AC_____
Item No. _____

UNIVERSITY OF MUMBAI

Syllabus for Approval

1	Title of the Course	**B. Sc. (Home Science), Branch I: Foods, Nutrition and Dietetics Semesters V and VI**
2	Eligibility for Admission	• **S.Y.B.Sc. Home Science (general or any specialization)** • **Admission will be based on merit.**
3	Passing Marks	**40% (Theory) and (Practical)**
4	Ordinances / Regulations (if any)	**O. 6086 with effect from 2014-15 and thereafter**
5	No. of Years / Semesters	**1 year/ 2 Semesters**
6	Level	~~**P.G.**~~ **/ U.G.**~~**/ Diploma / Certificate**~~ **(Strike out which is not applicable)**
7	Pattern	~~**Yearly**~~ **/ Semester** (Strike out which is not applicable)
8	Status	~~**New /**~~ **Revised** (Strike out which is not applicable)
9	To be implemented from Academic Year	From Academic Year **2017-18**

Date: 10.04.2017 Signature :

Name of BOS Chairperson / Dean : ___**Dr Geeta Ibrahim**_____

UNIVERSITY OF MUMBAI

Essentials Elements of the Syllabus

1	**Title of the Course**	**B. Sc. (Home Science)** **Branch I: Foods, Nutrition and Dietetics** **Semester V and VI**
2	**Course Code**	**USHSI**
3	**Preamble / Scope** The B.Sc. in Home Science specializing in Foods, Nutrition and Dietetics is designed to impart advanced knowledge and skills that is life oriented, career and community oriented. It has special relevance to industry and hospital application with the help of weekly field work, rural camp and hospital/industry internship programme.	
4	**Objective of Course / Course Outcome** • To equip students to plan diets for clinical and therapeutic conditions within a hospital, fitness center or gym setting. • To impart students a systematic approach to basic and applied aspects of food processing and technology. • To familiarize students with the various theoretical and practical aspects of food quality and its control. • To provide students with an opportunity to conduct independent research. **Eligibility** • S.Y.B.Sc. Home Science (general or any specialization) • Admission will be based on merit as per norms of the University of Mumbai	

Fee Structure

T.Y.B.Sc. (HOME SCIENCE)
BRANCH I : FOODS, NUTRITION AND DIETETICS
SEMESTERS V & VI

PROPOSED FEE STRUCTURE 2017-2018

No.	Particulars of the Fees		Amounts	
1	Tuition		800.00	
2	Laboratory		800.00	
3	Library		200.00	
4	Gymkhana		400.00	
5	Other/Ext.Curr.Act.Fees		250.00	
6	Group Insurance		50.00	
7	Magazine Fees		100.00	
8	Identity Card/Library Card		50.00	
9	Students welfare Fund		50.00	
10	Utility Fees		250.00	
11	Development Fund		500.00	
12	Exam fees		2120.00	
13	Vice Chancellor's Fund		20.00	
14	E. Charges		20.00	
15	Ashwamedha/Indradhanushya		30.00	
16	Disaster relief fees		10.00	
17	E. Services		50.00	
18	Convocation Fees		250.00	
19	National Services Scheme		10.00	
20	Field trips/Activities		1000.00	
		Total	**6960.00**	

*** FEES ARE DUE TO BE REVISED**

7	**No. of Lectures**	18 periods per week
8	**No. of Practical**	16 periods per week
9	**Duration of the Course**	1 year
10	**Notional hours**	10 periods per week
11	**No. of Students per Batch:** 30-40(Theory) & 15-20 (Practical)	
12	**Selection**- Merit at the qualifying examination	
13	**Assessment**– included in the syllabus copy as Scheme of Examination	
14	**Syllabus Details** – included in the syllabus copy	
15	**Title of the Unit**– included in the syllabus copy	
16	**Title of the Sub-Unit** – included in the syllabus copy	
17	**Semester wise Theory** – included in the syllabus grid	
18	**Semester wise List of Practical** – included in the syllabus grid	
19	**Question Paper Pattern** – included in the syllabus copy as Scheme of Examination	
20	**Pattern of Practical Exam**– included in the syllabus copy as Scheme of Examination	
21	**Scheme of Evaluation of Project / Internship-** – included in the syllabus copy	
22	**List of Suggested Reading**– included in the syllabus copy	
23	**List of Websites** – included in the syllabus copy wherever applicable	
24		
25	**List of You-Tube Videos –**Not Applicable	
	List of MOOCs–Not Applicable	

T.Y. B.Sc. (HOME SCIENCE)

BRANCH I : FOODS, NUTRITION AND DIETETICS

SEMESTER V

Revised w.e.f. June 2017

Course Code	Title	Internal Assessment Marks	Semester End Exam	Total Marks	Periods/ Week/ Division/ Batch	Credits
USHSI501	Nutritional Biochemistry-I	25	75	100	3	2
USHSI502	Clinical Nutrition and Diet therapy	25	75	100	3	2
USHSI503	Food Microbiology and Preservation	25	75	100	3	2
USHSI504	Human Nutrition - Macronutrients	25	75	100	3	2
USHSI505	Community Health and Nutrition	25	75	100	3	2
USHSI506	Food Production and Service in Institutions	25	75	100	3	2
USHSIP501	Part A – Diet Therapy	-	50	50	4	2
USHSIP502	Part B – Food Analysis & Clinical Biochemistry-I	-	50	50	4	2
USHSIP503	Part A – Community Nutrition	-	50	50	4	2
USHSIP504	Part B – Applications of Food Production and Service	-	50	50	4	2
	Total			**800**	**34**	**20**

Course Code	Title	Periods/Week/Division	Marks	Credits
USHSI501	Nutritional Biochemistry-I	3	100	2

Objectives:

1. To enable the students to apply the knowledge of nutrition and role of nutrients in the body.
2. To understand the chemistry and metabolism of the nutrients in the living system during health and disease.

Course Content		Periods

Unit I	• **Cell membrane structure and transport mechanism across cell membrane (Passive and active)**
	Carbohydrates:
	• Types of chemical bonds, significance of asymmetric C atom (isomerism)
	• Classification of carbohydrates:
	  • Monosaccharides - reactions of glucose (oxidation, reduction, enediol formation)
	  • Disaccharides: structure and properties
	  • Oligosaccharides: structure and properties
	  • Polysaccharides: Homoglycans and Heteroglycans (structure of starch and cellulose only)
	• Carbohydrate Metabolism: Reactions of EMP, TCA (with structures), HMP, Cori's cycle, Gluconeogenesis (no structures), Glycogen metabolism (no structures), Galactose and fructose metabolism
	• Blood Glucose Homeostasis
	• Disorders of carbohydrate metabolism
	• **Energy rich compounds: ATP, Creatine phosphate, Oxidative phosphorylation, Electron Transport Chain**
		15

Unit II	**Protein Chemistry** • Classification of amino acids, classification of proteins (both based on structure and function) • Protein structure: four levels of protein organization, bond stabilizing the structure, structure of α-helical and β-pleated sheet. Structure of Insulin and haemoglobin • Amino acid transport • Amino Acid metabolism (general reactions of amino acids) • Detoxification of NH3: Krebs-Hensleit cycle • Inborn errors of Phenylalanine, Tyrosine Tryptophan metabolism •	**15**
Unit III	• **Enzyme Chemistry** • Definition and classification IUB (up to 1 digit) of enzyme, enzyme specificity, turnover number • Units: Katal, IU • Factors affecting enzyme activity • Definition of km and significance • Enzyme inhibition	**15**

	• Definition of Holoenzyme, Coenzyme, cofactor, Allosteric site, active site, prosthetic group, isoenzyme	

References

Berg, Jeremy Mark, Tymoczko, John L and Stryer. (2002). *Biochemistry 5th Ed*. New York. W.H. Freeman and Co.

Brody Tom. (2004). *Nutritional Biochemistry 2nd Ed*. New Delhi. Elsevier/Reed. Elsevier. India Pvt. Ltd.

Chatterjee, M.N. Shinde and Rana. (2012). *Textbook of Medical Biochemistry*, *8thEd.* New Delhi, Jaypee

Brothers. Medical Publisher.

DandekarSucheta P. (2002). *Medical Biochemistry (Prep Manual for U.G.) 2nd Ed*. New Delhi B-1 Churchill

Livingstone Pvt. Ltd.

David L. N.,Michael M. C., (2013) *Lehninger Principles of Biochemistry 6th Ed.* W. H. Freeman and Co.

Rastogi S.C. (2003). *Biochemistry 2nd Ed.*New Delhi, Tata McGraw Hill Publishing Co. Ltd.

Course Code	Title	Periods/Week/Division	Marks	Credits
USHSI502	Clinical Nutrition and Diet Therapy	3	100	2

Objectives:

1. To impart the concept of modifying normal diets to therapeutic diets.
2. To enable the students to understand the underlying disease conditions, possible complications and pathological states and to understand principles of appropriate nutrition intervention approaches.
3. To enable the students to focus on the preventive role of nutrition in the current life style situations.

Medical Nutrition therapy

Each of the diseases to be discussed under the following heads of Etiology, Pathophysiology, Diagnosis, and principles of Management with special emphasis on nutritional care and Prevention.

Course Content		Periods
Unit I	• **Principles of diet therapy** • Team work in nutritional care • Review of Normal diet and Standard hospital diet • Overview of Nutritional Care process and counseling • **Weight management** • Regulation of food intake: Short term and Long term regulation, Set point theory • Obesity and Overweight: Classification, Etiology and assessment, Complications and Management (Nutrition and lifestyle, Pharmacological, Surgical and Behavioral) • Juvenile Obesity (in brief) • Underweight • Eating disorders - Anorexia Nervosa and Bulimia: Management (Medical, Nutritional care, Psychological support) and Prevention	**15**
Unit II	• **Diabetes Mellitus** • Etiology, Classification and Diagnosis • Long and short term complications(brief) • Management (Dietary Management, Insulin Therapy, Exercise, Pharmacological) • Overview of special conditions: Diabetes in Childhood, Pregnancy • Role of Nutrition in Prevention • **Nutrition in Infections** • Typhoid • Tuberculosis • HIV	**15**
Unit III	• **Cardiovascular diseases** • Hypertension: Oetiology and Risk factors, Pathophysiology, Management • Pathophysiology and Management of Atherosclerosis • Angina Pectoris, Myocardial Infarction • Congestive cardiac failure	**15**

	• Hyperlipidemia– classification, diagnosis and nutritional management (brief) • Metabolic syndrome and role of nutrition in its prevention. • **The hyper catabolic state, Surgery and Burns**- An overview • **Nutritional Support** • Enteral Nutrition • Parenteral Nutrition	

References

Antia F.P. (1997). *Clinical dietetics and nutrition*. (4th Ed.) New Delhi: Oxford University Press.

Bennion, M. (1997). *Clinical nutrition*. (7th Ed.) New York: Harper and Row Publishers.

Briony, T. (1995). *Blackwell Manual of Dietetic Practice*. (2nd Ed.) Oxford: New York Scientific Publication.

Burton, B.T. (1980). *Human nutrition*. (3rd Ed.) New Delhi: Tata McGraw Hill.

Davidson and Passmore. *Human nutrition and dietetics*. (18th Ed.) New Delhi: Tata McGraw Hill Publications.

Garrow, J.S. (1993). *Human nutrition and dietetics*. (9th Ed.) New York: Churchill Livingstone.

Mahan, L. K., Escott-Stump and Raymond, J.L. (2012). *Krause's Food and the Nutrition Care Process*. (13th Ed.) Missouri: Elsevier.

Robinson: (1989). *Normal and therapeutic nutrition*. (7th Ed.) New York: Macmillan Pub. Company.

Zeeman, F. J. (1998). *Applications of Clinical Nutrition*. Englewood Cliffs: Prentice Hall International

Course Code	Title	Periods/Week/Division	Marks	Credits
USHSI503	**Food Microbiology and Preservation**	3	100	2

Objectives

1. To introduce students to the field of microbiology and its relevance to food deterioration and preservation.
2. To impart knowledge regarding deteriorative factors and principles & techniques of preserving foods.

Course Content		Periods
Unit I	• **Major groups of microorganisms** Introduction to Bacteria, Yeast, Mold, Algae, Protozoa and Virus. Classification, morphology, reproduction and growth requirements of Bacteria, Yeast and Mold • **Intrinsic and extrinsic parameters of foods that affect microbial growth** Intrinsic factors: pH, moisture content, oxidation-reduction potential, nutrient content, antimicrobial constituents and biological structures. Extrinsic factors: Temperature of storage, relative humidity of environment, presence and concentration of gases in the environment. • **Microbial flora, spoilage, sources, characteristics and contamination in the following foods and their products** Cereals, Pulses, Vegetables, Fruits, Milk, Meat, Fish & Poultry Processed and convenience foods **D. Food Borne Illness- Pathogens, Toxins produced, Effects**	**15**
Unit II	• **Non microbial deteriorative factors in foods** Food enzymes and other chemical reactions, Infestation (insects, parasites, rodents), Temperature, Moisture, Oxygen, Light, Time, Physical stress and abuse. • **Food quality and its Meaning and Importance** General Principles of Food Preservation: Meaning, mode of action, and changes in foods- An overview. **Techniques of Preservation:** **1. Use of fermentation technology** Benefits and mechanism of fermentation- Factors controlling fermentations in foods. **2. Use of food additives** Broad classes of food additives and their application (Preservatives, Antioxidants, Sequesterants, Surface active agents, Stabilizers, Thickeners, Bleaching and Maturing agents).	**15**
Unit III	**Techniques of Preservation(Continued)** **3. Use of high temperature** (Heat Preservation) Degrees of heat preservation (blanching, pasteurization, canning, commercial sterilization); heat resistance of microorganisms (Thermal Death Time); selection of appropriate temperature. Protective effects of food constituents; methods used for heating food before and after packaging. **4. Use of low temperature (**Cold Preservation) Refrigeration and cool storage, Requirements of refrigerated storage Freezing and frozen storage Freezing methods (Air Freezing, indirect contact freezing, immersion	**15**

	freezing) Changes in foods during refrigeration and frozen storage **5.Use of dehydration and concentration** Benefits and factors affecting heat and mass transfer Physical and chemical changes during dehydration and concentration Methods of dehydration and Concentration **6. Use of ionizing radiations and microwave heating**: Ionising radiations (Gamma Radiation and Electron Beam Radiation), Sources and underlying principles, radiation effects, Application of radiation technology **Other emerging technologies- Hurdle technology, Infrared heating, ohmic heating, high pressure processing**	

References

Frazier, W. C. and Westoff, D. C. (1998) *Food Microbiology* New Delhi; Tata McGraw Hill

James, M. J. (1996) *Modern Food Microbiology* (4th Ed.) New Delhi: Published by S.K. Jain for C. B.S.

Publishers and distributors.

Pelczar, M. J., Reid, R. D. and Chan (2000*) Microbiology*. New Delhi: Tata McGraw Hill.

Potter, N. H. and Hotchkiss, J. H. (1996) *Food Science*,(5th Ed.)New Delhi:C.B.S. Publishers and distributors.

Subbulakshmi, G and Udipi, S. A. (2001) *Food Processing and Preservation*. New Delhi: New Age

International Ltd. Publishers.)

Manay, N. S. and Shadaksharswamy, M. (2004) *Food Facts and Principles,* New Delhi: New Age International Ltd Publishers.

Course Code	Title	Periods/Week/Division	Marks	Credits
USHSI504	**Human Nutrition- Macronutrients**	3	100	2

Objectives :

1. To reinforce the basic principles of nutrition
2. To impart in-depth knowledge on the functions, deficiency and toxicity of macronutrients
3. To enable the students apply knowledge of nutrition to daily life.

Course content		Periods
Unit I	• **Energy** Definitions, Units of energy, Components of Energy Expenditure, Physical activity (light, moderate, and heavy); Components of energy expenditure- Physical activity, BMR and Thermic effect of food Measurement of energy expenditure: Direct and Indirect calorimetry Computation of Energy requirements by factorial approach Energy requirements for various groups of population and during exercise; Energy imbalances • **Carbohydrates** Classification, Digestion and Absorption – an overview Dietary fibre; nutritional importance; Glycemic load and Glycemic Index- Factors influencing Resistant Starch-types & health benefits Carbohydrate needs of population Carbohydrate needs during exercise	**15**
Unit II	**Proteins** An overview of Classification and functions of Proteins and amino acids; Digestion and Absorption Evaluation of Quality of Proteins: Biological and Chemical methods Amino Acid imbalances Assessment of protein nutritional status- anthropometrical, biochemical and clinical methods Protein requirements in various stages of life and in exercise Protein Deficiency in vulnerable groups of population: Concerns of protein supplementation	**15**
Unit III	A: **Lipids** Overview of classification, functions, Digestion, absorption and Transportation EFA –Functions, Requirements and sources, Trans-fats and their health effects Nutritional importance of MCTs Requirement of fat - Fatty acid ratios Consequences of deficiency and excess of dietary fat intake B: **Interrelationship between Macronutrients**	**15**

References

Anderson, L., Dibble, M. and Mitchell, H. (1992) *Nutrition in health and disease*, 17th ed., J.B. Lippincott Co. Philadelphia

Bamji, M., Rao, P. N. and Reddy, V. *Textbook of Human Nutrition*, Oxford: IBH Pub. Co.

Davidson, S., Passmore, R., Brock, J and Truswell, A., (1975) *Human nutrition and dietetics*, 6th ed., ELBS
Edinburgh.
Guthrie, H. (1986) *Introductory Nutrition*, 6th ed., Times Mirror/Mosby College Publication.
Williams, S. (1981) *Nutrition and diet therapy*, 4th ed., Missouri: The C.V. Masby Co.Brown, J. E. (1999) Nutrition Now. 2nd ed. West/Wadsworth-International Thomson Publishing Co. USA.Grodd, J.L. and Gropper, S.S. (1999) Advanced Nutrition and human metabolism. Belmount CA Wodworth/ Thomson learning

Course Code	Title	Periods/Week/Division	Marks	Credits
USHSI505	**Community Health and Nutrition**	3	100	2

Objectives:

1. To create an awareness among students about the nutritional problems of the community with special emphasis on vulnerable sections.
2. To understand the different methods of assessing nutritional status of the community.
3. To recognize the deleterious effects of malnutrition in the development of our nation and means of combating the same.

Course content		**Periods**
Unit I	**Concept of Health, Public health, Public Health Nutrition** **Nutritional Epidemiology and Community nutrition.** -Demography, demographic cycle **Health Indicators and their significance** – Birth and death rates, IMR, MMR, TFR, U5MR etc **Identification of vulnerable groups** - Pregnant women, Nursing mother, Infants, Children, Special emphasis to girl child (including adolescents), Geriatric **Health Care System in India** – Primary, Secondary and Tertiary, National Health Policy, National Nutrition Policy-An overview.. **Emerging Nutritional public health problems, their risk factors & Monitoring:** - NCD"s,VAD, IDD, Anaemia, Malnutrition	15
Unit II	Indicators and data sources from existing macro and micro systems of information in India (NFHS, NSSO, ICDS, NSS, CENSUS) **Impact of Malnutrition on National development** Factors affecting malnutrition in India -, /Underlying causes of Malnutrition in India; Ultimate cost of malnutrition **Background of the Problems of Malnutrition in India.** Food Availability & related problems, Poverty, Illiteracy & Ignorance, Population explosion, Social & Cultural factors Food based strategies for control of common nutritional deficiencies-: Beri -Beri, Pellagra, Ariboflavinosis, Scurvy, Rickets & Osteomalacia Strategies for augmenting food production - Green, White, Brown and Blue revolution	15
Unit III	**Communicable and infective disease control** : Nature of communicable diseases, infections, contamination, transmission, vector borne diseases, environmental agents, control and prevention, **Community water and waste management** – Importance of water to the community, etiology and effects of toxic agents, water borne infections, safe drinking water, potable water, waste and waste disposal – liquid and solid waste	15

References

K. Park (2011). Texbook of Preventive and Social Medicine, 21st Edition. Banarsidas Bhanot Publishers. Jabalpur ISBN13:9788190607995.

Sheila ChanderVir (ed)(2011)*Public Health Nutrition in Developing countries* –Part I & Part II

Ebrahim G. J. (1983) *Nutrition in mother and child health* – London Mac Millan and Co.

Goel, S. L. (2001) *Community Health Care* (New Delhi) Deep and Deep Publication

Goel, S. L. (2001) *Community Health Care* (New Delhi) Deep and Deep Publication

Goel, S. L. (2001) *Health Care System and Management* Vol 1 – 4, New Delhi: Deep and Deep Publication
Gopaldas, T. Seshadri S. (1987) *Nutrition monitoring and assessment* Delhi: Oxford University Press.
Jelliffe, D.B, Jellife E.P (1989) Community Nutritional Assessment . Oxford University Press, New Delhi
Wadhwa, A and Sharma S. (2003) *Nutrition in the Community*, New Delhi: Elite Publishing House Pvt. Ltd.

Course Code	Title	Periods/Week/Division	Marks	Credits
USHSI506	Food Production and Service in Institutions	3	100	2

Objectives :

1. To be aware of the scope of food service management in commercial and welfare organizations.
2. To understand the purpose and goals of a food production and service institution with relevance to safety and ethics.
3. To acquire knowledge about facility planning and the process of the working of the food production and service institution.

Course Content		Periods

Unit I	**The Purpose and Goals of a Food production and service institution**
	• Introduction and overview of types of food production and service institutions
	• Relevance and purpose of such institutions
	• Current trends in catering
	• Role of Nutritionists in food production and service institutions
	• Styles of service
	• Goals of a food production and service institution
	• Food Safety and hygiene
	  • Control of microbial quality
	  • Food handling and prevention of food borne illness
	  • Personnel hygiene
	  • Waste disposal and pest control
	  • Environmental sanitation
	• Food standards and laws
	• Environmental and ecological concerns
	• Futuristic vision of food production and service
	  • Global outlook
	  • Creativity and innovation to meet needs
	  • Technological and IT competence
		15

Unit II	**Facility planning of a food production and service institution.**
	• Overview of space allocation
	• Formulation of project report
	• Kitchen design and planning with respect to area and space consideration, equipment requirements, ventilation and safety
	• Receiving and storage area design and layout
	• Service facilities in hospitals
	  • Types –centralized and decentralized
	  • Equipment required
		15

Unit III	**The process of running a food production and service institution**	**15**

	• Concept of food and work flow
	• Procurement
	• Purchasing
	  • Methods of purchasing
	  • Purchasing process
	• Receiving Procedures
	• Storage and inventory
	  • Role of a store keeper
	• Outline of scheduling pre –production production process and forecasting
	  • Standardisation and stepping up
	  • Menu planning
	  • Avoidance of waste and waste disposal	

References

Bhojwani M. (2007), *Food service management: Principles and practice*
Eckel P. J. (1985), *College and University Food Service Management*
Delfakis H, Nancy L, Van Burns J (1992), *Food Service Management*
Spears M. C ,Vaden A. E (1985), *Food Service Organizations—A management and systems approach*
Drummond K. (1997) *Nutrition for the Food Service Personnel*
National Association Institute (1998) *Handbook for Food Service Management*
Verghese B (1999) *Professional Food and Beverage Service Management*
Singh, Y. P. (2001) *Effective Food Management*
Fox A. (1971) *Hygiene and Food Production*

Course Code	Title	Periods/Week/Batch	Marks	Credits
USHSIP501	Diet Therapy	4	50	2

Objectives :

1. To familiarize the students with basic concepts of raw and cooked weights of foods the appropriate weights
2. To impart the concept of modifying normal diets to therapeutic diets.
3. To learn to plan therapeutic diets for management of clinical disease conditions
4. To teach diet modification through use of food exchange lists and calculated values.

Course content		Periods
Unit I	**Standardization** • Weights and measures • Recipes from different food groups	**15**
Unit II	**Weight management** • Obesity and over weight • Underweight • PEM	**15**
Unit III	**Diabetes Mellitus** • Type I • Type II • Gestational DM	**15**
Unit IV	**Cardiovascular diseases**	**15**

References

Roth, R. A. and Townsend C. E. (2003), *Nutrition and Diet Therapy*. Thomson, Delmar Learning.

Whitney E.N. and Rolfes S.R. (2002) *Understanding Nutrition*. Wadsworth, Thomson Learning.

Thompson J. and Manore. M (2005). *Nutrition : An Applied Approach*. Benjamin hummings.

Aronson. V. (1986). *The Dietetic Technician*. CBI book, Van Nostrand Reinhold Company, New York.

Rolfes, Pinn and Whitney (2006). *Understanding Normal and Clinical Nutrition*. Thompson Wadsworth.

Peckenpaugh. N. J. (2003) *Nutrition Essentials and Diet Therapy*. Saunders Publications.

Additional Reading

Mermel, V.L. (1995). Focus on Nutrition Mosby Publications.

Williams. S.R. (1993) Nutrition and Diet Therapy. Mosby Publication.

Course Code	Title	Periods/Week/Batch	Marks	Credits
USHSIP502	**Food Analysis and Clinical Biochemistry-I**	4	50	2

Objectives :

1. To impart practical skills in analytical procedures of foods and synthetic body fluids
2. To impart skills in the microbiological analysis of foods
3. To enable the students understand the principles of various analytical techniques.

Course content		Periods
Unit I	• Qualitative analysis of carbohydrates • Quantitative estimation of total sugars in different foods by Lane–Eynon's method. • Extraction of amylase from sweet potato and its use in starch hydrolysis. • Estimation of crude fibre • Determination of refractive index in fruit juice– Demonstration • Estimation of blood glucose by Folin-Wu method	**15**
Unit II	• Qualitative analysis of amino acids: • Colour reactions of amino acids • Identification of amino acids by paper chromatography- Demonstration • Quantitative estimation of protein in food by Micro Kjeldahl method- Demonstration • Estimation of the gluten content in cereal flours. • Estimation of serum total protein, albumin and globulin by Biuret's method.	**15**
Unit III	• **Microbial analysis of foods:** • Techniques of sterilization and preparation of media • Plating techniques- Spread plating and pour plating • Staining techniques- Simple staining and differential staining (Acid fast and Gram staining) •	**15**
Unit IV	• **Detection of Food Quality** • Detection of Food adulterants • Bacteriological analysis of milk- MBRT • Estimation of titratable acidity in curd/ •	**15**

References

Raghuramulu N., Madhavan K., Kalyanasundaram S. (2003). A manual of laboratory techniques (Second Edition) by ICMR

Mayer, L.H. (1987). Food Chemistry. CBS Publishers and Distributors
Oser, L.B. (1976). Hawk's physiological chemistry (14th Ed.)Tata McGraw Hill Pub. Co. Ltd.
Pearson, D. (1970). Chemical analysis of foods.(6th Ed.) London: J. A. Churchill

Course Code	Title	Periods/Week/Batch	Marks	Credits
USHSIP503	Community Nutrition	4	50	2

Objectives :

1. To acquire skills for different methods in assessment of nutritional status of the community.
2. To prepare and use the various types of communication aids for imparting nutrition education.
3. To learn various methods of research and apply it in project development.

Course content		Periods
Unit I	• Development of various tools for Nutritional Education such as - powerpoint, short films, puppets (finger, glove, body puppets, cardboard, paper etc) • Preparation of visual aids like flashcards, brochures, pamphlets, charts etc • Developing other techniques like skits, role play, street plays, demonstrations, songs etc	**15**
Unit II	• Developing data collection tools like diet survey, questionnaires, Food frequency questionnaires etc. • Implementing the developed tools	**15**
Unit III	• Conducting mini surveys • To analyze and interpret the data collected	**15**
Unit IV	• To present the data or Seminar on topics of current interest • To conduct nutrition education in the field scenario • Visit to relevant GO's, NGO's and industries	**15**

References

Gopaldas, T. Seshadri S. (1987) *Nutrition monitoring and assessment* Delhi: Oxford University Press.

Jelliffe, D. (1966) *The assessment of Nutritional Status of the Community*. Geneva WHO.

Swaminathan, M. (1985) *Essential of Food and Nutrition* Vol I and II Bangalore, Bangalore Printing and
Publishing Ltd.

Kothari C.R. Research methodology- Methods and Techniques, 2nd revised Edition, New Age International Publishers.

Mahajan B.K. Methods in Biostatistics- For medical students and research workers, 7th Edition, Jaypee Brothers Medical Publishers (P) Ltd.

Course Code	Title	Periods/Week/Batch	Marks	Credits
USHSIP504	Applications of Food Production and Service	4	50	2

Objectives :

1. **To** enable students to learn the process of recipe planning, standardization and menu planning
2. To study quantity cookery production and retailing with respect to varied meals and styles of service

Course content		Periods
Unit I	Standardization of recipes	**15**
Unit II	Planning, preparation and retailing of packed meals	**15**
Unit III	Planning, preparation and retailing for various styles of service	**15**
Unit IV	Planning, preparation and retailing for events	**15**

References

Bhojwani M. (2007), *Food service management: Principles and practice*
Eckel P. J. (1985), *College and University Food Service Management*
Delfakis H, Nancy L, Van Burns J (1992), *Food Service Management*
Spears M. C ,Vaden A. E (1985), *Food Service Organizations—A management and systems approach*
Drummond K. (1997) *Nutrition for the Food Service Personnel*
National Association Institute (1998) *Handbook for Food Service Management*
Verghese B (1999) *Professional Food and Beverage Service Management*
Singh, Y. P. (2001) *Effective Food Management*
Fox A. (1971) *Hygiene and Food Production*

T.Y.B.Sc. (HOME SCIENCE)
BRANCH |i : FOODS, NUTRITION AND DIETETICS
SEMESTER- VI

Revised w.e.f. June 2017

Course Code	Title	Internal Assessment Marks	Semester End Exam	Total Marks	Period/ Week/ Division/Batch	Credits
USHSI601	Nutritional Biochemistry –II	25	75	100	3	2
USHSI602	Clinical Nutrition and Diet therapy	25	75	100	3	2
USHSI603	Food Processing	25	75	100	3	2
USHSI604	Human Nutrition – Micronutrients and Functional foods	25	75	100	3	2
USHSI605	Nutritional Surveillance	25	75	100	3	2
USHSI606	Entrepreneurship in Food Nutrition	25	75	100	3	2
USHSIP601	Diet Therapy	-	50	50	4	2
USHSIP602	Food Analysis and Clinical Biochemistry- II	-	50	50	4	2
USHSIP603	Applied Nutrition	-	50	50	4	2
USHSIP604	Entrepreneurial Skill Development	-	50	50	4	2
	Total			**800**	**34**	**20**

Course Code	Title	Periods/Week/Division	Marks	Credits
USHSI601	Nutritional Biochemistry-II	3	100	2

Objectives :

1. To enable the students to apply the knowledge of nutrition and role of nutrients in the body.
2. To understand the chemistry and metabolism of the nutrients in the living system during health and disease.

Course Content		Periods

Unit I	**Lipids**
	• Definition, classification of lipids:
	  • Simple lipids
	  • Compound lipids (Phospholipids, Lipoproteins, Sulfolipids, Glycolipids, Sphingolipids
	  • Derived Lipids: Fatty acids – EFA, w-3, w-6, Eicosanoids and Prostaglandins (biosynthesis and functions), Cholesterol: Structure, functions, synthesis (without structure) and degradation
	• Lipid Metabolism: Knoop's β-oxidation of even C fatty acid (no structures),ketone body formation and utilization ,fatty acid biosynthesis of Palmitic acid (no structure), triglyceride synthesis
	• Lipid uptake and mobilization from adipose tissue
	• Lipid storage disorders
		15

Unit II	**Nucleic acid Chemistry** • Structures of purines, pyrimidines, Nucleosides, Nucleotides • DNA- Watson and Crick model DNA replication - a brief outline • RNA – structure and types • Protein synthesis: Transcription, Translations • Protein degradation: ubiquitin and proteasome system (an overview) • Introduction to Nutrigenomics (brief) • Disorders of purine metabolism	**15**
Unit III	• **Hormones:** Definition, classification, mode of action of Hormones. • Secretion, functions and common disorders of hormones with reference to hormones of the Pituitary gland (GH,TSH, α- MSH, oxytocin and ADH), Thyroid gland (T3 & T4) in brief synthesis of T3 and T4 without structure, pancreas (insulin, glucagon), adrenal cortical hormones and adrenal medullary hormones (synthesis in brief without structure), G.I. hormones (gastrin, secretin, CCK, ghrelin), Male and female sex hormones ,adipose tissue hormones (Leptin, adip0nectin) • **Acid-Base balance** Buffers: definition, types of buffers Role of lungs, kidneys and haemoglobin in Acid-Base balance Chloride shift mechanism Disorders of Acid-Base imbalance	**15**

	• **Fluid and electrolyte balance:** Fluid compartments of the body, Regulation of fluid and electrolyte balance (Hormonal Mechanism)	

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Course Code	Title	Periods/Week/Division	Marks	Credits
USHSI602	Clinical Nutrition and Diet Therapy	3	100	2

Objectives :

1. To impart the concept of modifying normal diets to therapeutic diets.
2. To enable the students to understand the underlying disease conditions, possible complications and pathological states.
3. To train students to plan appropriate nutrition intervention approaches and diets.
4. To enable the students to focus on the preventive role of nutrition in the current life style situations.

Medical Nutrition therapy

Each of the diseases to be discussed under the following heads: Etiology, Pathophysiology, principles of management (with special emphasis on nutritional care), Prevention.

Course Content		Periods
Unit I	• **Diseases of the Gastrointestinal System** • GERD, oesophagitis • Acute and chronic gastritis and peptic ulcer disease (gastric and duodenal) • Gluten induced enteropathy • Lactose intolerance • Diarrhoea, constipation, flatulence • Irritable Bowel Syndrome • Inflammatory bowel diseases • **Food Allergies and intolerances –**A Brief Overview	**15**
Unit II	• **Diseases of the Liver, Biliary system and Pancreas** • Liver: Functions of the liver, Viral Hepatitis (brief), Alcoholic liver disease, Cirrhosis, Hepatic encephalopathy • Biliary System**:** Cholelithiasis, Cholecystitis • Pancreatic diseases: Pancreatitis (acute and chronic) • **Inborn Errors of metabolism** • Phenylketonuria • Wilson's disease • **Cancer** – Role of nutrition in the aetiology, prevention and its management – an overview	**15**
Unit III	• **Renal diseases** • Functions of the kidney • Nephritis – acute and chronic • Nephrotic syndrome • Renal failure- ARF, CRF, Dialysis • Renal Transplant • Nephrolithiasis • **Chronic Obstructive Pulmonary Disease**	**15**

References

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Course Code	Title	Periods/Week/Division	Marks	Credits
USHSI603	**Food Processing**	3	100	2

Objectives :

1. To impart a systematic knowledge of basic and applied aspects of food processing and technology.
2. To gain in-depth knowledge about processing and preservation of techniques used for different food groups.
3. To emphasize the importance of effective food packaging and food quality control.

Course content		Periods
Unit I	• **Cereal and cereal product technology** • Structure, composition, nutritive value, milling and other basic processing techniques- An Overview. • Processing technology of the following: Yeast leavened breads, Cakes, Biscuits, Breakfast cereals, Pasta • **Pulses and legume technology** • Composition, Nutritive value and basic processing –An Overview • Toxic factors and their elimination. • Processing Technology of the following: Extruded soya products, Fermented soya products, Soya milk and ground nut milk • **Technology of oil seeds and oil processing.** • Extraction of oils • Refining of oil • Hydrogenation, plasticizing and tempering • Oil Blends • Margarine, shortenings and spreads • Confectionary fats, cocoa butter, cocoa powder • Mayonnaise	**15**
Unit II	• **Fruit and Vegetable technology** • Frozen vegetables and fruits • Canned vegetables and fruits • Dried fruits and vegetables • Chutney, pickle and sauces • Jams, jellies and marmalades and fruit cheese • Tomato juice & orange juice processing- Puree, pastes and powders • **Dairy technology-An overview of the following:-** • Milk composition • Factors affecting milk quality • Physical and chemical properties • Milk processing- Pasteurization, Homogenization, Standardization • Effect of processing on nutritive value	**15**

	• Milk Products- Milk powder, Sweetened condensed milk, Butter, Cheese, Ice cream, Shrikhand, Yogurt/ Probiotic products, Whey Protein Concentrate, Milk substitutes	
Unit III	**Flesh Food Technology:-Meat, Fish, Poultry and Egg** **Composition, Nutritive value and basic processing : An Overview** **Meat Processing:** Bacon**,** Ham**,** Sausages **Poultry and Egg Processing:** Frozen poultry**,** Poultry nuggets**,** Poultry meat products**,** Egg products **Fish Processing:** Meal**,** Fish oil**,** Frozen fish**,** Canned fish**,** Dried and smoked fish **Beverages:** Alcoholic Beverages- Beer, Wine**,** Non Alcoholic Beverages**,** Coffee, Tea, & Carbonated beverages **Newer trends in beverages** **Convenience foods- Snack food technology** **Food fortification** **Food packaging**: Functions and requirements of food packaging. Types of containers and Packaging materials, Packages with special features, Newer trends in packaging technology **Food laws and standards and systems** (National and International) Role of HACCP ,TQM and FSSAI in controlling quality of foods.	**15**

References

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Course Code	Title	Periods/Week/Division	Marks	Credits
USHSI604	**Human Nutrition- Micronutrients and Functional Foods**	3	100	2

Objectives :

1. To reinforce the basic principles of nutrition
2. To impart in-depth knowledge on the functions, deficiency and toxicity of micronutrients.
3. To enlighten students on the health benefits of functional foods
4. To enable the students to apply knowledge of nutrition to daily life.

Course content		Periods
Unit I	**Vitamins –** Chemistry, Metabolism, functions, Sources, RDA, deficiency and toxicity Effect of cooking and/or processing (wherever applicable) of **Fat soluble vitamins** (A, D, E and K) **Water soluble vitamins** (B-Complex and C)	**15**
Unit II	• **Minerals-** Metabolism, Functions, Effect of processing, Factors influencing absorption**,** Sources, RDA, Deficiency and Toxicity of **Macro-minerals** (Ca, P, Na, K, Mg) **Micro-minerals** (Iron, Iodine, Zn & Fluorine) **Trace elements** (Se, Cu)	**15**
Unit III	A: **Inter-relationship between Vitamins and Minerals; Macro-nutrients and Micro-nutrients** **B: Drug Nutrient Interactions** **C: Functional foods –**Classification, Mechanism of action, Food sources	**15**

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Course Code	Title	Periods/Week/Division	Marks	Credits
USHSI605	**Nutritional Surveillance**	3	100	2

Objectives

1. To create an awareness among students about the nutritional problems of the community with special
2. emphasis on vulnerable sections.
3. To understand the different methods of assessing nutritional status of the community.
4. To recognize the deleterious effects of malnutrition in the development of our nation and means of combating the same.

Course Content		Periods
Unit I	**Nutritional Surveillance and surveillance systems** Understanding Nutritional Surveillance and its purpose, Definitions of terms used in nutritional surveillance – Long term nutrition monitoring, Evaluation of programmes impact, timely warning and intervention systems. Types of nutritional surveillance appropriate to different situations **Assessment of Nutritional Status of a community -A, B, C and D Approach** • **Anthropometry** Measurement of height, weight, head and chest circumferences, mid upper arm circumference, skin fold thickness, interpretation of measurements and comparison with standards (NCHS, ICMR,WHO), classification according to grades of malnutrition **Anthropometric ratios - WHR, W/H, A/H** Rapid Field Assessment Techniques • **Biochemical parameters for assessing nutrition status** Clinical signs and symptoms of PEM, mineral and vitamin deficiencies	15
Unit II	• **Understanding the Clinical Signs in various Conditions** • Nutritional Deficiency disorders - Clinical signs and symptoms of PEM, SAM, MAM, mineral and vitamin deficiencies • **Diet Surveys** • Meaning, Importance, Objectives and Methods • Role of NNMB and highlights of NFHS	15
Unit III	• **Communication for Behavior change-:** Nutrition education – Training, Channels, Methods, Planning ,Implementation & Evaluation.,– Components of Behavior change communication (BCC), Various types of communication interpersonal, mass media, visual, verbal/nonverbal. Features of successful BCC, market research and social marketing • Role of various governmental, non-governmental organizations, National and International agencies in promoting nutrition and health status of the vulnerable sections of society e. g. FAO, WHO, UNICEF, NIN, CFTRI,CARE,NNMB, National Food Security act • National guidelines on infant and young child feeding (ICMR) • Public Distribution System (PDS)- ICDS, Mid-day Meal Programmes	15

References

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Course Code	Title	Periods/Week/Division	Marks	Credits
USHSI606	Entrepreneurship in Food Nutrition	3	100	2

Objectives :

1. To study planning an entrepreneurial venture and executing the plan.
2. To understand the requirements of the process of running a business with respect to marketing and human resources.
3. To gather inputs into finance, accounting procedures and profit management.
4. To understand the ethical and legal aspects of an entrepreneurial venture.

Course Content		Periods
Unit I	**Planning an entrepreneurial venture** • Definition and meaning of entrepreneurship • Types, classification and trends of Entrepreneurial ventures in foods and nutrition • Qualities and skills of an entrepreneur • Resources required for a business • Project formulation and evaluation • Business planning • Legal ,ethical and environmental considerations of the entrepreneurial venture • Overview of business regulation by the government	**15**

Unit II	**Business Processes**
	• Concepts of marketing
	  • Marketing structures and marketing mix
	  • Channels of distribution
	  • Marketing strategies
	  • Market segmentation, targeting and positioning
	• Concepts of Human Resource Management
	  • Recruitment and selection
	  • Training and development
	  • Performance appraisal
	  • Personnel action, retention and productivity improvement
	  • Overview of Labour management and relations.
		15

Unit III	**Financial considerations of entrepreneurship**
	• Funding for the business proposal
	  • Government and non-government opportunities for funds and resources.
	  • Franchising opportunities
	• Product pricing and profit generation
	  • Tools of analysis of costing, cost control and budgeting
	• Accounting procedures and financial statements
		15

References

Barrow Colin, Brown Robert, Clarke Liz, (2006). *The Successful Entrepreneurs guide book*. London: Kogan and Page.

Shring S, Jardine R., Mills J. (2001). *Introduction to Catering*. India: Delmar – Thomson Learning

Coltman Michael M. (2000). *Start and Run Profitable Restaurant*. Mumbai: Jaico Publishing House.

Erdosh George (2000). *Start and Run a Profitable Catering Business*. Mumbai: Jaico Publishing House.

Course Code	Title	Periods/Week/Batch	Marks	Credits
USHSIP601	Diet Therapy	4	50	2

Objectives :

1. To familiarize the students with basic concepts of raw and cooked weights of foods the appropriate weights
2. To impart the concept of modifying normal diets to therapeutic diets.
3. To learn to plan therapeutic diets for management of clinical disease conditions
4. To teach diet modification through use of food exchange lists and calculated values.

Course content		Periods
Unit I	Gastrointestinal Diseases	**15**
Unit II	Liver Diseases	**15**
Unit III	Gall Bladder and Pancreatic diseases	**15**
Unit IV	Renal Diseases	**15**

References

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Additional Reading

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Williams. S.R. (1993) Nutrition and Diet Therapy. Mosby Publication.

Course Code	Title	Periods/Week/Batch	Marks	Credits
USHSIP602	**Food Analysis and Clinical Biochemistry-II**	4	50	2

Objectives :

1. To impart practical skills in the analytical procedures of:
   - Foods for micronutrients, anti-nutritional factors & adulterants.
   - Synthetic body fluids: urine sample for creatinine and abnormal constituents and blood for haemoglobin content
2. To enable students to understand the significance of various food components in food quality.

Course content		Periods

Unit I	• Estimation of moisture content in foods
	• Estimation of ash content in foods and preparation of ash solution
	• Estimation of minerals in ash solution
	  • Estimation of calcium content in foods by EDTA method
	  • Estimation of phosphorus content in foods by Fiske Subbarow method
	  • Estimation of iron content in foods by Ramsay's method
		15

Unit II	• Estimation of Sodium and Potassium content in foods by Flame photometry- demonstration • Estimation of vitamin C content in foods by dye method • Determination of antinutritional factors in foods- Tannins • Estimation of total antioxidant capacity of foods	**15**

Unit III	• **Urine analysis:**
	  • Detection of abnormal constituents in urine
	  • Quantitative estimation of creatinine in urine
	• **Complete Blood Count (CBC)- Demonstration:**
	  • Determination of haemoglobin- Sahli's and Drabkin's method
	  • Determination of RBC, WBC, Haematocrit, MCV, MCH, platelet count, ESR, bleeding time, clotting time etc
		15

Unit IV	• Determination of refractive index & specific gravity of oils- Demonstration • Estimation of total fat in foods by Soxhlet's method- Demonstration • Analysis for chemical constants in oils: Acid Value, Iodine Value, Peroxide value & Saponification value • Estimation of serum total cholesterol	**15**

References

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Mayer, L.H. (1987). Food Chemistry. CBS Publishers and Distributors

Oser, L.B. (1976). Hawk's physiological chemistry.(14th Ed.) Tata McGraw Hill Pub. Co. Ltd.

Pearson, D. (1970). Chemical analysis of foods.(6th Ed.) London: J. A. Churchill

Course Code	Title	Periods/Week/Batch	Marks	Credits
USHSIP603	Applied Nutrition	**4**	**50**	**2**

Objectives :

1. To acquire skills for different methods in assessment of nutritional status of the community.
2. To prepare and use the various types of communication aids for imparting nutrition education.
3. To learn various methods of research and apply it in project development.

Course content		Periods
Unit I	**Assessment of Nutritional Status** To learn techniques of measurement of height, weight, head and chest circumferences, mid upper arm, skin fold thickness	**15**
Unit II	Interpretation of measurements and comparison with standards (NCHS, ICMR), Classification according to grades of malnutrition	**15**
Unit III	To learn to plot and interpret growth monitoring charts To counsel and guide mothers to improve nutritional status of the children	**15**
Unit IV	Visits to governmental and non-governmental community centres	**15**

References

Gopaldas, T. Seshadri S. (1987) *Nutrition monitoring and assessment* Delhi: Oxford University Press.

Jelliffe, D. (1966) *The assessment of Nutritional Status of the Community*. Geneva WHO.

Swaminathan, M. (1985) *Essential of Food and Nutrition* Vol I and II Bangalore, Bangalore Printing and
Publishing Ltd.

Course Code	Title	Periods/Week//Batch	Marks	Credits
USHSIP604	**Entrepreneurial Skill Development**	**4**	**50**	**2**

Objectives :

1. To study planning an entrepreneurial venture and executing the plan
2. To understand the requirements of the process of running a business with respect to marketing and human resources.
3. To gather inputs into finance, accounting procedures and profit management.
4. To understand the ethical and legal aspects of an entrepreneurial venture.

Course content		Periods
Unit I	**Product /service conceptualization** • Idea generation with market research • Project selection and evaluation.	**15**
Unit II	**Budgeting for the project**	**15**
Unit III	**Executing the proposed plan** • Product development • Logistics and protocol development • Packaging and labeling idea generation	**15**
Unit IV	**Marketing the developed product/service** • Applications of marketing concepts • Evaluation	**15**

References

Barrow Colin, Brown Robert, Clarke Liz, (2006). The Successful Entrepreneurs guide book. London: Kogan and Page.

Shring S, Jardine R., Mills J. (2001). Introduction to Catering. India: Delmar – Thomson Learning

Coltman Michael M. (2000). Start and Run Profitable Restaurant. Mumbai: Jaico Publishing House.

Erdosh George (2000). Start and Run a Profitable Catering Business. Mumbai: Jaico Publishing House.

Examination Scheme for B.Sc. Home Science Semesters V and VI:

Part A: Theory Papers

All theory papers of 100 marks are to be evaluated in two parts.

INTERNALS: **25 marks**. This comprises 20 marks for a 30-minute unit test, of which 10 marks are for objective-type of questions and 10 marks for questions requiring longer (but not essay) answers. The objective 10 marks can include the following types of questions:

- Agree/Disagree and give a one-or-two sentence reason.
- Fill in the blanks
- Answer in one or two sentences.
- Name the following.
- Define the following.

Please note that the objective 10 marks **cannot** have the following types of questions:

- MCQs.
- State whether True or False (without giving a reason).
- Match the following.

The remaining 5 marks indicate the extent to which the student was a responsible learner.

SEMESTER-END EXAMINATION: **75 marks.** The semester-end question paper is for 2 ½ hours. The semester-end examination question paper has to be set with 100% choice within each set of questions. For all three unit syllabi, the question paper must have four sets of questions; each of the four questions is compulsory, with options within each question:

- Question 1, carrying 20 marks, has a set of sub-questions from Unit I.
- Question 2, carrying 20 marks, has a set of sub-questions from Unit II.
- Question 3, carrying 20 marks, has a set of sub-questions from Unit III.
- For Questions 1, 2 and 3, no 20-mark question is permitted. In other words, this question cannot have a choice between two 20-mark questions. Possible sub-questions include the following formats: Answer any 2 sub-questions out of 4, or any 4 out of 8, or any 5 out of 10.
- Question 4, carrying 15 marks, has a set of sub-questions from Units I, II, and III. No 15-mark question is permitted. In other words, this question cannot have a choice between two 15-mark questions. Possible sub-questions include the following formats: Answer any 2 sub-questions out of 4, or any 3 out of 6.

Part B: For Courses with Practical : There will not be any Internal Examination or marking for practicals

External Semester End Examination for Practical :

Sr. No.	Particulars for External Practical Examination Semester End Practical Examination		Total Marks	Duration of Semester End Practical Examination
1	Laboratory Work	40 marks	50	3 ½ hours
2	Journal	5 Marks		
3	Viva	5 Marks		