



K.J.Somaiya College of Science and Commerce Revised (as on 05-07-2020) M.Sc. (II) Syllabus in Biochemistry Credit Based Semester and Grading System To be implemented from the academic year 2020-2021 Scheme for Theory Paper M.Sc. Semester III

Course Code	Topic Headings	Credits
20PS3BC1	Food Science and Pharmacology	4
20PS3BC2	Immunology	4
20PS3BC3	Endocrinology & Clinical Biochemistry	4
20PS3BC4	Genetics	4

M.Sc. Semester IV

Course Code	Topic Headings	
20PS4BC1	Microbiology, Community/public health and Nutrition	4
20PS4BC2	Biotechnology & Nanotechnology	4
20PS4BC3	Food processing and Safety management,	4
20101000	Entrepreneurship	
	Soft Skills - Management processes and Business	4
20PS4BC4	communication	







SEMESTER III

Course Code	UNIT	TOPIC HEADINGS	Credit	L /
			S	Week
	Ι	Functional foods and nutraceutical		1
	II	Food spoilage, preservation and quality control		1
20PS3BC1	III	Pharmacokinetics and Clinical Research	4	1
	IV	Mechanism of drug action and structure- function relationship and Investigational New Drug (IND) Application		1
	Ι	Introduction of Immune system, Immunity & Immune response		1
20052002	II	Antibody mediated Immunity	4	1
20133002	III	Immunological Tolerance& Immunodeficiency's	4	1
	IV	Complement system & Cytokines		1
	Ι	Overview of Endocrinology; Hormones of Hypothalamus, Pituitary, Thyroid and Parathyroid glands.		1
20PS3BC3	II	Hormones of Gonads and adrenal glands and Pancreas	4	1
	III	Organ Function Tests and Immunological Tests		1
	IV	Quality Control for Laboratories Clinical Research		1
20PS3BC4	Ι	Overview of classical genetics, structure and characteristics of nucleic acids, chromosomal aberrations.		1
	II	Gene regulation and techniques in nucleic acid analysis: Regulation of gene expression.	4	1
	III	Replication of DNA and chromosomal abnormalities.		1
	IV	Recombinant DNA Technology (RDT) and Tissue culture		1







Course Code	Practicals	Credits
20PS3BC1P	Paper I	2
20PS3BC2P	Paper II	2
20PS3BC3P	Paper III	2
20PS3BC4P	Paper IV	2
	Total	8





SEMESTER IV

Course Code	UNIT	TODIC HEADINGS	Credit	L /
course coue	UNII	TOTIC HEADINGS	S	Week
	т	Morphology of microbes, Microbial		1
	1	techniques and Environmental microbiology		1
	II	Viruses and Infectious diseases		1
20PS4BC1	III	Overview of Community/public Health and nutrition	4	1
	IV	Community disease/disorders control and community communication		1
	Ι	Bio process technology and Fermentation		1
	II	Plant & Environmental Biotechnology		1
20PS4BC2	III	Animal & Marine Biotechnology.	4	1
	IV	Nanotechnology		1
	Ι	Food processing and Safety management, Entrepreneurship		1
20PS4BC3	II	Food packaging	4	1
	III	Auditing in food industry and Accreditations		1
	IV	Entrepreneurship		1
	Ι	Management processes		1
20054004	II	Organizational behavior	Д	1
	III	Business communication	т	1
	IV	Group Discussion, Listening and Reading		1

Course Code	Title	Credits
	Research Project / Survey based project /Internship	
20004000	/Online Internship /online certificate	0
20P54BCP	courses/programmes initiated and designed by	8
	government of India like SWAYAM, NPTEL etc.	





SEMESTER III

Course Code	Title	Credits
20PS3BC1	Food Science and Pharmacology	4
 UNIT I: Functional nutraceutic functional Significance diseases an Classification and flower dietary fibr antioxidant phytoestrop derivatives Carbohydra - saponins, Functional microbiota bacterium delivery of probiotics, foods, type benefits , Sp Sources an Concept of fiber , Rol- diseases .i.e diabetes m nutraceutic 	proal foods and nutraceuticals foods, definition, concept and history, Teleology of als, evolution and classification of nutraceuticals and foods, Traditional foods, designer foods and pharma foods, e of nutraceuticals and functional foods in the management of d disorders on based on food source – plant and animals, Plants – herbs s as functional foods, soya, olive oil, tea, grape wine, garlic re, and others, Natural occurrence of certain phytochemicals- s and flavonoids, omega 3 and 6 fatty acids, carotenoids, gens, glucosinates, organo sulphur compounds, isoprenoid , phenolic substances, fatty acids and structural lipids , ates and amino acid based derivatives ,Isoflavones, terpinoids tocotrienols and simple terpenes foods of microbial origin- human gastrointestinal tract and its , Concept of probiotics with examples, lactobacillus and bifido , Advances in probiotics, gut microflora and health benefits, immune modulators through functional foods, guidelines for probiotic microflora and functions , Prebiotics, ingredients in es of prebiotics and its effect in gut microbes and health pirulina as bioactive components d role of functional foods and nutraceuticals in diseases , dietary supplements, phytochemicals, phytosterols, dietary e of nutraceuticals in health and management of any five e. inborn errors of metabolism/obesity/neurological disorder/ ellitus/ hypertension/ CVD/ cancer/arthritis/AIDS , Role of als in sports nutrition.	15
UNIT II: Food s Bio Chemica Factors maturati	Spoilage, preservation, Food science and quality control mistry of Food Spoilage I and biochemical indices of food quality causing food spoilage during food ripening, vegetable ion and their control.	15



Somerige TRUST M.Sc. II Syllabus

Post mortem changes in meat and their control.	
 Food Poisoning by microorganisms and their products: 	
Different types, symptoms of food poisoning: Botulism, Staphylococcus	
food poisoning, Clostridium perfringens poisoning, poisoning due to	
salmonella, Trichinosis.	
Investigations of food borne diseases.	
Preventive measures for food borne outbreaks.	
Food Preservation	
General principles of food preservation	
Preservation by use of high and low temperatures, drying, radiations,	
chemical preservatives, inert gases, mechanical preservation	
techniques (vacuum packaging, tetra packs).	
• QC, GMP and other topics	
General principles of Quality Control and Good Manufacturing	
Practices in food industry.	
• Food Adulteration: Common food adulterants, their harm effects and	
physical and chemical methods for their detection	
• Food additives: Various additives such as preservatives, antioxidants,	
emulsifiers, sequesterants, humectants, stabilizers with respect to	
chemistry, food uses and functions in formulations.	
• Colours, flavours, sweeteners, acidulants with respect to chemistry,	
food uses and functions in formulations, indirect food additives	
• Sensory evaluation: Objectives, type of food panels, characteristics of	
panel member, layout of sensory evaluation laboratory, sensitivity	
tests, threshold value, paired comparison test, duo-trio test, triangle	
test, hedonic scale, chemical dimension of basic tastes, Amoore's	
classification of odorous compounds. Sherman and Sczezniak	
classification of food texture.	
UNIT III: Pharmacokinetics and Pharmacodynamics	
• Pharmacokinetics: Pharmacokinetics (PK) and drug metabolism,	
objectives of PK Analysis in drug discovery, fundamental concepts in	
drug absorption, distribution, metabolism & elimination (ADME)	15
Kinetics of drug following different modes of drug administration.	15
Introduction to important PK parameters, PK of oral administration	
&bioavailability	
• Pharmacodynamics (mechanism of drug action)	
UNIT IV: Mechanism of drug action and structure-function relationship	
and Investigational New Drug (IND) Application	15





•	Mechanism of Drug Action and structure: Function Relationship:	
	Molecular basis of drug action; antipyretic drugs: Paracetamol,	
	antiallergic drugs:- Cetrizine Hydrochloride. Drug-Nutrient	
	Interaction. Computer-based drug designing.	
•	Investigational New Drug (IND) Application: Animal pharmacology	
	& toxicology studies.	
	New Drug Application (NDA): Introduction to NDA, NDA forms,	
	contents of NDA, Preparation & Submission of documents, guidance	
	documents for NDAS.	
٠	Strategies in drug therapy	
	a. Central nervous system: antidepressants	
	b. Respiratory system: pharmacotherapy of bronchial asthma	
	c. GI system: antacids	
	d. Cardiovascular system: beta adrenergic blockers	
	e. Endocrine system: thyroid modulators	

Course Code	Title	Credits
20PS3BC2	Immunology	4
UNIT I: Introd	uction of Immune system, Immunity & Immune response	Number
Cells an	d organs of Immune systems: Lymphoid cells, mononuclear,	of
phagocy	tes, antigen presenting cell, polymorphs, mass cells and	Lectures
platelets	s. Primary and secondary Lymphoid Organs, Lymphocyte	
Traffic.		
 Major H 	istocompatibility Complex (MHC): General organization and	
inherita	nce of MHC. Structure of Class I and Class II HLA Molecules and	
organiza	tion of Class I and Class II HLA Genes. Cellular distribution of	15
MHC M	lolecules. Regulation of MHC Expression- Determinant	
Selection	n Model, Holes in the Repertoire Model. MHC and susceptibility	
to disea	se. Antigen processing and presentation. Self MHC Restriction	
of T Ce	ll Role of Antigen presenting cells. Pathways for Antigen	
Processi	ng, Cytosolic and endocytic pathway.	
• T cell su	bset and their function.	
• T cell r	eceptor, structure, organization and rearrangement of TCR	
genes. T	cell receptor complex- TCR- CD3. T cell accessory membrane	
molecul	e. Ternary TCR Peptide MCH Complex. T cell – Maturation,	







Activation 8 Differentiation	
Activation & Differentiation.	
• Development of Immune System in short- Myelold Cells, Memory B cells	
• Immune Response to infectious diseases: Viral, Bacterial, Fungal and	
Protozoal diseases, Helminthes (parasitic worms) infections- effector	
mechanisms	
UNIT II: Antibody mediated Immunity	
• B cell maturation, activation and differentiation.	
Antigens ,Antibodies and Their Interactions	
• Antigens, Antigenic determinants, antigenicity and immunogenicity.	15
• Immunoglobulin: Basic structure, classes, subclasses, function.	
Antibody receptors.	
 Organization and expression of immunoglobulin genes. 	
 Theories of antibody formation, Immunoglobulin variability. 	
Genetic basis of antibody diversity.	
Regulation of Immunoglobulin production.	
 Monoclonal antibodies: Production and clinical uses. 	
• Engineered monoclonal antibodies, Chimeric and hybrid monoclonal	
antibodies.	
Regulation of Immune response, Antigen-Antibody Interaction (Ag-Ab	
Interaction).	
• Strength of Ag-Ab Interaction, Antibody Affinity, Scatchard Equation,	
Antibody Avidity, Cross Reactivity.	
Primary and Secondary Ag-Ab Interaction	
UNIT III: Immunological Tolerance& Immunodeficiencies:	
• Pathways to B and T cell tolerance, General characteristics of B and T	
cell tolerance	15
 Mechanisms of tolerance inductions self-tolerance 	
Potential therapeutic applications of tolerance	
T cells Immune Response in Transplantation	
• Types of graft, immunological basis of graft rejection- 1st set, 2nd set	
rejection- role of T lymphocytes	
Clinical manifestation of graft rejection, General and specific	
immunosuppressive therapy	
• Experimental Animal Models: In Breed Strength, Adoptive Transfer	
Systems, SCID Mice and SCID Human Mice.	
• Cell Culture System: Primary Lymphoid Cell Culture, Clone Lymphoid	
Cell Line, Hybrid Lymphoid Cell Line	





Immunodeficiencies.	
Classification of Immunodeficiencies: primary and secondary	
• Immunology of HIV/AIDS: Discovery, causes, structure, process	of
infection, destruction of CD4.	
 Autoimmunity and autoimmune diseases and their etiolog 	gy:
Organ specific autoimmune diseases (Hashimoto's thyroiditis a	nd
insulin dependent diabetes mellitus).	
• Diagnostic and prognostic value of auto antibodies: Treatment of	f
autoimmune diseases.	
UNIT IV: Complement system & Cytokines	15
• Complement System: Definition, components and function.	
Complement activation, Classical and alternative pathways of	
membrane attack complex. Complement receptor and biological	
consequences of Complement activation, cell lysis, inflammatory	
response, opsonisation of antigen, viral neutralization, Solubilisation	L I
of immune complexes.	
Complement deficiency.	
• Cytokines: General structure and functions, Cytokine receptors,	
cytokine antagonists. Cytokine secretion by TH1 and TH2 subsets.	
Cytokine related diseases. Therapeutic uses of cytokines. Immune	
Responses	
• Inflammation mediators of inflammation and process of inflammation	n
• Hypersensitivity Gel and coombs classification types I to IV with	
mechanisms	

Course Code	Title	Credits
20PS3BC3	Endocrinology & Clinical Biochemistry	4
UNIT I : Ove	erview of Endocrinology; Hormones of Hypothalamus,	Number
Pituitary, Thy	roid and	of
Parath	yroid glands.	Lectures
 Organiza 	ation of Mammalian Endocrine System, Classification of	
hormon	es, Overview of circulation, modification and degradation,	
Target t	ssue, feed-back control.	
 Biosynth 	nesis, Storage, Secretion, Transport and Metabolic effects	15
(includii	ng hypo and hyper conditions) of Hormones of Hypothalamus.	
Biochem	ical assessment and changes in hypothalamus disorders.	





Mechanisms of Hormone action, Role of Secondary Messengers-cAMP,	
cGMP, Ca and Calmodulin, Plasma membrane receptors, adenylate	
kinase, Role of G Proteins, protein kinases, tyrosine kinases, inositol	
phosphates, steroid hormone receptors.	
• Pituitary hormones: Biochemistry and mechanism of action.	
Regulation of synthesis and secretion. Hypo and hyper activity of	
pituitary hormones-gigantism, dwarfism, acromegaly, diabetes	
insipidus, syndrome of inappropriate ADH secretion.	
• Thyroid hormones: synthesis, secretion, transport and mechanism of	
action. Metabolic fate and biological actions. Antithyroid agents.	
Thyroid diseases, thyrotoxicosis, goiter, hypothyroidism, Graves'	
disease, Hashimoto's disease. Thyroid function tests.	
Parathyroid Hormone and Calcitonin: Biological actions, regulation	
of calcium and phosphorus metabolism. Calcitriol. Pathophysiology.	
UNIT II: Hormones of Gonads and adrenal glands and Pancreas	15
• Gonadal hormones: Androgens and estrogens-synthesis, secretion,	
transport and mechanism of action. Metabolic fate and biological	
actions. Ovarian cycle, Pregnancy, Biochemical changes in pregnancy.	
Adrenal hormones: Adrenal cortex- glucocorticoids and	
mineralocorticoids-synthesis, secretion, transport and mechanism of	
action. Metabolic fate and biological actions. Adrenal androgens-	
metabolic effect and functions. Adrenal medulla- catecholamines-	
synthesis, secretion, transport and mechanism of action. Metabolic fate	
and biological actions. Abnormal secretion of adrenal hormones-	
Addison's disease, Cushing's syndrome, Congenital adrenal	
hyperplasia, phaeochromocytoma.	
Biochemical assessment and changes in Endocrine disorders of Adrenal	
Medulla, Adrenal Cortex, ovaries, testes	
• Pancreatic hormones: Islets of Langerhans and Hormone secretion.	
Biosynthesis, secretion and mechanism of action. Biological actions.	
Receptors, intracellular mediators and signalling pathways of insulin	
and glucagon. Somatostatin, Pancreatic polypeptide and insulin like	
growth factors.	
Biochemical assessment and changes in Endocrine disorders of pancreas	
• Gastrointestinal hormones: producing cells, synthesis, structure,	
secretion and functions, GIP, VIP, gastrin, CCK and other peptides.	
• Hormones secreted from other organs and tissues: liver, kidney,	





heart, thymus and pineal gland.	
UNIT III: Quality Control for Laboratories and Clinical Research	
Clinical diagnostics: Diagnostic Kits and their applications.	15
• Concept and significance : Bio safety, Bio Hazards and Bio ethics.	
• Concept of QC, QA GMP, GLP in labs & production processes.	
Lab/process validation & Accreditation.	
• Maintenance & Management of Lab/Experimental animals and Animal	
House, CPCEA guidelines, ICH-GCP	
Clinical Research and Trials: Clinical research and its importance,	
significance & rationale, Clinical Trials- Stages/ Phases I to IV,	
milestones in clinical trials.	
Ethical Issues: Values & principles in clinical investigation,	
international guidelines, patient care in clinical research, conflict of	
interest. Ethical review, informed consent, vulnerable populations,	
biological samples. Databases, confidentiality, fraud & misconduct	
UNIT IV: : Organ Function Tests and Immunological tests	15
Biochemical Assessments and Changes in Endocrine Disorders	
(Pituitary, thyroid, adrenal medulla, adrenal cortex, ovaries, testis).	
Liver Function test.	
 Renal Function test including mechanism of urine formation. 	
 Gastric and Pancreatic Function test. 	
Thyroid Function test.	
Cardiac Profile	
Pregnancy tests.	
 Use of ELISA, RIA and IRMA techniques in assay of hormones 	
• Tissue typing and laboratory investigations: microcytotoxicity test,	
mixed lymphocyte reaction (HLA Typing)	
 Use of ELISA, RIA and IRMA techniques in assay of hormones 	

Course Code	Title	Credits
20PS3BC4 Genetics		4
UNIT-I: Overv	iew of classical genetics, structure and characteristics of	Number
nucleic acids, chromosomal aberrations .		of
• Mendelian genetics: Mendelian laws and basis of inheritance, genotype,		Lectures
phenotype.	Chromosomal theory of heredity, Meischer, Griffith, Hershey-	15
Chase & Ave	ery; RNA as genetic material.	





•	Non Mendelian genetics: Incomplete dominance, codominance, multiple	
	alleles, pleiotropy, recessivity, sex determination, sex-linked traits, sex-	
	linked inheritance, lethal genes.	
•	Problems based on above concepts.	
•	Structure and characteristic of DNA & RNA: Base composition of DNA,	
	double helical structure, Chargaff's rule, A, B & Z DNA, liner, circular and	
	supercoiled DNA. Tm of DNA, its relation to GC content, unique and	
	repetitive sequences of DNA, Cot curves and its significance, C-value	
	paradox; movable genes, transposons & retroposons, invert repeats.	
	Types of RNA, structure & functions, genetic code & their characteristics.	
•	Organization of DNA in genome: Histones, nucleosomes, structure of	
	chromatin Eukaryotic chromosomes, Prokaryotic chromosomes,	
	lampbrush & polytene chromosomes.	
•	Functions of gene: Gene mapping by conjugation, transformation &	
	transduction.	
•	Chromosomal abnormalities: Euploidy and aneuploidy (Autosomal and	
	Sex chromosomes) Monosomies (Turner syndrome), Disomies and	
	trisomies (Down Syndrome) and their causes.	
•	Mutations: Types of mutations, Physical, chemical and Biological agents	
	causing mutations	
•	DNA repair Mechanism: Photo-reactivation, nucleotide excision, SOS	
	repair, recombinational repair mismatch repair.	
UN	IIT II: Replication of DNA and chromosomal abnormalities.	
•	Replication: Modes of replication; Messelson and Stahl's experiment for	15
	semi-conservative replication.Concepts of replication initiation,	
	elongation and termination in prokaryotes and eukaryotes, enzymes and	
	accessory proteins involved in DNA replication, Fidelity in replication,	
	replication of single stranded circular DNA, difference between	
	prokaryotic and eukaryotic replication. Genomic and subcellular organelle	
	replicons, viral and plasmids replicons, replication origin, initiation and	
	replication, multiple initiation sites, Okazaki fragments.	
•	Transcription of DNA: DNA dependant RNA polymerases in prokaryotes	
	and eukaryotes, Mechanism of transcription: template directed synthesis,	
	sigma cycle, promoter recognition. Properties of promoter in prokaryotes	
	and eukaryotes Post-transcriptional processing; maturation of rRNA &	
	tRNA, RNA splicing mechanism, poly A tail and 5'capping, noncoding	
	sequences. Reverse Transcription	
•	Translation: Mechanism of translation: activation, initiation (importance	





	of Shine-Dalgarno sequence), elongation and termination: Rho-dependent	
	Post translational processing and modification, signal hypothesis	
UN	NIT III: Gene regulation and techniques in nucleic acid analysis	15
: R	egulation of gene expression.	
•	Organization of gene: Structural & regulatory elements; split genes.	
•	Regulation of gene expression	
•	Prokaryotic gene regulation: Positive and negative control, induction	
	and repression, attenuation. Example: lac, trp, operons; SOS regulation.	
•	Eukaryotic gene regulation: Role of upstream, downstream and	
	enhancer elements, cis-trans acting elements in gene expression,	
	examples and experimental evidences.	
•	Medical genetics: Genetic screening, Genetic diagnosis, Genetic	
	counselling.	
•	Techniques in nucleic acid analysis: Amplification (PCR), Restriction	
	mapping, DNA sequencing methods: , RNA sequencing technique,	
	Oligonucleotide synthesis , Allele specific oligonucleotide (ASO), RFLP,	
	SNPS, RAPD, Quantitative trait loci, Technique based on nucleic acid	
	nybridization, dot-blot, FISH, Karyotyping , sex determination	
TIN	UT W. Desembinent DNA Teshnelery (DDT) and Tissue sultains	1 2
UN	NIT IV: Recombinant DNA Technology (RDT) and Tissue culture	15
UN •	NIT IV: Recombinant DNA Technology (RDT) and Tissue culture Gene cloning, isolation of genes, obtaining genes from eukaryotic and	15
UN •	NIT IV: Recombinant DNA Technology (RDT) and Tissue culture Gene cloning, isolation of genes, obtaining genes from eukaryotic and prokaryotic organisms, problems of isolation of genes, isolation of gene fragments cDNA synthesis PCR designing of primers for PCR chemical	15
UN •	NIT IV: Recombinant DNA Technology (RDT) and Tissue culture Gene cloning, isolation of genes, obtaining genes from eukaryotic and prokaryotic organisms, problems of isolation of genes, isolation of gene fragments. cDNA synthesis, PCR, designing of primers for PCR, chemical synthesis of genes, shotgun experiments, gene bank, gene library	15
UN •	NIT IV: Recombinant DNA Technology (RDT) and Tissue culture Gene cloning, isolation of genes, obtaining genes from eukaryotic and prokaryotic organisms, problems of isolation of genes, isolation of gene fragments. cDNA synthesis, PCR, designing of primers for PCR, chemical synthesis of genes, shotgun experiments, gene bank, gene library Vectors for cloning in bacteria : plasmid bacteriophage cosmid	15
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UN • •	 NIT IV: Recombinant DNA Technology (RDT) and Tissue culture Gene cloning, isolation of genes, obtaining genes from eukaryotic and prokaryotic organisms, problems of isolation of genes, isolation of gene fragments. cDNA synthesis, PCR, designing of primers for PCR, chemical synthesis of genes, shotgun experiments, gene bank, gene library Vectors for cloning in bacteria: plasmid, bacteriophage, cosmid, phagemid. Cloning in yeast vectors: Yep, Yrp, Ycp Cloning in plant cells: suitable vectors – caulimo viruses, Ti plasmid, cloning in mammalian cells, viral vector, shuttle vector. 	15
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Application of PTC. Micropropogation and Protoplast fusion. Suspension Cultures for production and secondary metabolites. Gene Transfer and Transgenic for crop improvement

• Animal Tissue Culture (ATC): Principles, Techniques, Methodology and Application of ATC. Transfection using eggs, cultured stem cells and nuclei in development of transgenic animals. Frontiers of contraceptive research, cryopreservation of sex gametes& embryos, Ethical issues in embryo research

Detail Syllabus for Semester- III Practicals

Paper 1

Microbial analysis of food products

- Identification of salmonella, Escherichia Coli and yeast
- Determination of shelf life of various food products
- Preparation of Microbial Media
- Isolation of Microbes and plating techniques
- Methylene blue reduction test(MBRT) for quality of milk
- Sterilization of culture media, glassware by hot air oven

Food Science

- Estimation of Vitamin C by Iodometry/ DCPIP method.
- Estimation of Trypsin inhibitors from raw seeds
- Estimation of Sodium Benzoate from Jam/Jellies/Sauces.

Food science and Pharmacology

- 1. Preparation of Aspirin from salicylic acid
- 2. Estimation of Methyl salicylate
- 3. Estimation of Aspirin
- 4. Isolation of Lycopene from tomato
- 5. Estimate the acidity of Milk/Fruit juice
- 6. Isolation of Casein.
- 7. Estimation of phosphorous from the food sample
- 8. Estimation of Magnesium from food sample
- 9. Food adulteration tests
- 10. Isolation of essential oils from orange/ lemon peels







Paper 2

Serology

- 1. Rheumatoid arthritis factor
- 2. c- reactive protein
- 3. Widal
- 4. VDRL
- 5. Pregnancy test
- 6. ELISA (Demonstration)
- 7. Immunodiffusion (Demonstration)

Paper 3

Biochemical Tests for Endocrine glands Assessment

- 1. Demonstration of Radioimmunoassay
- 2. Glucose Tolerance Test (GTT) [to assess the function of pancreas]
- 3. Calcium (Ca) by Clark and Collip Method/ Trinder Method [To assess the function of thyroid and parathyroid glands]

Organ function tests

- 1. Pancreatic Function Tests: Estimation of Serum Amylase Activity.
- 2. Estimation of serum Total Proteins,
- 3. Albumin & determination of A/G ratio.
- 4. Biochemical Examination of CSF : Glucose, Proteins, Chlorides. **Demonstration Experiments**
- 1. Estimation of T₃, T₄ and TSH from Serum/plasma
- 2. Estimation of Vitamin D3 levels from serum/plasma
- 3. Estimation of FSH and LH levels from serum/plasma
- 4. Estimation of Testosterone levels from serum/plasma

Paper 4

Isolation of DNA and RNA

- 1. Isolation of DNA (crude) from germinating moong /Onion seeds
- 2. Isolation of RNA (crude) from Baker's yeast

Demonstration Experiments

- 5. Determination of base composition of DNA.
- 6. Staining of Cellular RNA & DNA and microscopic examination.
- 7. Study of bacterial conjugation
- 8. Study of bacterial transformation.





- **Department: Biochemistry**
 - 9. Study of mutation in E.coli by UV.
 - 10. Induced expression of alpha & beta galactosidases and catabolic repression in microorganisms.
 - 11. Chemical Mutagenesis in Yeasts.
 - 12. Polymerase chain Reaction (PCR).
 - 13. Cell free protein synthesis.
 - 14. Restriction Digestion & separation of DNA restriction fragments
 - 15. Gene cloning & selection of recombinant clones.
 - 16. Tm of DNA.
 - 17. AMES Test.
 - 18. Estimation of Serum Glycosylated Haemoglobin
 - 19. Separation of LDH lsoenzymes
 - 20. Arterial Blood Gas Analysis
 - 21. DNA Sequencing
 - a. Maxam Gilbert Method
 - b. Sanger's Method
 - 22. Blotting Techniques (Southern, Western, Northern)





SEMESTER IV

Course Code			Title				Credits
20PS4BC1	Microbio	logy, Co	ommunity/	public healt	h and Nutritio	n	4
							Number of
UNIT-I: Mor	phology	of n	nicrobes,	Microbial	techniques	and	Lectures
Environmenta	l microbio	logy					
 Morpholog and protozoa eubacteria - p cell wall and and motlility. appendaged pseudomonac and cocci, my Microbiologi microbial ide nutrition, cor isolation of microbes. Sterilization a pasteurizatio alcohol, alden Testing of dis Environme nitrogen cycc nitrogen fixat microbes in a Air sanitatio techniques fo complete test 	y and Ultr Classification optidoglyc cell membr Cell inclus bacteria, sp ds, lactic ar obacteria, r cal technic entification struction of chemoaut nd disinfe n,autoclavin by de, dyes, infectants. ental micr le, proteol cion – symb ir, factors e n; microbi or detectin	ctions of grant and ane of an and ane of an and ane of an and ane of an another and another anothe	ture :Ultra microbes, n related moi gram - posit dies. Purple spirochaete ionoc acid a and myco Aethods in n culture teo re media. E s, chemoho physical a ing, filtrati h, phenol, su Walker coef gy biochemi mmonificat nd nonsyml s the extent of water a r quality, p	structure of l molecular tax lecules. Struct rive and negat and green bas s, gliding and bacteria. End plasma. Archa nicrobiology, chniques. Prin Carichment cu eterotrophs gents – dry on, radiation urface acting a ficient. cal role of ion, nitrifica piotic. Air mic and type of m nd waste w presumptive	bacteria, fungi, conomy, cell wa ture and synthe tive bacteria. Fl acteria. Buddin d sheathed bac ospore forming aebacteria. Currents methe nciples of mic alture techniqu and photosyn r heat, moist . Chemical age agents, metallic soil microorga tion, denitrific crobiology; Sou ater. Bacteriol test, confirmed	algae alls of esis of agella g and cteria, g rods ods in robial es for thetic heat, ents – salts. unism, ration, rce of in air. ogical d and	15
Viruses	: Bacteria,	plant,	animal and	tumor viruse	es. Classificatio	n and	15
structur	e of viruse	s.DNA v	viruses: pos	sitive and neg	ative strand. D	ouble	
strandeo	d RNA v	viruses.	example o	of herpes,	pox, adenovi	ruses,	
retrovir	uses, viroid	s and p	rions.				
 Pathoge 	nesis of vira	al disea	ses				





		[
	a. Entry, contact, and primary replication	
	b. Viral spread and cell tropism	
	c. Cell injury and clinical illness	
	d. Recovery from infection	
	e. Virus shedding	
	Infectious Diseases :	
•	Detailed Study of following infections including Etiology, Transmission,	
	Pathogenesis, Clinical Manifestations, Lab. diagnosis, Prophylaxis, and	
	Treatment.	
	1. Respiratory tract infections: Pneumonia- Bacterial & Viral	
	2. Central nervous system infections:- Meningitis / Japanese Encephalitis.	
	3 Sexually transmitted diseases: Synhillis Human nanilloma virus	
	infection Human immunodeficiency virus	
	4 Vector borne infections: Malaria Dengue	
Fn	arging infectious disease	
	Emorging disease nattorns	
•	Emerging uiral diseases: Source Agute Despiratory Sundrome H1N1	
•	Emerging viral diseases: Severe Acute Respiratory Syndrome, mini	
	Innuenza Avian Innuenza, COVID-2019 (Corona virus)	
•	Emerging Bacterial Infections: Multi-drug resistant tuberculosis, MRSA, E.	
•	Emerging Zoonotic Bacterial Pathogens: Helicobacter species	
UN	NIT III : Overview of Community/public Health and nutrition	15
	• Definition and concepts of community/public health, Public Health	
	Nutrition	
	• Policies in Community nutrition :National Food Security Act, National	
	Nutrition Policy, National Nutrition Mission- maternal nutrition	
	(antenatal and postnatal care),National water policy, National Health	
	policy, surveys and nutritional statistics	
	Identification of vulnerable groups	
	• Approaches and strategies for improving programmes in public health	
	nutrition: - Health based interventions including immunization	
	provision of safe drinking water, provision of safe drinking water and	
	sanitization facilities Food fortification use of hiotechnology	
	sunnlementary feeding	
	supplementary recurring	





 Education based interventions including growth monitoring and promotion. Role of Public Health Nutritionist in National development Health indicators Emerging Nutritional public health problems, their risk factors & Monitoring: - NCDs, VAD, IDD, Anaemia 	
 Communicable and infective disease control : Nature of communicable diseases, infections, contamination, transmission, vector borne diseases, environmental agents, control,prevention and management of various food borne and water borne diseases Malnutrition: Causes and problems of malnutrition Preventive strategies for Macro and micronutrient deficiencies and associated disorders: Chronic Energy Deficiency/ Protein Energy Malnutrition and Severe Acute Malnutrition of Micronutrient deficiencies - Vitamin A deficiency, Nutritional Anemias, Iodine deficiency disorders, Vitamin D deficiency and Osteoporosis, Zinc Deficiency 	
 Meaning and significance of nutritional status assessment Nutritional surveillance for programme planning: Triple A approach Development of low cost recipes under Community Nutrition Strategies for augmenting food production - Green, White, Brown and Blue revolution Public Health implications and preventive strategies for: Obesity, Hypertension, Cardiovascular diseases, Diabetes Nutritional Counseling: Concept and importance of counseling in the nutrition care process, tools of counseling, Skills and attributes of a counselor • Barriers to effective communication, Understanding dietary patterns and food choices and their impact on counseling, Behaviour Change Communication and models for behaviour change, Counseling strategies, Designing of counseling plans 	







Course Code	Title	Credits
20PS4BC2	Biotechnology & Nanotechnology	4
		Number of
UNIT I: Bio pro	ocess technology and Fermentation	Lectures
Bioproc	ess Technology:	
Types of B	ioreactors: Stirred Tank, Recycle reactors, discontinuous, semi	15
continuous	and continuous.	
Parameter	s for Bio process: Bio mass, Substrates, product, O2and CO2,	
Temperatur	e, agitation.	
Bio process	monitoring with respect to O_2 transfer, energy transfer, rate of	
utilization, e	efficiency and computer base monitoring	
Downstrea	m processing : process for product recovery, recycling of	
residual rav	v, by product recovery, waste/effluent treatment	
Fermen	tation	
Primary and	d secondary of microbes, inoculums preparation, fermentation	
media, indu	strial sterilization, strain improvement, metabolic and genetic	
regulations	during fermentations, pure and mix culture fermentations.	
Products	from microorganisms: enzymes (Amylases, Proteases,	
Pectinases),	Primary metabolites (Glu, vit B12), Antibiotics(Penicillin),	
Pigments (C	arotenoids), Sweeteners, Beverages (wine, Beer)	
Fuels from	microbes, microbial polymers and microbial steroid bio	
transformat	ions.	
UNIT II: Plant	& Environmental Biotechnology	
• Plant T	issue Culture (PTC): Principles, Techniques, Methodology and	15
Applicat	ion of PTC. Micropropogation and Protoplast fusion. Suspension	
Cultures	for production and secondary metabolites. Gene Transfer and	
Transge	nic for crop improvement	
• Organic	Farming: Principles, Certifications,	
Soil Less	s Farming Practices: Hydroponics, Aeroponics	
 Integrat 	ed Sustainable farming practices: Aquaponics.	
 Data Dri 	ven Agriculture/Smart farming (use of drones, probes/sensors,	
robots (GIS) Example: AgSmartic (India)	
 Degrada 	tion of Xenobiotic Compounds in Environment - Decay	
behavior	ur & degradative plasmids: Hydrocarbons. Substituted	
hvdroca	rbons. Oil pollution. Surfactants.	
Bioreme	ediation of contaminated soils	





	·
 Biopesticides; their roles in pest management Solid wastes; Sources and management: composting, wormiculture and methane production, Food, feed and energy from solid waste (biomass and agrowastes) Global Environmental Problems: Ozone depletion, UV-B and greenhouse effect, Acid rain, its impact and biotechnological approaches for management. UNIT III: Animal & Marine Biotechnology. 	
 Animal Tissue Culture (ATC): Basic of animal tissue culture: Methods of cell dissociation/separation and preparation of primary cell culture, characteristics of cells in vitro, cell culture growth parameters, detection, prevention and determination of contamination in tissue culture. Culture: Short term culture, Specialized cells: bone marrow myogenesis in vitro skin cell culture, erythrogenesis - leukemia cells, chondriogenesis- in vitro, cryopreservation of tissues and cell lines. Analysis and Production: cell synchronization, cell transformation in vitro, Mass cultivation- cytodex and biofermentors. Cell cloning and Transgenic animals. Applications: Stem cells & therapeutic cloning, Tissue engineering and 3D printing. Transfection using eggs, cultured stem cells and nuclei in development of transgenic animals. Frontiers of contraceptive research, cryopreservation of sex gametes& embryos, Ethical issues in embryo research. Marine Bio Technology: Medical Application of Marine resources – Anticancer and Antiviral compounds, Antimicrobial agents, Marine Toxins. 	
seaweeds and their application.	
UNIT IV:- Nanotechnology	15
 Bionanotechnology: Concept. Types of bionanostructures (Carbon nanostructures, nanoshells, dendrimers, quantum dots, nanowires, liposomes). Synthesis of bionanoparticles: Physical, chemical and biological methods. Applications of nanotechnology: medicine and diagnostics (antimicrobial properties, therapies, drug delivery including rate programmed drug delivery, Microencapsulation of cells. imaging) agriculture, environment. 	
• reconfiques for analysis of nanomaterials, Mechanical properties of	





nanomaterials, structural properties of nanomaterials.	
Potential risks of Bionanotechnology.	

Course Code	Course Code Title		
Food processing and Safety management,		4	
Entrepreneurship		Ŧ	
Unit I – Food p			
Food Processir			
 Manu Food Heat High radia Non-t Extru Shelf l produ Overy Edibl indus proce 	afacturing processes: batch, Semi-batch and continuous processing techniques: processing: Pasteurization technique, Ohmic heating and Pressure processing, Dehydration by drying (contact, tion, sublimation), retort processing technique hermal processing and Hurdle technologies usion processing technique ife of processed food: Determination of shelf – life of food acts, transports of perishable food items. view, Design, Facilities and processes of following industries: e Oils Fats Industry, Milk industry, Beverage stry(alcoholic and non-alcoholic), fruits and vegetable essing industry	15	
Food Safety ma Intro FOOD Act a Produce Food and F Other AGM Food Hub, and N Impo			







FSSAI Schedule 4

- International Food Safety Standards:ISO 22000: 2018 Standard, HACCP, FSSC 22000, BRCGS, IFS, SQF
- Terms, Definitions and principles of Food Safety Management System in context of an organization
- Leadership & Management Commitment on achieving objectives of Food Safety Policy
- Role of Food Safety Officer (FSO) and career in regulatory and Food Safety field
- Planning Support through Resources and Communication mechanism, Traceability & Emergency Preparedness of an organization
- Operations, Hazard Analysis, Hazard Assessment & Hazard Control Plan
- Personal hygiene and HACCP implementation in industries

Unit II – Food packaging

- Introduction of Food packaging: Objectives and need of food packaging,
- Packaging materials for food packaging,: wood, cloth, paper, metals, glass, plastic packaging, basic types of plastics used in packaging technology, edible packaging, additional packaging materials, adhesives used in food packaging, printing of packaging materials
- Properties of packaging materials such as tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, methods of testing and evaluation; barrier properties of packaging materials; theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate and its measurement, water vapor transmission rate and its measurement
- Food packaging systems- different forms of packaging such as rigid, semirigid and flexible forms, retortable pouches, tetrapack packaging system for dehydrated foods, frozen foods, dairy products, fresh fruits and vegetables, meat, fish, poultry, sea foods, vanaspati ghee & basmati rice
- Properties, advantages and limitations of the following packaging materials: Glass, aluminum, its foil, metal tin containers. Paper and paperboards, laminates and multilayer composition, retortable







pouches plastic films

- Deteriorative changes in foodstuff and packaging methods for prevention, shelf life of packaged foodstuff, methods to extend shelf-life
- Package labeling functions and regulations
- Packaging Machinery Bottling, can former, form fill and seal machines, bags – their manufacturing and closing, vacuum packs unit, shrink pack unit, tetra pack unit
- Advanced Packaging Technologies: RFID, Bar Codes, ESD protective packaging

Unit III – Auditing in food industry and Accreditations

- Definition and overview of food auditing
 Types of audits: internal audit, second party audit, third party audit,
- Seven principles of ISO Auditing, ISO 19011Requirements
- Product and process audits, HACCP audits and certification audits.
 Steps and process of auditing. HACCP based SOPs checklist, Qualities and traits required for an auditor
- Audit Management and planning: Role and responsibilities of auditors and lead auditors and Pre-audit information required to plan the audit Inspection of food establishments, manufacturing units: Food regulatory enforcement and compliance through inspection. Inspectional requirements for food business operators: general inspection procedures
- Standard Operating Procedures Preparing scope, quality policy and quality objectives of food processing company, Defining Standard operating procedure purpose Format developing and implementing, effective writing. SOP for purchasing raw materials, receiving raw materials, storage, cleaning, holding, cooling, freezing, thawing, reheating, personal hygiene, facility and equipments. Systems in laboratory accreditation
- Post Audit activities : Evidence based report writing, including writing valid, factual and value adding non-conformity report
- Evaluation of case scenarios and assigning critical, major, minor nonconformances to specific examples of processes and plant behaviour.
- Proposals for corrective action and follow up.
- Onsite Auditing VS Remote Auditing. Use of Information and Communication technology (ICT) in Remote auditing
- Accreditations IAF, QCI, National Accreditation Board for Testing and Calibration Laboratories (NABL), Role of Accreditation bodies (





e.g NABCB, RvA, UKAS), and related applicable standards (ISO/ TS	
22003, ISO 17021-1, ISO 17025)	
Unit IV – Entrepreneurship	
 Unit IV - Entrepreneurship Entrepreneurship and enterprise - Concept, definition, meaning and meaning with special context to Food and allied areas of the Indian scenario. Concept and overview of startups Types, classification and trends of Entrepreneurial ventures in foods and nutrition Resources required for a business Process of entrepreneurial development and planning a new Enterprise Functions and classification of Entrepreneur and supporting institutions and schemes by the National and International agencies for promotion of entrepreneurship in the country such as NSIC, NIMSME, NIESBUD, KVIC and National Financial Institutions, Business plan format for tiny and small enterprises, planning small scale units Product pricing and profit generation and assessment of financial viability Investment and risk analysis and cost benefit analysis. 	
• Tools of analysis of costing, cost control and hudgeting market	
survey tools	
	1

Course Code	Title	Credits
20PS4BC4	Soft Skills - Management processes and Business communication	4







Unit-I : Management processes:	Number of
• Understanding an organisation, definition, concept of organisation, social	Lectures
system, goal, organisational process- vision and mission	
• BHAG – Big Hairy audacious goal	
• Organisation process – strategy (corporate, business) structure, system,	
processes, job, task	
• Definition and important of management, Evolution of management thought, principles of management	
 Definition and importance of planning, steps in planning 	15
Decision making	
• SWOT analysis	
• Definition and importance of organising	
 Staffing and its importance in organisation 	
• Directing and leading- Characteristics and importance of leading, role and	
functions of leading	
• Definition, importance & process of Controlling. Effective controlling	
techniques.	
Unit-II : Organizational behaviour:	15
• Etiquettes and manners	
 Stress and time management 	
• Definition, importance of values	
 Attitudes, its function and component 	
 Emotional intelligence and its impact 	
• EI and organisation	
• Emotional labour	
• Indian perspective of EI	
 Motivation:- definition and importance 	
• Group, Team :- definition , overview & benefits	
Unit-III : Business communication	15
• Communication: definition, characteristics, process, barriers, overcoming	15
barriers, classification, importance of communication, types and channels of	
communication	
• Business communication: types, channels, stakeholders, communication network in an organisation	
 Oral presentation: types of oral communication 	
 Principles of writing business letters, types of business letter 	
• Report: types of business report, steps in report writing, do's and don't	
• Resume writing : types do's and don't.	





• Letters: Job Application Letter, Acceptance of Job Offer, Letter of Resignation, Letter of Recommendation, Letter of Appointment, Promotion and Termination, Letters under Right to Information (RTI) Act, Letters of Complaints, Consumer Grievance Letters etc					
Unit - IV : Group Discussion, Listening and Reading					
Group discussion:					
 Skills required for GD, types of GD's, strategies for GD's 					
• Job interviews.					
• Entrepreneurship / start-ups.					
• Government scheme and fundings.					
Listening:	15				
• overview, importance, types, barriers of listening, strategies of effective					
listening.					
• Effective questioning: types of questioning.					
Reading:					
ullet Definition, purpose (extensive, intensive), skimming, scanning, SQ3R					
technique of reading.					

Detail Syllabus for Semester- IV Practical

20PS4BCP: Research Project / Survey based project /Internship /Online Internship /online certificate courses/programmes initiated and designed by government of India like SWAYAM, NPTEL etc.

GUIDELINE TO CARRY OUT PROJECT WORK

1. The main purpose of introduction Project Work at MSc Part II is to make the students familiar with Research Methodology i.e. reference work, experimental work, statistical analysis of experimental data, interpretation of results obtained, writing of project work and compilation of bibliography in proper order. This will not only help train the inquisitive minds of the students, but also inspire them to take up research- oriented higher studies and career.

2. Each student shall complete a research project during his/ her academic year of MSc Part- II. However, the initial reference work can be started in MSc part- I and summer vacation to MSc Part-II

3. Nature of Research Project:-





The following will be considered as the Research Project.

- a. Experimental based involving laboratory analytical work, or
- b. Survey based Field work with statistical analysis of data collected, or
- c. Any reputed research Institute training /Industrial R & D training/work experience where the candidate has undergone actual hands on training in production/ instrumental analytical techniques/FDP/ Clinical/Phamaceutical Biochemistry etc.
- d. Start ups in the field of Nutrition, dietetics, food science and other areas related to biochemistry can also be considered as Projects.

4. Schedule for Submission of project Work:-

- a. The final copy of the project work (2 Copies) will have to submitted to the HOD by the date assigned by the Head of the Department
- 5. The project containing about 50-100 pages. Should be divided into the following parts:a. Certification of completion of Project Work from the HOD.
 - b. Acknowledgement.
 - c. Introduction
 - d. Review of Related Literature
 - e. Aims and Objectives
 - f. Signification of research problems selected
 - g. Plan of work
 - h. Material and Methods
 - i. Results
 - j. Discussion
 - k. Bibliography

Internal Assessment Scheme (Theory) for M.Sc- II

Semester III	Paper	Paper	Paper	Paper
	Ι	II	III	IV
Internal online Test/open book test/MCQ's	20	20	20	20
Assignment (Active participation in the events organised	10	10	10	10
by department and submission of its report) /				
Industrial Visit and IV Report / Research paper				
presentation(online)				
MOOC / Assignment / Review of Literature or Book or	10	10	10	10
Paper / Field study / Mini project(online survey based)				
/ Workshop(online) / Presentation (oral/poster)				
(online)/ preparing small subject related				





Total	40	40	40	40
theory class such as Presentation, Group Discussion, Mock Interview, Mock Meetings				
concepts studied in the theory class/ Classroom activities/tutorials based on concepts studied in the				
related areas / Classroom activities / tutorials based on				
agencies/ Attending Seminars, workshops and short				
industries/organization/international or National				
research institutes/				
content/ One page write up on at least five food related				
calcium / Iron Proteins / Fibres/				
planning/ Recipe/Product development - foods rich in				
documentaries/Preparation of Diet chart / menu				

A Distribution of Marks & Credits

Theory 100 Marks per paper					Practicals per paper (50)		
Semester Examinatic (60)	End on	Theory	Internal Assessment (40)		Internal Practical Evaluation	External Evaluatio n (Marks)	
No. of Units	Marks per Unit	Total Marks	Class Test (1 X 20 Marks)	Assignment (2 X 10 / 1 X 20 Marks)	Practicals each one from different skills / Techniques	Viva Voce/ Examinati on/ Interpretat ion of Data, etc	
04	15	60	20	20	20	30	





Year	Semester	Marks			Credits		
Tour		Theory	Practical	Total	Theory	Practical	Total
M Ca Davit I	Ι	4 Papers X 100 = 400 Marks	4 Practical X 50= 200 Marks	600	16	8	24
M. Sc. Part I	II	4 Papers X 100 = 400 Marks	4 Practical X 50= 200 Marks	600	16	8	24
M. Sc. Part II	III	4 Papers X 100 = 400 Marks	4 Practical X 50= 200 Marks	600	16	8	24
M. SC. Part II	IV	4 Papers X 100 = 400 Marks	Research project/Internship = 200 Marks	600	16	8	24
TOTAL				2400			96

Note: The options mentioned for internal evaluation (40 marks) can also be considered for external evaluation(60 marks), if needed under any natural calamity/pandemic situation

Suggested Readings for paper 20PS3BC1 and 20PS4BC1 Practical 20PS3BC1P :

- 1. GMP for pharmaceuticals, A plan for TQC SH Wiling & JR Stoker, Marul Dekker Inc,New York, 4th Edition, 1997
- 2. Total Quality Assurance for the Food Industries WA Gould & RW Gould. CTI Publications Inc, USA 1988
- 3. Current Good Manufacturing Practices for Food Plan Sanitation WA Gould, CTI Publications Inc. USA 1980
- 4. Essentials of Pharmacotherapeutics, 3rd Ed., By F.S.K.Barar, S chand& Company Ltd. 2005.

SOMAIYA VIDYAVIHAR KJ Somaiya College of Science & Commerce



- Department: Biochemistry
- 5. Pharmaceutical chemistry, G Melentyeva L LAntonova Mir Publishers, Moscow
- 6. Chemical Pharmacology, R B Barlow, 2nd Ed, Methven and CO. New Fetters Lane
- 7. Medicinal Chemistry, Vol I, 3rd Ed, Alfred Burga, Wiley Inter sciences
- 8. Textbook of paramedical chemistry, Jayshree Ghosh, S chand and company, New Delhi
- 9. Pharmacology, B Suresh, 1st Ed. Shanti, Publication.
- 10. Nutritional Quality Index of Foods; R.G. Hansen, B.W. Wyse, A.W. Sorenson AVI Publishing Co., Inc., 1979.
- 11. Handbook of Nutraceuticals and Functional Foods Edited by Robert E.C.Wildman, Routledge Publishers.
- 12. Nutraceuticals by L. Rapport and B. Lockwood, Pharmaceutical Press.
- 13. "Personality Development and Soft Skills (Old Edition)" by Barun K Mitra
- 14. "Soft Skills" by Hariharan S and S P Shanmugapriya

Suggested Readings for paper 20PS3BC2 and 20PS4BC2 and practicals

- 1. Weir D.M., immunology, 5th ed., ELBS and Churchill Livingston.
- 2. Chakravarthy A.K. Immunology, Tata McGraw Hill, New Delhi.
- 3. Callaghan Richard B. Immunology, Academic Press
- 4. Weir D.M., Immunology: Student's Notes, ELBS- Oxford.
- 5. Bowry T.R., Immunology Simplified, 2nd Ed., ELBS and Oxford.
- 6. Ivan, Immunology Method Manual, Vol. 4 1997, Academic Press, Sani Diego.
- 7. Roitt Ivan and others, Immunology, 6th Ed., Mosby, Edinburg.
- 8. Kuby, Janis, Immunology. 3rd Ed., 1997, W.H. Freeman Co.
- 9. Hood Leroy E., Immunology, 2nd Ed., 1976, Benjamin Cummings Publication
- 10. Industrial Microbiology AH Patel, McMillan India Ltd, 1st Edition
- 11. Topley Wilson, Topley and Wilson's Principle of Bacteriology, Virology and immunity
- 12. Edward Arnold Ltd., London
- 13. Industrial Microbiology AH Patel, McMillan India Ltd, 1st Edition
- 14. Food Microbiology Frazier &Westhoff, Tata McGraw Hill Publishers, New Delhi

Suggested Readings for paper 20PS3BC3 and 20PS4BC3 and Practical 20PS3BC3P

- 1. Murrary Robert Harper's biochemistry, 24th edition, Prentice Hall International UK LTD, 1990
- 2. Satyanarayanan Biochemistry
- 3. Vasudevan Text Book of Medical Biochemistry
- 4. Voet&Voet Biochemistry, 2nd edition
- 5. Chatterjee and RanaShinde Medical Biochemistry
- 6. Rodney Boyer Experimental Biochemistry Pearson Publ. Sawheny and Singh
- 7. Practical Biochemistry by David Plummer





- Department: Biochemistry
- 8. Chemical Process Industries Norris Shreeve& Joseph Brink
- 9. Roger's Industrial Chemistry Vol I & II Edited by CC Furnas
- 10. Molecular Biology and Biotechnology Edited by JM Walker & EB Gingdd, Panima
- 11. Educational Book Agency, New Delhi, 2nd Edition
- 12. Introduction to plant Biotechnology HS Chawla, oxford & IBH Publishing Co, New Delhi, 2nd Edition.
- 13. Nanotechnology, A Genetic Introduction to the next big idea Mark Ratner & Daniel Ratner,Pearson Education
- 14. Animal Biotechnology Edited by AK Shrivastava, oxford & IBH publishing Co, New Delhi, 2005
- 15. Proteins, Biochemistry & Biotechnology Gary Walsh, John Wiley & Sons, 2002
- 16. Biotechnology, An Introduction Susan R Barnum, Vikas Publishing House, International Student Edition
- 17. Enzymes, Biochemistry, Biotechnology, Clinical Biochemistry Trevor Palmer, First East-West Press Ed. 2004
- 18. Principles of fermentation Technology, Stanbury, Whitaker and Hall, Butterworth Heinemann (1997), Indian Edition.
- 19. Basic Biotechnology. Ratledge & Kristiansen, Cambridge press (2001).

Suggested Readings for paper 20PS3BC4 and 20PS4BC4 and Practical 20PS3BC3P

- 1. Peter Russel, igenetics
- 2. Lewin Benjamin, Genes (Latest edition) Oxford Univ. Press
- 3. Jha A.P. Genes and Evolution 1993, Macmillan, Delhi.
- 4. Williamson Robert, Genetic Engineering I, Academic Press
- 5. Williamson Robert, Genetic Engineering 2, Academic Pres
- 6. Fisher R.A. Genetic Theory of Natural Selection, RESTE, New Delhi.
- 7. MitraSnadhya, Genetic Engineering: Principles and Practice, Macmillan India Pvt. Ltd.
- 8. Sang J. H, Genetics, 1984, Longman, London, 1984.
- 9. Hayes, William, Genetics of Bacteria and Viruses, CBS Publisher, New Delhi.
- 10. Bain Bridge Brian W, Genetics of Microbes, 1980, Blackie and Son, London
- 11. Barrow Colin, Brown Robert, Clarke Liz, (2006). The SuccessfulEntrepreneurs guide book. London: Kogan and Page.
- 12. Shring S, Jardine R., Mills J. (2001). Introduction to Catering. India:
- 13. Delmar Thomson Learning Coltman Michael M. (2000). Start and Run Profitable Restaurant. Mumbai: Jaico Publishing House.
- 14. Erdosh George (2000). Start and Run a Profitable Catering Business. Mumbai: Jaico Publishing House.





- 15. B. Srilakshmi. Nutrition Science. Fifth edition. New age international publishers.
- 16. B. Srilakshmi. Dietetics. Seventh edition. New age international publishers
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Scheme of Examination

Semester End Examination 60 marksInternal Evaluation40 marksTotal100 marks

Scheme of Semester End examination[Theory] M.Sc. (Sem I TO Sem IV)

Each theory paper shall carry 60 marks Each theory paper shall be 2 1/2 hours duration Each theory paper shall contain 04 questions of 15 marks each as follows:

- QI: Based on Unit I
- Q II : Based on Unit II
- Q III : Based on Unit III
- Q IV : Based on Unit IV

Marking system for <u>Questions I to IV</u> Attempt any three out of five ------ 05 marks each





Scheme of Practical Examination at MSc Part I and MSC Part II (Sem I to III)

1) Each practical (20**PS1BC1P** to 20**PS3BC3P**) shall carry 50 Marks.

2) Distribution of 50 Marks shall be as follow:ExperimentsMarks

a) Any Two Experiments : 40
(20 Marks each)
b) Certified Journal : 05
c) Viva- voce Exam : 05
TOTAL :50

3) Duration of Practical Examination

A) For 20PS1BC1P to 20PS3BC3P

i) Two days with 2 Sessions on each day i.e. Total 4 Sessions.

ii) Each Sessions shall be of 3 ½ Hours.

iii) Morning Session: 09.00 am to 12:30 pmAfternoon Session: 01:00 pm to 04:30 pm

B) For 20PS4BCP:

Research Project / Survey based project /Internship /Online Internship /online certificate courses/programmes initiated and designed by government of India like SWAYAM, NPTEL etc. carrying 200 Marks to be evaluated internally in Sem IV as per the guidelines included in the syllabus.