidate is required to answer 3 questions. The answer shall not exceed 350 words.

Objectives :

This course will enable the student to :

1. Develop a holistic knowledge base and understanding of the nature important nutrition problems and their prevention and control for the disadvantaged and upper socio-economic strata in society.
2. Understand the causes/determinants and consequences of nutrition problems in society:
3. Be familiar with various approaches to nutrition and health intervention programmes and policies.

UNIT - I

1. Definition and key concepts - community, nutritional anthropology, community health & community nutrition. Role of public nutritionists the health care delivery. Ecology of Health & Specific determinants of food behavior
2. Population Dynamics - Demographic transition, population structure, fertility behaviour, population policy, fertility, nutritional and quality life - interrelationship.
3. Health Economics and Economics of malnutrition - Social and behaviour consequences, economic losses - reduced physical and mentalefficiency, loss due to premature deaths, underutilization of potential women and the ultimate cost of

under nutrition. Impact on national development. Cost-benefit, cost effectiveness and cost efficiency. .

4. Sectors and public policies relevant to nutrition & Primary health care of the community - National health care delivery system determinants of health status, indicators of health.

UNIT - II

5. Magnitude and background of the problem of malnutrition in India.
6. Nutritional status –
 - (a) Nutrition and non-nutritional indicators.
 - (b) Planning and conducting a nutritional status assessment survey.
 - i. Defining scope and objectives of survey, defining population and selecting samples.
 - ii. Selecting and standardizing parameters.
 - iii. Executing the survey-organizing team, materials, training and field testing of methodology, verification and cross checking of data. Interpretation of data and reporting.
 - (c) Monitoring and evaluation.
8. Food and Nutrition Security
9. National Food and Nutrition Policy, Plan of Action and Programmes

UNIT - III

10. Approaches and Strategies for improving nutritional status & health:
 - (a) Programmatic options - their advantages and demerits. Feasibility, available resources (human financial & infrastructural) and support. Case studies of selected strategies and programmes : their rationale and context, selection of interventions from a range of possible options.
 - (b) Health based intervention (primary health care & family welfare programmes)
 - (c) Food based interventions including fortifications, genetic improvements of food and supplementary feedings.
 - (d) Nutrition education for behaviour changes. Participatory training.
11. Community Nutrition Programme Management -

- (a) Planning - identification of problem, analysis of causes, resources. constraints, selection of intervention. setting a strategy.
- (b) Implementation and supervision
- (c) Operations monitoring, surveillance and evaluation (process & impact evaluation).

UNIT IV

12. Food quality assurance- Introduction to quality assurance. Current concept of quality control, Principles of Quality assurance, Raw material quality assurance, in process quality assurance, finished product quality.
13. Food safety and toxicology- Introduction, Hazards- Microbiological, Nutritional, Environmental, physical, Biological, Chemical, HACCP- as a method to prevent food borne diseases.
14. Naturally occurring toxicants and food contaminants-Lathyrus. Favism. Hamagglutins, Ackee fruit poisoning, Presser amines, fungal toxins. Toxicants in natural spices and flavours, food fat, Cynogenetic glycosides. Carcinogens, Goitrogens, Solanine, Saponine, Toxic minerals Antivitamins Radioactive materials.
15. Food Additives- Introduction, Role of different additives in controlling the quality of food product, Antioxidants, Chelating agents, Colouring agents Curing agents, Emulsifiers, Flavour and Flavour enhancers, Flour improvers, Humectants & Anticaking agent, Leavening agents, Nutrient supplement, Nonnutritive Sweeteners. PH Control agents, Stabilizers & Thickeners, Preservatives, Additives and Food safety.

UNIT V

16. Food packaging-Functions of food packaging, requirement for effective food packaging, food packaging materials and forms, safety of food packaging.
17. Government regulation of food and nutrition labeling- Introduction, food and nutrition law and acts, food labeling, nutrition labeling.
18. Evaluation of food quality
 - (a) Sensory evaluation-
 - (b) Objective evaluation-
Advantages, disadvantage, basic guidelines.
18. New food product development- Defining new food product, classification & characterization of new food product, food product development tool.

PRACTICAL

Hours of instruction per week : 3

Max. Marks : 50

Contents :

1. Comparison of rural, urban and tribal communities for.
 - (a) Determinants of malnutrition
 - (b) Socio-economic groups
 - (c) The types of nutritional problems in different segments and age groups through analysis of secondary data.
2. Training in Nutritional status assessment techniques applicable for community. Community based project for assessment of nutritional status of any vulnerable groups.
3. Development of low cost nutritive recipes suitable for various vulnerable groups at micro, meso and macro levels.
4.
 - (a) Development and use of charts. posters. flash cards. flip charts and other IEC materials for health and nutrition education.
 - (b) Use of Demonstration as a technique for Nutrition Education
 - (c) Analysis and critical appraisal of a TV/Video film (presented before the class).
5.
 - (a) Critical Appraisal of existing interventions and programmes in the voluntary sector and the government and suggestions to improve the same vis-à-vis target groups in society and specific needs.
 - (b) Surveillance systems used in Nutritional and Health programmes.
6. Development of a plan for a nutrition intervention project in the community (The target groups need to be specified). Implementation of intervention for 2-4 weeks followed by assessment of impact. Reporting on impact and possible improvements.
7. Field experience in operational public nutrition programmes: nutrition rehabilitation centres. Fortification programmes cost analysis.
8. Design of sensory experiments-selection of panel, training of panel, types of panel, development of score card data analysis, interpretation of results,
9. Individual tests for sensory evaluation- conduct test to know the sensitivity, acceptability of a new product, to Know likes & dislikes.
10. Assessment of purity & quality using appropriate standard tests in different food group.

11. Preparation of purity & quality using appropriate standard tests in different food group.
12. Preparation of squashes, syrups sauces, pickles chutneys (any three preparation should be prepared in bulk)
13. Standardization of recipes in relation of nutritive value. cost & time.
14. Visits to Commercial food manufacturing. Packaging units where food products are developed & tested.

Reference:

1. Fuller G.W. (1994) New Food product development. CRC Press
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3. Mahony, M.O. (1986) Sensory evaluation of food .Marcel Dekkr Inc.
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PAPER VIII

CLINICAL AND THERAPEUTIC NUTRITION

Duration of Examination : 3 hrs.

Max. Marks : 50

Note:-

The question paper shall contain three sections. **Section A** contains 5 questions two from each unit of 2 marks each. The candidate is required to answer all the questions. The answers should not exceed 50 words. **Section B** shall contain 5 questions one from each unit with internal choice. Each question shall be of 4 marks. The answers should not exceed 200 words. The candidate is required to answer any 4 questions. **Section C** shall contain 5 questions of 8 marks each, one from each unit. The candidate is required to answer 3 questions. The answer shall not exceed 350 words.

Objectives:

This Course will enable the students to :

1. Understand the etiology, physiology and metabolic anomalies of acute and chronic diseases and patient needs.
2. Know the effect of the various diseases on nutritional and dietary requirements.
3. Be able to recommend and provide appropriate nutritional care for prevention and treatment of various diseases.

UNIT - I

1. Concepts of Diet Therapy - growth of dietetics. Purposes and principles of Therapeutic diets. Modifications of normal diet. Classification of Therapeutic diets.
2. Role of dietitian, definition of nutritional care, interpersonal relationship with the patient, assessment of nutritional status of outdoor and indoor patients. Indemnification of high risk patients. Assessment of patient needs based on interpretation of patient data-clinical, biochemical, bio- physical & personal. Planning and implementing dietary care.
3. Recent advances and techniques in feeding substrates. Study and review of hospital diets - basic concepts and methods in oral feeding, tube feeding internal and parenteral feeding.

UNIT - II

4. Diet in surgical conditions - pre and post operative diets. Dumping syndrome Trauma. Diet in burns.
5. Obesity - cause, complications, treatment.

6. Diet in fevers and infections - types of fevers, metabolism in fevers general dietary considerations, diet in influenza, typhoid, recurrent malaria and tuberculosis.
7. Diet in gastritis. peptic ulcer (gastric and duodenal). Etiology- symptom clinical findings, treatment, dietary modifications, chemical, mechanism thermal irritants, four stage diets.

UNIT - III

8. Diet in disturbances of the GIT-small intestines and colon-Diarrhoea (child and adult). Classification modification of diet, fibre, residue, nutrition adequacy. Constipation and flatulence. Dietary considerations in ulcerative colitis-symptoms, dietary management.
9. Diet in diseases of the liver, gall-bladder and pancreas- basic hepatic functions, etiology, symptoms and dietary management in hepatitis. viral hepatitis A and B cirrhosis of liver and hepatic coma. Role of alcohol in the liver diseases. Dietary treatment in cholelithiasis and pancreatitis.
10. Diabetes: etiology, classification, signs and symptoms, types of insulin, meal management, dietary treatment oral hypoglycemic drugs, carbohydrate, lipid and protein metabolism in diabetes, short and long term complications of diabetes.

Unit IV

11. Diet in Renal Diseases-basic renal function, symptoms and dietary treatment in acute and chronic glomerulonephritis, nephrotic syndrome acute and chronic renal failure, Dialyses- hemodialysis and peritoneal dialysis Urinary calculi-causes, treatment, acid and alkali ash producing foods and neutral foods. Dietary treatment.
12. Diet in cardiovascular diseases- acute and chronic diseases of the heart, multiple risk factors, atherosclerosis, plaque formation, hyperlipidemia different types of hyperlipoproteinemia, treatment, dietary management.
13. Diet for hypertension-primary and secondary hypertension Role of renin in development of hypertension Dietary management. Low sodium diets.

Unit V

14. Feeding infants-problems in feeding children in the hospital.
15. Nutritional Education and Diet Counseling.
16. Diet and Drug Interaction- effects of drugs on food and nutrient intake ingestion, digestion, absorption, metabolism and requirement. Effects of food nutrients and nutritional status on absorption and efficacy of drugs.
17. Nutrition Cancer- nutrition for the cancer patient. role of diet in cause of cancer metabolic effects of cancer. Cancer cachexia, nutritional effects of cancer therapy.

PRACTICAL

Hors of Instruction/ week:3

Max Marks:50

1. Planning and preparation of diets with modifications in:
 - a) Consistency:
 - b) Fibre and Residue.
 - c) In Diarrhoea
 - d) For Peptic Ulcer
 - e) For Liver diseases.
 - f) For Obesity
 - g) For fevers and infections
 - h) For Insulin and non-insulin dependent diabetes.
 - i) For cardiovascular diseases.
 - j) For kidney diseases.
 - k) Trauma (burns)
 - l) Surgery
2. Market survey of commercial nutritional supplements and nutritional support substrates.
3. Preparation of Diet Counseling aids for common disorders.
4. Case studies: Selection of 3 to 5 admitted patients from a unit of a Hospital. Study of cliical. Nutritional, biochemical profile of the patient on admission, during hospital stay and at discharge. Therapeutic Modification of the diet for that condition. Dietary counseling of the patients. Study of accepts ability and compliance of diet planning, maintenance diets on discharge. Report writing.

References:

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2. Shils, M.E. Olson, J.A. Shike, M and Ross, A.C. (1999): Modern Nutrition in Health and Disease 9th edition. Williams and Wilkins.
3. Escott-Stump S (1998): Nutrition and Diagnosis Related Care 4th edition Williams and Wilkins.
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6. Davis. J. and sheer. K. (1994) Applied Nutrition and Diet Therapy.
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8. Guyton. A.C. and Hall, J.E.(1999): Textbook of Medical Physiology 9th edtion, W.B. Saunders Co.
9. Ritchie, A.C.(1990) Boyd's Textbook Pathology 9th edition Lea and Febige Philadelphia
10. Fauci, S.A et al (1998): Harrison's Principle of Internal Medicine. 14th edion, McGraw Hill.
11. World Cancer Research Fund(1997), Food, Nutrition and the Prevention Cancer- A Global perspective, Washington E.D. WCRF.
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13. Williams S.R. Nutrition and Diet Therapy C.V. Mosloy Co. 1973
14. Antia F.P. Clinical Dietetics and Nutrition 3rd edition. Oxford University Press, Bombay 1989.
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19. Srilakshmi S. Dietetics 1999.

20. WHO(1995) Diabetes Mellitus WHO Technical Report Series WHO(Geneva)

Journals:

1. Indian Journal of Nutrition and Dietetics.
2. Journal of Dietetic American Association
3. Nutrition Update Series.
4. American Journal of Clinical Nutrition
5. European Journal of Clinical Nutrition
6. Nutritional Reviews
7. World Review of Nutrition and Dietetics
8. Journal of Applied Nutrition
9. WHO Expert Committee-TRS.

PAPER IX

CASE STUDY

Periods/week : 6

Max. Marks: 100

Case study is compulsory for each student. Every student should be allotted a research supervisor. The Research Supervisor will be from the department and if required the minor guide, from the same department or any other department to which the topic may be related.

The allotment of the Research Supervisor should be done by the mid of the Previous year. The topic of research be decided by the research Supervisor in consultation with the Head of the Department during the first academic year (M.Sc. Previous). It is the responsibility of the research supervisor that the student is making the required progress in work.

The student will have to give research proposal seminar in the beginning of final year and a seminar on the findings of research before submitting the case study. The suggestions and constructive criticism of the faculty should be made use of by the student for further improving the improving the case study.

The case study report/survey report/field work shall be hand written and shall not be more than 100 pages and is to be submitted in triplicate so as to reach the office of the Registrar at least three weeks before the commencement of the theory examination. Only such candidates who shall be permitted to offer case study/field work/survey report (if provided in the scheme of examination) in lieu of a paper as those who have secured at least 55% marks in the aggregate, irrespective of the number of papers in which a candidate actually appeared at the examination.

N.B. (i) Non-collegiate candidates shall not be eligible for offer case study/survey report.