

K.J.Somaiya College of Science and Commerce

M.Sc. (II) Syllabus in Biochemistry

**Credit Based Semester and Grading System
To be implemented from the academic year 2019-2020**

Scheme for Theory Paper

M.Sc. Semester III

Course Code	Topic Headings	Credits
19PS3BC1	Food Science and Pharmacology	4
19PS3BC2	Immunology	4
19PS3BC3	Endocrinology & Clinical Biochemistry	4
19PS3BC4	Genetics	4

M.Sc. Semester IV

Course Code	Topic Headings	Credits
19PS4BCP	Research Project/ Internship	24

SEMESTER III

Course Code	UNIT	TOPIC HEADINGS	Credit	L /
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			s	Week
19PS3BC1	I	Functional foods and nutraceuticals	4	1
	II	Food spoilage, preservation and quality control		1
	III	Pharmacokinetics and Clinical Research		1
	IV	Mechanism of drug action and structure-function relationship and Investigational New Drug (IND) Application		1
19PS3BC2	I	Introduction of Immune system, Immunity & Immune response	4	1
	II	Antibody mediated Immunity		1
	III	Immunological Tolerance& Immunodeficiency's		1
	IV	Complement system & Cytokines		1
19PS3BC3	I	Overview of Endocrinology; Hormones of Hypothalamus, Pituitary, Thyroid and Parathyroid glands.	4	1
	II	Hormones of Gonads and adrenal glands and Pancreas		1
	III	Organ Function Tests and Immunological Tests		1
	IV	Quality Control for Laboratories Clinical Research		1
19PS3BC4	I	Overview of classical genetics, structure and characteristics of nucleic acids, chromosomal aberrations.	4	1
	II	Gene regulation and techniques in nucleic acid analysis: Regulation of gene expression.		1
	III	Replication of DNA and chromosomal abnormalities.		1
	IV	Recombinant DNA Technology (RDT) and Tissue culture		1

Course Code	Practicals	Credits
19PS3BC1P	Paper I	2
19PS3BC2P	Paper II	2
19PS3BC3P	Paper III	2
19PS3BC4P	Paper IV	2

	Total	8
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SEMESTER IV

Course Code	Title	Credits
19PS4BCP	RESEARCH PROJECT / INTERNSHIP	24

SEMESTER III

Course Code	Title	Credits
19PS3BC1	Food Science and Pharmacology	4
<p>UNIT I: Functional foods and nutraceuticals</p> <ul style="list-style-type: none"> ● Functional foods, definition, concept and history, Teleology of nutraceuticals, evolution and classification of nutraceuticals and functional foods , Traditional foods, designer foods and pharma foods , Significance of nutraceuticals and functional foods in the management of diseases and disorders ● Classification based on food source – plant and animals , Plants – herbs and flowers as functional foods, soya, olive oil, tea, grape wine, garlic dietary fibre, and others, Natural occurrence of certain phytochemicals- antioxidants and flavonoids, omega 3 and 6 fatty acids, carotenoids, phytoestrogens, glucosinates, organo sulphur compounds, isoprenoid derivatives, phenolic substances, fatty acids and structural lipids , Carbohydrates and amino acid based derivatives , Isoflavones, terpinoids – saponins, tocotrienols and simple terpenes ● Functional foods of microbial origin- human gastrointestinal tract and its microbiota , Concept of probiotics with examples, lactobacillus and bifido bacterium , Advances in probiotics, gut microflora and health benefits, delivery of immune modulators through functional foods, guidelines for probiotics, probiotic microflora and functions , Prebiotics, ingredients in foods, types of prebiotics and its effect in gut microbes and health benefits , Spirulina as bioactive components ● Sources and role of functional foods and nutraceuticals in diseases , Concept of dietary supplements, phytochemicals, phytosterols, dietary fiber , Role of nutraceuticals in health and management of any five diseases .i.e. inborn errors of metabolism/obesity/neurological disorder/ diabetes mellitus/ hypertension/ CVD/ cancer/arthritis/AIDS , Role of nutraceuticals in sports nutrition. 		15

UNIT II: Food spoilage, preservation, Food science and quality control

15

- **Bio Chemistry of Food Spoilage**

Chemical and biochemical indices of food quality

Factors causing food spoilage during food ripening, vegetable maturation and their control.

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

- **SHELF LIFE OF PROCESSED FOOD:** Determination of shelf – life of food products, transports of perishable food items.

- **FOOD PACKAGING:** Introduction to packaging. Packaging operation, package-functions and design. Principle in the development of protective packaging. Flexible packaging, Introduction to different packaging materials and different types of packing . Deteriorative changes in foodstuff and packaging methods for prevention, shelf life of packaged foodstuff, methods to extend shelf-life.

	<ul style="list-style-type: none"> • 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 Szczniak classification of food texture. <p>FOOD LAWS (only introduction): Codex Alimentarius, Prevention of Food Adulteration (PFA) Act, Agmark, Fruit Products Order (FPO), Meat Products Order (MPO), Bureau of Indian Standards (BIS), MMPO, FSSAI and HACCP</p>	
<p>UNIT III: Pharmacokinetics and Pharmacodynamics</p>	<ul style="list-style-type: none"> • Pharmacokinetics: Pharmacokinetics (PK) and drug metabolism, objectives of PK Analysis in drug discovery, fundamental concepts in drug absorption, distribution, metabolism & elimination (ADME) Kinetics of drug following different modes of drug administration. Introduction to important PK parameters, PK of oral administration & bioavailability • Pharmacodynamics (mechanism of drug action) 	<p>15</p>
<p>UNIT IV: Mechanism of drug action and structure-function relationship and Investigational New Drug (IND) Application</p>	<ul style="list-style-type: none"> • 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. <p>New Drug Application (NDA): Introduction to NDA, NDA forms, contents of NDA, Preparation & Submission of documents, guidance documents for NDAS.</p> <ul style="list-style-type: none"> • Strategies in drug therapy <ol style="list-style-type: none"> 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 	<p>15</p>
<p>Course Code</p>	<p>Title</p>	<p>Credits</p>

19PS3BC2	Immunology	4
<p>UNIT I: Introduction of Immune system, Immunity & Immune response</p> <ul style="list-style-type: none"> • Cells and organs of Immune systems: Lymphoid cells, mononuclear, phagocytes, antigen presenting cell, polymorphs, mass cells and platelets. Primary and secondary Lymphoid Organs, Lymphocyte Traffic. • Major Histocompatibility Complex (MHC): General organization and inheritance of MHC. Structure of Class I and Class II HLA Molecules and organization of Class I and Class II HLA Genes. Cellular distribution of MHC Molecules. Regulation of MHC Expression- Determinant Selection Model, Holes in the Repertoire Model. MHC and susceptibility to disease. Antigen processing and presentation. Self MHC Restriction of T Cell Role of Antigen presenting cells. Pathways for Antigen Processing, Cytosolic and endocytic pathway. • T cell subset and their function. • T cell receptor, structure, organization and rearrangement of TCR genes. T cell receptor complex- TCR- CD3. T cell accessory membrane molecule. Ternary TCR Peptide MCH Complex. T cell – Maturation, Activation & Differentiation. • Development of Immune System in short- Myeloid Cells, Memory B cells • Immune Response to infectious diseases: Viral, Bacterial, Fungal and Protozoal diseases, Helminthes (parasitic worms) infections- effector mechanisms 		<p>Number of Lectures</p> <p style="text-align: center;">15</p>
<p>UNIT II: Antibody mediated Immunity</p> <ul style="list-style-type: none"> • B cell maturation, activation and differentiation. • Antigens ,Antibodies and Their Interactions • Antigens, Antigenic determinants, antigenicity and immunogenicity. • 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 		<p style="text-align: center;">15</p>
<p>UNIT III: Immunological Tolerance& Immunodeficiencies:</p> <ul style="list-style-type: none"> • Pathways to B and T cell tolerance, General characteristics of B and T cell tolerance • 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 		<p style="text-align: center;">15</p>

<ul style="list-style-type: none"> • 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 etiology: Organ specific autoimmune diseases (Hashimoto's thyroiditis and insulin dependent diabetes mellitus). • Diagnostic and prognostic value of auto antibodies: Treatment of autoimmune diseases. 	
<p>UNIT IV: Complement system & Cytokines</p> <ul style="list-style-type: none"> • 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 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 • Hypersensitivity Gel and coombs classification types I to IV with mechanisms 	15

Course Code	Title	Credits
19PS3BC3	Endocrinology & Clinical Biochemistry	4
<p>UNIT I : Overview of Endocrinology; Hormones of Hypothalamus, Pituitary, Thyroid and Parathyroid glands.</p> <ul style="list-style-type: none"> • Organization of Mammalian Endocrine System, Classification of hormones, Overview of circulation, modification and degradation, Target tissue, feed-back control. • Biosynthesis, Storage, Secretion, Transport and Metabolic effects (including hypo and hyper conditions) of Hormones of Hypothalamus. • Biochemical 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. 		<p>Number of Lectures</p> <p>15</p>

<ul style="list-style-type: none"> • 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. 	
<p>UNIT II: Hormones of Gonads and adrenal glands and Pancreas</p> <ul style="list-style-type: none"> • 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, pheochromocytoma. 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. 	15
<p>UNIT III: Quality Control for Laboratories and Clinical Research</p> <ul style="list-style-type: none"> • Clinical diagnostics: Diagnostic Kits and their applications. • 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 	15
<p>UNIT IV: : Organ Function Tests and Immunological tests</p> <ul style="list-style-type: none"> • Biochemical Assessments and Changes in Endocrine Disorders (Pituitary, 	15

<p>thyroid, adrenal medulla, adrenal cortex, ovaries, testis).</p> <ul style="list-style-type: none"> • 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 	
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Course Code	Title	Credits
19PS3BC4	Genetics	4
<p>UNIT-I: Overview of classical genetics, structure and characteristics of nucleic acids, chromosomal aberrations .</p> <ul style="list-style-type: none"> • Mendelian genetics: Mendelian laws and basis of inheritance, genotype, phenotype. Chromosomal theory of heredity, Meischer, Griffith, Hershey-Chase & Avery; 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. 		<p>Number of Lectures 15</p>
<p>UNIT II: Replication of DNA and chromosomal abnormalities.</p> <ul style="list-style-type: none"> • Replication: Modes of replication; Messelson and Stahl's experiment for 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 		<p>15</p>

<p>replicons, replication origin, initiation and replication, multiple initiation sites, Okazaki fragments.</p> <ul style="list-style-type: none"> • 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 and Rho-independent, nonsense codons, role of RF1 and RF2 and GTP Post translational processing and modification, signal hypothesis 	
<p>UNIT III: Gene regulation and techniques in nucleic acid analysis : Regulation of gene expression.</p> <ul style="list-style-type: none"> • 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 hybridization, dot-blot, FISH, Karyotyping , sex determination 	15
<p>UNIT IV: Recombinant DNA Technology (RDT) and Tissue culture</p> <ul style="list-style-type: none"> • 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. • Introducing DNA into cell, transformation, microinjection, electroporation, selection of recombinant clones, colony hybridization, Southern & Northern hybridization, use of probes • Medical and Biological applications of recombinant DNA technology (RDT), Diagnostic probes for genetic and other diseases, Anti-sense technology and therapeutics, agricultural, industrial and commercial applications of RDT. • Human Genome project • Plant Tissue Culture (PTC): Principles, Techniques, Methodology and Application of PTC. Micropropagation 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 	15

development of transgenic animals. Frontiers of contraceptive research, cryopreservation of sex gametes& embryos, Ethical issues in embryo research	
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Detail Syllabus for Semester- III Practicals

Paper 1

Microbial analysis of food products

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

Food Science

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

Food science and Pharmacology

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

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 & Clinical experiments

1. Isolation of DNA (crude) from germinating moong /Onion seeds
2. Isolation of RNA (crude) from Baker's yeast
3. Estimation of Serum ALT
4. Estimation of Serum AST
5. Estimation of Total & Direct Billirubin

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.
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. T_m of DNA.
17. AMES Test.
18. Estimation of Serum Glycosylated Haemoglobin
19. Separation of LDH Isoenzymes
20. Arterial Blood Gas Analysis
21. DNA Sequencing
 - a. Maxam Gilbert Method
 - b. Sanger's Method
22. Blotting Techniques (Southern, Western, Northern)

Detail Syllabus for Semester- IV Practical

19PS4BCP: Research Project / Internship

GUIDELINE TO CARRY OUT PROJECTWORK

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/Pharmaceutical 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 I	Paper II	Paper III	Paper IV
Internal Test	20	20	20	20
Assignment (Active participation in the events organised by department and submission of its report) / Industrial Visit and IV Report / Research paper presentation	10	10	10	10
MOOC / Assignment / Review of Literature or Book or Paper / Field study / Mini project / Workshop / Presentation (oral/poster)	10	10	10	10
Total	40	40	40	40

A Distribution of Marks & Credits

Year	Semester	Marks			Credits		
		Theory	Practical	Total I	Theory	Practical	Total
M. Sc. Part I	I	4 Papers X 100 = 400 Marks	4 Practical X 50= 200 Marks	600	16	8	24
	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
	IV	-	Research project = 600 Marks	600	-	24	24
TOTAL				2400			96

Suggested Readings for paper 19PS3BC1 and 19PS4BC1 and Practical 19PS3BC1P :

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. Winchester A.M. Genetics: A Survey of Principles of Heredity, Oxford IBH Public Co.
12. Industrial Microbiology – AH Patel, McMillan India Ltd, 1st Edition
13. Chemical Process Industries – Norris Shreeve& Joseph Brink
14. Roger’s Industrial Chemistry Vol I & II – Edited by CC Furnas
15. Molecular Biology and Biotechnology – Edited by JM Walker & EB Gingdd, Panima
16. Educational Book Agency, New Delhi, 2nd Edition
17. Introduction to plant Biotechnology – HS Chawla, oxford & IBH Publishing Co, New Delhi, 2nd Edition.
18. Nanotechnology, A Genetic Introduction to the next big idea – Mark Ratner & Daniel Ratner, Pearson Education
19. Animal Biotechnology – Edited by AK Shrivastava, oxford & IBH publishing Co, New Delhi, 2005
20. Proteins, Biochemistry & Biotechnology – Gary Walsh, John Wiley & Sons, 2002
21. Biotechnology, An Introduction – Susan R Barnum, Vikas Publishing House, International Student Edition
22. Enzymes, Biochemistry, Biotechnology, Clinical Biochemistry – Trevor Palmer, First East-West Press Ed. 2004
23. Principles of fermentation Technology, Stanbury, Whitaker and Hall, Butterworth Heinemann (1997), Indian Edition.
24. Basic Biotechnology. Ratledge & Kristiansen, Cambridge press (2001).

Suggested Readings for paper 19PS3BC2 and 19PS4BC2 and practicals

1. Murrery 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

Suggested Readings for paper 19PS3BC3 and 19PS4BC3 and Practical 19PS3BC3P and 19PS4BC3P

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. Topley Wilson, Topley and Wilson’s Principle of Bacteriology, Virology and immunity
11. Edward Arnold Ltd., London

12. Principles of Environmental Chemistry – Kothandaram&Swaminathan, BI Publishers, Chennai
13. Environmental Chemistry – AK De, New Age International Publishers, 4th Edition
14. Fundamental Concepts of Environmental Chemistry – Sodhi, Narosa Publishing House, 2002
15. Introduction to plant Biotechnology – HS Chawla, oxford & IBH Publishing Co, New Delhi,2nd Edition.
16. Nelson DI, Cox MM – Lehninger Principles of Biochemistry
17. Murraray Robert – Harper’s biochemistry, 24th edition, Prentice Hall International UK LTD,1990
18. Satyanarayanan – Biochemistry

Suggested Readings for paper 19PS3BC4 and 19PS4BC4 and Practical 19PS3BC3P and 19PS4BC3

1. Industrial Microbiology – AH Patel, McMillan India Ltd, 1st Edition
2. Food Microbiology – Frazier & Westhoff, Tata McGraw Hill Publishers, New Delhi
3. GMP for pharmaceuticals, A plan for TQC – SH Wiling & JR Stoker, Marul Dekker Inc,New York, 4th Edition, 1997
4. Total Quality Assurance for the Food Industries – WA Gould & RW Gould. CTI Publications Inc, USA 1988
5. Current Good Manufacturing Practices for Food Plan Sanitation – WA Gould, CTI Publications Inc. USA 1980
6. Essentials of Pharmacotherapeutics, 3rd Ed., By F.S.K.Barar, S chand& Company Ltd. 2005.
 1. Pharmaceutical chemistry, G Melentyeva L LAntonova Mir Publishers, Moscow
 2. Chemical Pharmacology, R B Barlow, 2nd Ed, Methven and CO. New Feters Lane
 3. Medicinal Chemistry, Vol I, 3rd Ed, Alfred Burga, Wiley Inter sciences
 4. Textbook of paramedical chemistry, Jayshree Ghosh, S chand and company, New Delhi
 5. Pharmacology, B Suresh, 1st Ed. Shanti, Publication.
 6. Nutritional Quality Index of Foods; R.G. Hansen, B.W. Wyse, A.W. Sorenson AVI Publishing Co., Inc., 1979.
 7. Handbook of Nutraceuticals and Functional Foods Edited by Robert E.C.Wildman, Routledge Publishers.
 8. Nutraceuticals by L. Rapport and B. Lockwood, Pharmaceutical Press.

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 18PS1BC1P to 18PS3BC3P**

- 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 pm
Afternoon Session: 01:00 pm to 04:30 pm

B) For 19PS4BC1:

Project Work carrying 600 Marks to be evaluated internally in Sem IV as per the guidelines included in the syllabus.