

## SCHOOL OF BASIC MEDICAL SCIENCES

The School of Basic Medical Sciences consists of the Departments of Anatomy, Endocrinology, Genetics, Medical Biochemistry, Microbiology, Pathology, Pharmacology and Environmental Toxicology and Physiology.

Along with the establishment of Post Graduate Institute of Basic Medical Sciences (PGIBMS), the division of Medical Biochemistry was first established in March 1968. In January 1969, the divisions of Endocrinology and Genetics came into being. Subsequently, all these divisions became independent departments. Later, the PGIBMS was expanded in 1976 when the Taramani campus started functioning, with the addition of the departments of Microbiology, Pharmacology and Environmental Toxicology and Physiology. The third phase of expansion of PGIBMS was in 1977, when the departments of Anatomy and Pathology were added. All departments are involved in active research, training Ph.D. students and offering postgraduate degree programmes.

The department of **Anatomy** offers M.Sc. Anatomy and M.S. Neuroscience programmes. It is a DST-FIST supported department carrying out research in neural transplantation, cortical localization, and neuro-electrophysiology in primates and comparative neuroanatomy of primates including man. The department has a well-equipped aseptic operation theatre, tissue processing laboratory, neuroimmunology laboratory, rare collections of histological slides, audio-visual teaching aids and video and audio cassette library. It has several sophisticated equipment like cryostat, vibrotome, microscope, fluorescent microscope, stereo zoom microscope, neonatal incubator, surgical diathermy, bio-monitor, X-ray machine, electro-physiological unipolar cortical stimulator etc.

The department of **Endocrinology** is a research department recognized by UGC for Departmental Research Support under UGC Special Assistance Programme (UGC-SAP-DRS-I) to facilitate research in the following thrust areas since 1999.(1) Reproductive and Molecular Endocrinology and (2) Environmental Endocrinology. The UGC-SAP-DRS-II programme is in operation since 2004. UGC has also selected this department for its Assistance for Infrastructural development in science and technology (ASIST) since April 2005 to create infrastructure for offering the new M.Sc. Biomedical Science programme and for research in Environmental Endocrinology and Hormone Toxicity. The Department of Science and Technology, Govt. of India has selected the department for infrastructural and equipment facilities for Research indents FIST programme from 2000 onwards. In addition to this, the department is funded by various National Agencies such as DBT, CSIR, DST, DAE, ICMR and UGC. The department undertakes research works involving evaluation of hormones and receptors at the level of genes, in endocrines, reproductive, bone and metabolic disorders and cancer. The department has sophisticated equipments like electroporator, PCR machine, ELISA reader, CO<sub>2</sub> incubators, vacuum concentrator, ion-exchange chromatography, double beam spectrophotometer, spectrofluorimeter, research microscopes with fluorescence, phase contrast and photography, electrophoretic and blotting systems, inverted microscope, stereo zoom microscope, ultra deep freezers, rotary vacuum flash evaporator, cell culture facility and temperature and light controlled animal room facility. The department has BARC recognized radioisotope laboratory. The department also offers M.Phil. and Ph.D. programmes in Endocrinology and two elective papers for M.Sc. CBCS students and a P.G. Diploma in Applied Endocrinology.

The department of **Genetics** is supported under DST-FIST programme. The faculty members pursue basic and applied research in frontier areas of Genetics that has direct/indirect bearing on health care. The areas of interest include clinical cytogenetics (mental retardation, infertility and birth defects), molecular and biochemical genetics (lysosomal storage disorders, hearing, visual and speech disorders), molecular biology (intron-exon organization, DNA-drug genotoxicity, evaluation and search for potential antimutagens, occupational risk assessment etc.). The department offers postgraduate research programmes leading to M.Sc. (Biomedical Genetics and Molecular Biology), M.Phil. and Ph.D. degrees. The department has animal house, cold room, departmental library and a centralized instrumentation facility, which includes thermo cyclers, transilluminator, spectrophotometer, refrigerated centrifuges, DNA sequencer, fluorescence microscope etc. The department also offers consultancy services on genetic counseling, clinical cytogenetics, genetic toxicology evaluation of suspected compounds and molecular and biochemical diagnosis of lysosomal disorders.

The department of **Medical Biochemistry** offers M.Sc. Medical Biochemistry. It is a **UGC-SAP-DRS I and DST-FIST** supported department specializing in metabolic free radical mediated diseases including Diabetes mellitus, arteriosclerosis, alcoholism, kidney stone disease, cancer, ageing and biochemical toxicology. The facilities of the department include various sophisticated instruments including Scintillation counter, Double beam UV spectrophotometers, spectrofluorimeter, epifluorescence microscope, ultracentrifuge, super speed refrigerated centrifuges, ELISA readers, deep freezers, equilibrium dialyzers, electrophoresis units, thin layer and column chromatographic systems. The department offers expert consultancy in clinical biochemistry in selected areas of metabolic disorders and kidney stone disease.

The department of **Microbiology** offers M.Sc. Medical Microbiology and M.D. Microbiology and is a **UGC-SAP-DRS-I and DST-FIST** department. The faculty members do research in medical microbiology (diarrhoeal diseases, new diarrhoea pathogens, respiratory pathogens, hospital acquired bacterial, fungal and viral infections; sequelae; Herpes keratitis; AIDS. Immunology (development of diagnostic kits for microbial characterization of bacterial, fungal and viral pathogens by RFLP, cloning and sequencing and development of antibacterial, antifungal and antiviral agents from medicinal plants and marine organisms; Indigenous development of vaccines; Evaluation of industrial products like vaccines, drugs, devices, kits, disinfectants etc. The facilities of the

department include tissue culture systems; antigen & antibody purification and characterization; preservation of microbial cultures; *In vitro* and *in vivo* laboratory models for drug and vaccine development; design and conduction of clinical trials, evaluation etc. The sophisticated equipments of the department are : ELISA systems, HPLC, UV-vis spectrophotometer, UV- Transilluminator with photography, PCR – Systems, Ultracentrifuge and refrigerated centrifuge, lyophiliser, luminometer, tissue culture laminar flow systems, environmental temperature controlled shakers, ice flaker, deep freezers, liquid nitrogen cylinders, different electrophoresis systems including blotting systems and chromatographic systems, CO<sub>2</sub> Incubator and water purification systems.

The department of **Pathology** offers M.D.Pathology and Diploma in Clinical Pathology programmes. The faculty carry out research in histopathology, immunology, haematology, haematopathology, immuno-histochemistry and *in situ* hybridisation. The facilities of the department are histopathology with frozen section facilities, histochemistry cytochemistry, immunohistochemistry *in situ* hybridization for viral DNA and RNA. The department is a referral centre for immunohistochemistry and immunocytochemistry. The department is also a WHO training centre for immunohistochemistry and cytochemistry.

The department of **Pharmacology & Environmental Toxicology** offers M.Sc. Environmental toxicology and M.D.Pharmacology and is a **UGC- SAP- DRS-I AND DST-FIST department**. The faculty members carry out intensive research in experimental pharmacology, phytopharmacology, traditional medicine formulations, immunopharmacology and toxicology, neuropharmacology and toxicology, cardiovascular pharmacology, aquatic toxicology, environmental toxicology and food toxicology. The expertise and facilities can be used for screening of pharmacological as well as toxicological profile of drugs and medicinal plants as well as toxicology evaluation of specific environmental pollutants. The department has the sophisticated equipment of fluorescence spectrophotometer, high pressure liquid chromatography, UV visible spectrophotometer, soft laser screening densitometer, refrigerated centrifuge, thin layer chromatography system, high speed kymograph for anesthetized animal experiments, physiograph, electro cardio graph, rota-rod, actophotometer, electrophoresis unit, flame photometer, liquid nitrogen cylinder etc.

The department of **Physiology** offers M.Sc. Physiology programme. The faculty members carry out research in the areas of neuroimmunomodulation, stress physiology, liver regeneration, cassava studies and medical / laboratory instrumentation. The facilities of the department include recording of basic physiological data, behavioral studies in small animals, all common biochemical investigations, all haematological investigations, computer facility for physiological data acquisition etc. The sophisticated instruments of the department are HPLC (Waters) with ECD detector, spectrofluorometer, UV- visible spectrophotometer, flame photometer, single channel strip chart recorder (physiograph), 8-Channel physiological data recorder (Polyrite), Single Channel ECG recorder, deep freezers, laminar flow hood, ultrasonic disintegrator etc.

#### **Faculty**

M.Michael Aruldhas, M.Phil., Ph.D. - Chairperson

#### **Anatomy**

R. Muthuswamy, Ph.D. - Professor and Head  
K. Kamatchi Venugopal, Ph.D. - Professor  
V. Sankar, Ph.D. - Lecturer  
S. Prakash, Ph.D. - Lecturer

#### **Endocrinology**

M. Michael Aruldhas, M.Phil., Ph.D. - Professor and Head  
N. Srinivasan, M.Phil., Ph.D. - Professor  
K. Balasubramanian, M.Phil., Ph.D. - Professor  
J. Arunakaran, M.Phil., Ph.D. - Lecturer  
B. Ravisankar, M.Phil., Ph.D. - Lecturer

#### **Genetics**

A. Ramesh, Ph.D. - Professor and Head  
S.T. Santhiya, M.Phil., Ph.D. - Professor  
Malathy Raghunathan, Ph.D. - Reader

G. Jayaraman, Ph.D. - Reader  
 A. K. Munirajan, Ph.D. - Reader  
 N. Chandra, M.Phil., Ph.D. - Lecturer

**Medical Biochemistry**

P. Varalakshmi, Ph.D. - Professor and Head  
 C. Panneerselvam, Ph.D. - Professor  
 D. Sakthisekaran, Ph.D. - Professor  
 P. Sachthanandam, Ph.D. - Professor  
 P. Kalaiselvi, Ph.D. - Lecturer

**Microbiology**

T. Sundarraj, Ph.D. - Professor and Head  
 P. Rajendran, Ph.D. - Professor  
 Thangam Menon, Ph.D. - Professor  
 Usha Anadarao, Ph.D. - Professor  
 R. Elanchezian, Ph.D. - Professor  
 Padma Krishnan, Ph.D. - Lecturer

**Pathology**

Rama Gopalan, M.D. - Professor and Head  
 P. Shanthi, M.D. - Professor  
 K. Rekha, M.D. - Lecturer

**Pharmacology and Environmental Toxicology**

R. Venkatakrishnamurali, M.D., Ph.D. Professor and Head  
 M.P. Balasubramanian, Ph.D. - Professor  
 S.L. Maheswari, Ph.D. - Professor  
 S. Karthikeyan, Ph.D. - Lecturer

**Physiology**

R. Sheela Devi, Ph.D. - Lecturer and Head in-charge  
 R. Ravindran, Ph.D. - Lecturer

**M.Sc. BIOMEDICAL SCIENCES (Endocrinology)**

**SEMESTER I**

Core Code	Title	L	T	P	Credit
BMS C401	Biochemistry – I	2	1	0	3
BMS C402	Molecular Biology of the Cell	2	1	0	3
BMS C403	Principles of Endocrinology	2	1	0	3
BMS C404	<i>Practical I</i>	0	1	3	4
Elective*		2	1	0	3
Elective*		2	1	0	3

**SEMESTER II**

BMS C405	Principles of Human Physiology	2	1	0	3
BMS C406	Molecular Genetics	2	1	0	3
BMS C407	Biochemistry – II	2	1	0	3
BMS C408	<b>Practical II</b>	0	1	3	4
Elective*		2	1	0	3
Elective*		2	1	0	3

**SEMESTER III**

BMS C409	Hormones : Chemistry, biosynthesis, secretion and metabolism	2	1	0	3
BMS C410	Hormones : Physiological action	2	1	0	3
BMS C411	Endocrine Pathology	2	1	0	3
BMS C412	<b>Practical III</b>	0	1	3	4
Elective*		2	1	0	3
Elective*		2	1	0	3

**SEMESTER IV**

BMS C413	Molecular Endocrinology	2	1	0	3
BMS C414	Genetic engineering and hormone biotechnology	2	1	0	3
BMS C415	Hormones and Reproduction	2	1	0	3
BMS C416	<b>Dissertation</b>	0	0	6	6

\* Offered by other departments

**M.Sc. BIOMEDICAL SCIENCES (Endocrinology)****Abstract**

<b>BMS C401</b>	<b>Biochemistry – I</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>Dept. of Medical Biochemistry</b>
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UnitI : H, acids, bases and buffers, Henderson – Hasselbach equation, osmotic pressure, Donnan membrane equilibrium, surface tension, viscosity and their biological applications, Thermodynamics of biological systems, first, second and third laws of thermodynamics, enthalpy, entropy, free energy change and high energy compounds.

UnitII : Carbohydrates - Classification of carbohydrates, structure and properties of biologically important monosaccharides and disaccharides; Structure and function of homoglycans like starch, glycogen, cellulose, chitin and heteropolysaccharides like glycosaminoglycans, glycoproteins and bacterial cell wall polysaccharides.

UnitIII: Aminoacids – Classification, structure and properties of aminoacids, biological derivatives of amino acids, peptide bond, classification and properties of proteins (electrophoretic mobility, salting in and salting out), primary, secondary, tertiary, quarternary structure of proteins and forces stabilizing them, Ramachandran Plot, Isolation, purification and sequencing of proteins.

UnitIV: Lipids - Classification, structure and functions of lipids and lipoproteins, properties of fatty acids and fats. Vitamins - Properties, functions as coenzymes and deficiency states of water and fat soluble vitamins. Minerals and trace elements.

UnitV : Nucleic acids - Structure of purine and pyrimidine bases, structure of DNA, tRNA and mRNA. Viscosity, hyperchromic effect, melting point of DNA, Chemical and enzymatic methods of sequencing of nucleic acids.

Acids, Bases and Buffer; Thermodynamics of biological system; Classification, structure and functions of carbohydrates, Amino acids and Lipids, Nucleic acids – Chemistry and Methods of Sequencing.

BMS C402	Molecular Biology of the Cell	2	1	0	3	<b>Dept. of Genetics</b>
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Cell structure, continuous and synchronous cell culture, cell fractionization. Molecular organization of cell, transport of small and - macro molecules, intra cellular organelles. Structure and functions of mitochondria, nucleus, nuclear envelope, cell cycle, and cell movement. Oncogens and neoplastic cell group, tumour suppressor genes.

BMS C403	Principles of Endocrinology	2	1	0	3	Dept. of Endocrinology
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Autocrine, Paracrine and Endocrine regulators. Hypothalamo – hypophyseal axis, Feed back regulation of Endocrine system. Hormones – function tests and assays.

BMS C404	<b>Practical - I</b>	0	1	3	4	Dept. of Endocrinology
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Collection and Preservation of biological samples, Principles and uses of Colorimeter, Spectrophotometer, Flourimeter, Atomic absorption spectrophotometer, Beta and Gamma counters, Iso – electric focusing, PAGE.

## SEMESTER - II

BMS C405	Principles of Human Physiology	2	1	0	3	Dept. of Physiology
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Circulatory system – composition and functions of plasma, blood coagulation, transfer of blood gases. Respiratory system – components and their functions - Transport of oxygen and CO<sub>2</sub>, Acid – Base balance. Digestive system – composition and functions; Digestion and absorption of carbohydrates, Lipids, Proteins etc. Excretory system – Structure of nephron, formation of urine, tubular reabsorption and secretion; Nervous system – organization, nerve impulses and neurotransmission, Action Potential, Visual auditory pathways.

BMS C406	Molecular Genetics	2	1	0	3	Dept. of Genetics
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Molecular organization of chromosomes, Linkage and cross over, Molecular structure of genes, structure and functions of nucleic acids, replication of DNA and proof reading. Microbial genetics – transformation, transduction and conjugation in bacteria, phage genetics. Gene expression – transcription, translation, and regulation, the Operon model. - Human genetic disorders, genes in population.

BMS C407	Biochemistry – II	2	1	0	3	Dept. of Medical Biochemistry
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Classification and Mechanism of action of enzymes, Michaelis – Menton equation, industrial use of enzymes, carbohydrate and lipid metabolism, biological oxidation. Amino acids – deamination, decarboxylation and transamination, phenylketoneuria, Parkinson's disease, urea cycle. Synthesis and degradation of purines and pyrimidines. Prokaryotic and eukaryotic replication, Transcription and Translation.

BMS C408	<b>Practical II</b>	0	1	3	4	Dept. of Endocrinology
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Ultracentrifugation, Paper chromatography of amino acids and carbohydrates. Purification of enzymes and proteins. Separation and estimation of Lipids using TLC. Ion-Exchange chromatography, Flow cytometry and DHPLC.

## SEMESTER- III

BMS C409	Hormones: Chemistry, biosynthesis, secretion and metabolism	2	1	0	3	Dept. of Endocrinology
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Structure, synthesis, regulation and metabolism of peptide and glycoprotein hormones, steroid and thyroid hormones, catecholamines and indolamines.

BMS C410	Hormones: Physiological action	2	1	0	3	Dept. of Endocrinology
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Hormonal control of Growth, metabolism, reproduction, water and electrolyte balance.

BMS C411	Endocrine Pathology	2	1	0	3	Dept. of Endocrinology
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Neuroendocrine disorders, hypo- and hyperthyroidism, Diabetes mellitus, Grave's disease, congenital adrenal hypo – and hyperplasia, osteoporosis, osteopetrosis, Cushing's disease, polycystic ovarian disease, cryptorchidism, menstrual disorders, infertility, hormone resistant syndrome and multiendocrine neoplasia.

BMSC412	<i>Practical III</i>	0	1	3	4	Dept. of Endocrinology
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Surgical endocrine techniques, radioiodination of peptides, RIA, ELISA, RRA, Semen analysis, isolation and purification of cells, cell culture, and gene expression analysis.

BMS C413	Molecular Endocrinology	2	1	0	3	Dept. of Endocrinology
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Genetic control of hormone synthesis and principles of hormone actions. Molecular aspects of synthesis and regulation of peptide, thyroid and steroid hormones and biogenic amines. Genomic and nongenomic actions of steroid and peptide hormones.

BMS C414	Genetic engineering and Hormone Biotechnology	2	1	0	3	Dept. of Endocrinology
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Hormones and genes involved in sex differentiation, growth and development. Gene transfer and knock out models, recombinant DNA technology based hormone production, gene silencing and gene therapy. Gene manipulation studies in metabolic and reproductive endocrinology.

BMS C415	Hormones and Reproduction	2	1	0	3	Dept. of Endocrinology
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Genetic, endocrine and biochemical aspects of testis and ovarian differentiation and development. Neuroendocrine perspectives of mammalian reproduction. Endocrine, paracrine and autocrine regulation of spermatogenesis, oogenesis, ovulation and steroidogenesis. Structure, function and regulation of male and female accessory sex organs. Conception and contraception.

BMS C416	Dissertation	0	0	6	6	Dept. of Endocrinology
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### M.Sc. MEDICAL BIOCHEMISTRY

Code	Course Title	Credit	C/E/S	Faculty
BMS C001	Chemistry of Biomolecules	3	Core	Dr. P. Sachdanandam
BMS C002	Analytical Biochemistry	3	Core	Dr. P. Varalakshmi
BMS C003	Cellular Biochemistry	3	Core	TRF
BMS C004	Practicals I	4	Core	Dr. P.Varalakshmi/ Dr. P. Sachdanandam / TRF
BMS C005	Food Science and Nutrition	3	Core	Dr. D. Sakthisekaran
BMS C006	Immunology	3	Core	Dr. C. Panneerselvam
BMS C007	Macromolecular Biosynthesis	3	Core	Dr. P. Varalakshmi
BMS C008	Practicals II	4	Core	Dr. P.Varalakshmi/ Dr. D.Sakthisekaran Dr. P. Sachdanandam
BMS C009	Enzyme Biochemistry and Biotechnology	3	Core	Dr. P. Sachdanandam
BMS C010	Molecular Physiology and Cell Signaling	3	Core	Dr. P.Kalaiselvi
BMS C011	Medical Biotechnology	3	Core	Dr. C. Panneerselvam
BMS C012	Practicals III	4	Core	Dr.C.Panneerselvam/Dr.P.Sachdanandam/Dr. P.Kalaiselvi
BMS C013	Hormonal Biochemistry	3	Core	Dr. D. Sakthisekaran
BMS C014	Metabolic and Gene Regulation	3	Core	Dr. P.Kalaiselvi
BMS C015	Molecular Basis of diseases	3	Core	TRF
BMS C016	Project	6	Core	All Faculty
Elective Courses				
BMS E001	Principles of Biochemistry I	3	Elective	All Faculty
BMS E002	Principles of Biochemistry II	3	Elective	All Faculty
BMS E003	Intermediary Metabolism	3	Elective	Dr. P.Kalaiselvi
BMS E004	Applied Microbial Biochemistry	3	Elective	TRF

## M.Sc. MEDICAL BIOCHEMISTRY

BMS C001	<b>Chemistry of Biomolecules</b>	3	Core	Dr. P. Sachdanandam
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Chemistry of monomeric units of polysaccharides, proteins and nucleic acids (structure and function only). Isolation and purification of polysaccharides, proteins and nucleic acids, Determination of molecular Weight and shape of polysaccharides, proteins and nucleic acids, Classification of proteins, lipids, and their properties, lipoproteins- structure, composition and function.

BMS C002	<b>Analytical Biochemistry</b>	3	Core	Dr. P. Varalakshmi
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Principles of centrifugation, laws of sedimentation Estimation of purity of macromolecules, general approaches to biochemical investigations, chromatography- different types, Principles and types of electrophoretic techniques. Spectroscopy – basic laws, ORD, circular dichroism, X-ray, U.V, visible, basic principles, instrumentation and application of mass spectrometry, Tandem mass spectrometry, ESR and NMR.

BMS C003	<b>Cellular Biochemistry</b>	3	Core	TRF
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Biochemical composition of plasma membrane, molecular organization, Isolation and Characterization of Plasma model membranes, Mitochondria – Structure, Respiratory chain carriers, Oxidative phosphorylation. Membrane transport, different kinds of transport, Transport proteins, Microtubules, golgi apparatus, Ribosomes, lysosomes, Nuclear envelope, Nucleolus. Vesicular traffic in the secretory and endocytic pathways. The molecular mechanisms of vesicular transport and maintenance of compartmental diversity.

BMS C004	<b>Practicals I</b>	4	Core	Dr. P.Varalakshmi/ Dr. P. Sachdanandam / TRF
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Subcellular fractionation of a cell by differential centrifugation and assay of markers Isolation and Estimation of Glycogen, DNA from animal tissue, RNA from yeast Denaturation of DNA and UV absorption studies. Estimation of pyruvate, lactate, Tryptophan, phosphate, protein, riboflavin, thiamine

BMS C005	<b>Food Science and Nutrition</b>	3	Core	Dr. D. Sakthisekaran
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Food and food habits, body weight, BMR Respiratory quotient, overview of vitamins and minerals, Antioxidant and oxidative stress, Nutrition in disease, Nutrition and body's defense, RDA, Dietary guidelines for diseases prevention, drug nutrient problems in modern science, Effect of drugs on food and nutrients, Nutritional therapy, Food preparation and management.

BMS C006	<b>Immunology</b>	3	Core	Dr. C. Panneerselvam
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Immunity: Innate and acquired immunity, antitoxic antibacterial and antiviral immunity, Antigenicity. Antigens, Immunogens, Immunoglobulins Isolation, structure and classification, Antigen-Antibody interactions, cells of immune system, complement system, production of vaccines and their uses, Immunological techniques, Allergy and hypersensitivity, Transplantation.

BMS C007	<b>Macromolecular Biosynthesis</b>	3	Core	Dr. P. Varalakshmi
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Biosynthesis of nucleic acids, DNA replication-procaryotic and eucaryotic systems, replication of bacterial viruses, animal viruses, plasmids, mitochondrial DNA Transcription, procaryotic and eucaryotic, Post-translational modification of proteins, inhibitors and modifiers of protein synthesis, Translation of both procaryotes and eucaryotes, Inhibitors, modifiers, Proteo glycans and glycoprotein synthesis

BMS C008	<b>Practicals II</b>	4	Core	Dr. P.Varalakshmi/ Dr. D.Sakthisekaran Dr. P. Sachdanandam
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Enzyme Studies Isolation, Purification and Kinetic studies of Acid phosphatase. Alkaline phosphatase of rat kidney or liver, Urease from plant seeds Amylase from saliva Food Analysis, Serotyping, Production of antibody, Assay of IgM, IgG

BMS C009	<b>Enzyme Biochemistry and Biotechnology</b>	3	Core	Dr. P. Sachdanandam
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An introduction to enzyme structure, Bioenergetics, detailed enzyme Kinetics, Enzyme regulation, Enzyme technology-isolation and purification of enzymes, immobilized enzymes, commercial production of enzymes and their applications

BMS C010	<b>Molecular Physiology and Cell Signaling</b>	3	Core	Dr. P.Kalaiselvi
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Chloroplast and Photosynthesis, Nitrogen fixation system, gaseous transport and acid base homeostasis, cell-cell adhesion, chemistry of muscle contraction, cell signaling- cell surface receptors, second messengers, G protein, MAP Kinase pathway, intracellular receptors, cell cycle, Apoptosis

BMS C011	<b>Medical Biotechnology</b>	3	Core	Dr. C. Panneerselvam
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Restriction and modification systems, Genomic – cDNA library construction, DNA polymorphism, Human Genome Project, Application of human gene mapping, current status of human gene mapping, DNA finger printing, Production of monoclonal antibodies and their uses in diagnosis of diseases.

BMS C012	<b>Practicals III</b>	4	Core	Dr.C.Panneerselvam/Dr.P.Sachdanandam/Dr. P.Kalaiselvi
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Liver Function test, Renal Function test, Estimation of blood glucose by orthotoluidine and glucose oxidase method. Determination of glycosylated Hb. Glucose Tolerance Test, Lipid profile, Endocrine function

BMS C013	<b>Hormonal Biochemistry</b>	3	Core	Dr. D. Sakthisekaran
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Hormones of the hypothalamus and pituitary, hormones of the adrenals, medulla, endocrine function of the kidney, Sex hormones, Endocrine responsive cancer, Pancreatic hormones and other gastro-intestinal hormones, biosynthesis and regulation of secretion of insulin and glucagon, Hormones of the thyroid and Parathyroid Prostaglandins-chemical nature and biosynthesis, biological action.

BMS C014	<b>Metabolic and Gene Regulation</b>	3	Core	Dr. P.Kalaiselvi
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Principles of metabolic control, identification of rate limiting enzymes, glycolysis, gluconeogenesis, Key enzymes involved in their regulation, HMP shunt - NADPH and G6 PD. Fatty acid biosynthesis, role of hormones and diet. Biosynthesis and regulation of fat metabolism, TCA cycle – ICDH,  $\alpha$ -KGDH as regulatory sites, urea cycle, Purine, Pyrimidine biosynthesis and their regulation, Starve feed cycle, Regulation of activity of genes and gene products in prokaryotes and eukaryotes.

BMS C015	<b>Molecular Basis of diseases</b>	3	Core	TRF
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Nutritional and protein disorders, insulin resistance, Diabetes mellitus, hypercholesterolemia, atherosclerosis, lipoproteinemia, Myasthenia gravis, Grave's disease, clinical laboratory medicine, statistical tests, Quality control, Free radicals and Antioxidants, Implication of free radicals in diseases, Cancer Biology, Molecular basis of cancer, Chemotherapy, other Contemporary therapies.

BMS C016	<b>Project</b>	6	Core	All Faculty
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#### Electives

BMS E001	<b>Principles of Biochemistry I</b>	3	Elective	All Faculty
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Classification of carbohydrates and their elementary functions, lipids-Classification, Structure and function of amino acids, Proteins and their structure, Purines, Pyrimidines, nucleosides, nucleotides and nucleic acids. Inborn errors of metabolism, enzymes in clinical diagnosis.

BMS E002	<b>Principles of Biochemistry II</b>	3	Elective	All Faculty
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Enzymes and their classification, mechanism of action, types of inhibition, vitamin Co-enzymes, pathways involved in glucose metabolism, TCA Cycle, biological oxidation, amino acid metabolism, caloric requirement, RDA, Vitamins assay and vitamin deficiency states.

BMS E003	<b>Intermediary Metabolism</b>	3	Elective	Dr. P.Kalaiselvi
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Pathways involved in glucose metabolism TCA Cycle, biological oxidation, amino acid catabolism, Metabolism of fats, eicosanoids, prostaglandins, Steroids and bileacids, Nucleotide metabolism.

BMS E004	<b>Applied Microbial Biochemistry</b>	3	Elective	TRF
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Characteristics and classification of microbes, industrial microbiology, Antibiotics and Vitamin production, Immobilized enzyme technology, waste water treatment water purification – BOD, COD, THOD, Aerobic and anaerobic composting, biodegradation.



BMS C001	Chemistry of Biomolecules	3	Core	Dr. P. Sachdanandam
Unit I:	INTRODUCTION : Chemistry of Monomeric Units of Polysaccharides, Proteins and Nucleic acids (structure and function only). Isolation and purification of Polysaccharides, Proteins and Nucleic acids, Determination of molecular Weight and shape of Polysaccharides, proteins and nucleic acids.			
UnitII:	POLYSACCHARIDES: General Methods of investigating the structure, methylation, acetylation, graded degradation of acid hydrolysis, enzymic hydrolysis and periodate oxidation methods. Homoglycans: Occurrence, structure, isolation, purification, properties and biological functions of glycans. A brief account of chitin, nectans, mannans, xylans, galactans and galacturonans. Heteroglycans and Complex carbohydrates: Occurrence ,structure, isolation, purification, properties and biological functions of mucopolysaccharides, bacterial cell wall Polysaccharides, sialic acids and blood group substances. A brief account of Polysaccharides with xylane backbone, Polysaccharides with glucose and manose backbone and Polysaccharides with galactose backbone. Chemical synthesis of Polysaccharides			
UnitIII:	PROTEIN –I: Terminology : Peptide bond, peptides, polypeptides, and proteins. Protein as biological machinery (functions) Structure: Primary, secondary and tertiary structure of proteins and its determination. Conformation of protein structure and its study with absorption of spectroscopy, polarization spectroscopy and x-ray diffraction methods. Peptide synthesis, organization of amino acids in peptide chain, organization of peptide chain in protein, Ramachandran's plot. Determination of amino acid sequence- insulin.- Classification of Proteins: Fibrous proteins, structure of $\alpha$ keratin, collagen and filamentous proteins, Globular proteins- structure and function of hemoglobin. Properties of proteins in aqueous solutions: isoelectric pH, acid base properties, electrophoretic mobility, influence of ionic concentration on the protein solubility, hydrolysis of proteins, denaturation and renaturation of proteins, protein stability			
UnitIV:	PROTEIN – II : Lysozyme- A case study – structure, enzymic activity, mechanism of action, the ionization state of side chains and denaturation of lysozyme. Metalloprotein- A case study- The biological periodic table, the relative importance of the metal and protein components of metalloprotein; a hierarchy of behaviour from metal to metalloprotein.			
UnitV:	NUCLEIC ACIDS: structure, chemical and enzymic methods of sequence analysis, properties in aqueous solutions, sedimentation behaviour, viscosity, hyper-chromic effect, melting point of DNA, hydrolysis of Nucleic acids, hybridization techniques and chemical synthesis of Nucleic acids. LIPIDS : Classification, properties, structure and functions; Lipoproteins- structure, composition and function.			

BMS C002	Analytical Biochemistry	3	Core	Dr. P. Varalakshmi
Unit I:	Physical properties of water, structure of water, hydrogen bonding, dipole moment, ionization of water, pH scale, acids, bases and buffers, pH measurements Bond angles, bond lengths, contact distances, asymmetry of right handed and left handed molecules Osmotic pressure, osmolarity of fluids and electrolyte balance. Donnan membrane equilibrium, dialysis. Surface tension and viscosity of blood. Electrochemical techniques- principles of redox reactions, pH electrode, Clarke's Oxygen electrode and their applications.			
Unit II:	Centrifugation principles, basic principles and laws of sedimentation. Preparative and analytical ultracentrifuges. Sedimentation equilibrium methods. Types of separation methods in preparative centrifuges. Differential and density gradient centrifugation. Analysis of sub-cellular fractions. Estimation of purity of macromolecules and detection of conformational changes. General approaches to biochemical investigations. Organ and tissue slice technique. Cell disruption and homogenizing techniques. Cell sorting and cell counting. Cryopreservation. Microscopy, Cytophotometry and Flow cytometry, manometric techniques.			
Unit III:	Chromatography: Theory and practice, column chromatography, column efficiency and resolution. Types of adsorption chromatography- hydroxyapatite chromatography and hydrophobic-interaction chromatography (HIC). Types of partition chromatography- normal phase and reverse phase- liquid chromatography, chiral and counter current chromatography. Paper chromatography, ion-exchange chromatography. Exclusion chromatography, chromatofocussing, affinity chromatography. Principles and application of GLC, LC, LPLC and HPLC. Selection of chromatographic systems.			
Unit IV:	Electrophoretic principles, support media, factors affecting electrophoresis. Types of electrophoretic techniques-zonal and disc electrophoresis. High and low voltage electrophoresis. Principles and applications of PAGE. Isoelectric focusing, Isotachopheresis, PFGE and capillary electrophoresis. Electrophoresis of proteins and nucleic acids.			
Unit V:	Spectroscopy: basic laws of light absorption, optical rotatory dispersion, circular dichroism, X-ray diffraction. UV and visible light spectrophotometry, spectrofluorimetry. Atomic flame photometry, Plasma emission spectroscopy, infra-red spectrophotometry. Basic principles, instrumentation and application of mass spectrometry, Tandem mass spectrometry, ESR and NMR. Radiochemical methods, basic concepts, detection, counting methods and applications, autoradiography, Cerenkov radiation. Enzymes monitoring techniques and assay methods.			

BMS C003	<b>Cellular Biochemistry</b>	3	Core	TRF
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UnitI: Plasma Membrane : Biochemical composition :Membrane proteins glycophorin, bacteriorhodopsin, membrane bound enzymes-cell surface antigens, Molecular organization, freeze fracture technique and fluid mosaic model, lipid and protein fluidity and molecular mobility of proteins. Isolation and characterization of plasma model membranes: isolation techniques for making multilamellar vesicle, bilayer, reconstitution of proteins into vesicles, liposomes.

UnitII: Mitochondria-Structure of mitochondria, inner and outer membrane, cristae, matrix aerobic respiration, respiratory chain carriers, respiratory enzyme complexes and redox potential, inhibitors of respiratory chain, uncouplers,. Thermodynamic principles, Energy rich bonds, coupled reactions and oxidative phosphorylations, Bioenergetics. Reconstitution experiments, theories on oxidative phosphorylation-Chemiosmotic hypothesis- loop mechanism, respiratory control, inhibitors of oxidative phosphorylation. Microsomal electron transport: Components and function-cyt p450-biosynthesis of steroids and their detoxification, oxidation of xenobiotics, microsomal hydroxylations and NADPH- dependent mixed function oxidation.

Unit-III: Membrane transport: Small molecules, simple diffusion, Donnan equilibrium, diffusion of charged and uncharged particles, Flick's law, Nernst law passive transport.Facilitated transport :Pores and channels-properties, carriers, specificity, ionophores Transport proteins: Periplasmic binding proteins.

Active transport : Energy for active transport. Na pump models mechanisms, Ca pump, ATP dependent proton pump. Co-transport: Symport and Antiport; sodium dependent glucose transport aminoacids and calcium.

UnitIV: Microtubules-Structure, function and assembly, Colchicine interaction- formation of centrioles, basal bodies and mitotic spindle, cytokinesis. Golgi apparatus: ultra structural organization – cisternae dictyosomes: functions: exocytosis: Protein maturation and modifications; sorting of proteins. Ribosomes: Assembly of ribosomal sub units.

Lysosomes: formation and function- phagocytosis, nucleus-Nuclear envelope: pore complex: Nucleolus-Structure and composition: Chromosome: Chromatin structure. ucleosome, histone and non histone proteins.

UnitV: Vesicular traffic in the secretory and endocytic pathways- Transport from  
a) the ER through Golgi apparatus b)Trans Golgi Network to Lysosomes

Mannose 6-Phosphate receptor shuttles - Transport in excitable cells. Internalization of macromolecules by phagocytosis, endocytosis and exocytosis - Pinocytosis: Receptor mediated endocytosis- delivery of iron by transferring and infection. - The molecular mechanisms of vesicular transport and maintenance of compartmental diversity.

BMS C004	<b>Practicals I</b>	4	Core	Dr. P.Varalakshmi/ Dr. P. Sachdanandam / TRF
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1. Preparation of buffers and titration curves for simple acids and amino acids
  2. Separation Procedures
    - a. Separation of amino acids and sugars by paper Chromatography
    - b. Separation of aminoacids, protein and protein hydrolysate by Ion Exchange Chromatography
    - c. Separation of lipids by TLC
    - d. Separation of plant pigments by column chromatography
    - e. Separation of protein by Gel filtration
    - f. Separation of glycoprotein by PAGE and lipoprotein by Agar Gel Electrophoresis
- Subcellular fractionation of a cell by differential centrifugation and assay of markers** (any two fractions sufficient)  
Nucleus (DNA), Mitochondria (SDH), Cytosol (LDH), Lysosome (Acid phosphatase), Microsome (Glucose 6 phosphatase)

**Biochemical Studies and Estimation of Macromolecules**

- a. Isolation and Estimation of Glycogen from liver
- b. Isolation and Estimation of DNA from animal tissue
- c. Isolation and Estimation of RNA from yeast
- d. Separation of starch from plant source and assessment of its purity
- e. Determination of N and C terminal aminoacids
- f. Denaturation of DNA and UV absorption studies

**Colorimetric Estimations**

- a. Estimation of pyruvate
- b. Estimation of lactate
- c. Estimation of Tryptophan
- d. Estimation of Total and Inorganic phosphate
- e. Estimation of protein by Lowry's method

**Fluorimetric Estimations**

- a. Estimation of vitamin - riboflavin, thiamine

BMS C005	<b>Food Science and Nutrition</b>	3	Core	Dr. D. Sakthisekaran
Unit I:	The meaning of food – Food habits – The Nutrients, Nutrition and body weight - Determination – Food and energy – Basal metabolic rate (BMR) – Factors influencing BMR – Respiratory quotient – Food value of different commodities, conventional and novel sources of food.			
Unit II:	An overview of vitamins and minerals – function of water soluble and fat soluble vitamins – vitamin preparation, enrichment and fortification – overload and criteria of food sources – functions of minerals – requirements of macro and micro elements – under load and overload criteria for food sources. Antioxidants and oxidative stress			
Unit III:	Nutrition for infants, children and adults – nutrition in pregnancy and lactation. Nutrition in diseases (liver disease, pancreatic insufficiency, obesity, alcoholism, cardiovascular disease, kidney disease) and malnutrition – Recommended daily dietary allowances.			
Unit IV:	Nutrition and Body's defense – Dietary Guidelines for Disease Prevention, The Process of Cancer Development, the body's Defense system and Nutritional Therapy. Drug–Nutrient Interactions - Drug-Nutrient Problems in Modern Medicine. Effects of Drugs on Food and Nutrients.			
Unit V:	Food Preparation and management – Food spoilage and Food preservation – Canning, Pressure canning, Freezing, Lyophilization and ionizing radiation. Food Microbiology – Micro organisms as food and in food products – Bacterial food poisoning and its prevention – Fermentation and fermented food products. Mycotoxins, aflatoxin, citrinin, patulin and mycotoxicosis.			

BMS C006	<b>Immunology</b>	3	Core	Dr. C. Panneerselvam
	<b>Core Course</b>			
UnitI:	Immunity: Innate and acquired immunity, antitoxic antibacterial and antiviral immunity – Self and non-self discrimination – Structure and function of primary and secondary lymphoid organs – Phagocytic cells and their killing mechanisms – Differentiation of stem cell and idiotypic variations. Antigenicity: Antigens , autoantigens , blood group antigens, bacterial, viral and tumour antigens – Tissue antigenic determinants – Haptens – Immunogens.			
Unit II:	Immunoglobulins: Isolation of immunoglobulins – Basic structures, functions, classification and variations of immunoglobulins – Theories of immunoglobulin formation – Organisation and expression of immunoglobulin genes – Generation of antibody diversity. Antigen – Antibody Interactions: Examples of antitoxins, opsonin, bacteriolysin, inflammatory process – Avidity and specificity of antibody – Multivalent binding – Cross reactivity – Kinetics of antigen antibody reactions.			
Unit III:	Cells of Immune system: T and B lymphocytes – T cell receptor diversity – T and B cells interactions – Antigen processing and presentation – Kinetics of primary and secondary immune response. Complement system: Complement activation and its biological consequences. Production of vaccines and their uses.			
UnitIV:	Immunological Techniques: Principle and titre of antisera – Precipitation, agglutination – Precipitation test – Immunodiffusion – Immune adherence – Immuno electrophoresis – Immunofluorescence – Complement fixation test – Widal test – VDRL test – Test for AIDS. Hybridoma technique: Monoclonal antibody – merits and demerits – Recombinant antibodies, DNA vaccines – Radioimmuno assay – Enzyme immunoassay – ELISA and EMIT – Immunotherapy.			
UnitV:	Allergy and Hypersensitivity – Immediate Hypersensitivity, Delayed Hypersensitivity. Transplantation: Immunological response, HLA and other systems of human major histocompatibility complex, rejection mechanism. Auto antibodies and autoimmune diseases.			

BMS C007	<b>Macromolecular Biosynthesis</b>	3	Core	Dr. P. Varalakshmi
Unit I:	Biosynthesis of nucleic acids Biosynthesis of purines and pyrimidines, modes of replication, experimental models, semi-conservative replication of double stranded DNA, replication of circular DNA, central molecular dogma, reverse transcription			
Unit II:	DNA Replication Enzymology of DNA replication, action of gyrase, polymerization reactions and polymerases of prokaryotic and eukaryotic systems, binding proteins, DNA ligase, DNases, events in the replication fork, termination, replication of bacterial viruses, animal viruses, plasmids and mitochondrial DNA.			
Unit III:	Transcription Basic features of RNA synthesis, prokaryotic and eukaryotic DNA-dependent RNA-polymerases, prokaryotic and eukaryotic transcription - initiation, elongation and termination; classes of RNA molecules, mRNA, tRNA, rRNA: biosynthesis, maturation, post-transcriptional processing and splicing mechanisms; hypersensitive sites and enhancers.			
Unit IV:	Translation Prokaryotic and Eukaryotic ribosomes, protein synthesis, genetic code, amino acid activation, initiation, elongation and termination of prokaryotic and eukaryotic translation. Post-translational modification of proteins, polysomes, coupled-transcription and translation. Inhibitors and modifiers of protein synthesis.			
UnitV:	Proteoglycans and glycoprotein synthesis Glycosaminoglycans, hyaluronic acid, chondroitin sulphate, dermatan sulphate, keratin sulphate, heparin, glycoprotein synthesis (N-linked oligosaccharide, role of dolichol carrier- oligosaccharide transferring			

enzyme, ER and golgi apparatus, O-linked oligosaccharide synthesis with an example of mucin).  
 Proteoglycans, mucoproteins, bacterial cell wall- peptidoglycan framework N- and O- glycosidic protein – anti-freeze, glycoprotein and mucins.

BMS C008	<b>Practicals II</b>	4	Core	Dr. P.Varalakshmi/ Dr. D.Sakthisekaran Dr. P. Sachdanandam
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#### Enzyme Studies

- a. Isolation, Purification and Kinetic studies of
  - i) Acid phosphatase. Alkaline phosphatase of rat kidney or liver
  - ii) Urease from plant seeds
  - iii) Amylase from saliva
- b. Assay of phosphatase, ATPase and Creatinine Phosphokinase,  $\beta$ - glucuronidase, LDH (spectrophotometric assay)
- c. Immobilization of Alkaline Phosphatase by entrapment method

#### Food Analysis

- a. Proximate analysis of food material for protein, carbohydrate, fat, calorific value calculation
- b. Ash content and Moisture content of food
- c. Estimation of Ca and Fe from ash

#### Immunological Studies

- a. Serotyping
- b. Production of antibody
- c. Determination of Antibodytitre.
- d. Assay of IgM, IgG
- e. Qualitative determination of antigen by Outcherlony diffusion technique

BMS C009	<b>Enzyme Biochemistry and Biotechnology</b>	3	Core	Dr. P. Sachdanandam
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#### Unit I: ENZYME STRUCTURE

X- ray diffraction, enzyme structure, chemical modification by active site directed reagents- Modification of protease, active site, Affinity Labelling; Other probes for enzyme structure, site directed mutagenesis, classification of enzymes, co factors as carriers: Redox carriers (NAD, NADP, flavin proteins, lipoate, glutathione, ascorbic acid, quinones, cytochromes) CO Carriers (Biotin): Amino group Carriers (Pyridoxal phosphate, Acyl coA, carnitine). Carriers of one carbon Group: (Tetra hydrofolate, Homocystene) Aldehyde Carrier (T-P) Phosphate Carriers (ADP) Sulphate Carriers (adenosine triphosphate): Glycosyl Carriers (UDP).

#### Unit II: AN INTRODUCTION TO BIO ENERGITICS, AND KINETICS

First and second laws of thermodynamics ; Enthalpy, entropy, and free energy; free energy and chemical reaction; Factors affecting rate of chemical reaction – Collision theory , Activation energy and transition-state theory, catalysis.

#### ENZYME KINETICS

General Kinetic principles: Steady – state enzyme kinetics MM equation and linear transformation of MM equation – reversible reactions – fast reactions and methods of study- rate equation by King and Altman, Enzyme Inhibition: kinetics of competitive, noncompetitive, uncompetitive and mixed inhibitors, Reactions of two substrates- isotope exchange.

#### Unit III: ENZYME REGULATION

Allosteric and Cooperative effects: Conquered model of Monod et al, and Sequential model of koshland et al, principles of metabolic regulations; feedback regulations of multifunctional pathway, NAD/ NADH ratio, adenylate change - Mechanism of enzyme action : Acid base Catalysis, covalent catalysis, chymotrypsin, metals in enzyme catalysis: Pyruvate kinase, Super oxide dismutase creatine kinase, carboxy peptidase Multi enzyme complex: Fatty acid synthetase complex, Biological significance of multi enzyme complex.

#### Unit IV: ENZYME TECHNOLOGY

Isolation and purification of enzymes: extraction of enzymes- soluble enzymes, membrane bound enzymes, purification- precipitation methods, chromatographic methods, and electrophoretic methods, criteria of purity- total activity and specific activity, crystallization of enzymes - Immobilized enzymes, techniques of immobilization, effect of immobilization on enzyme activity, application of immobilized enzymes. Immobilized enzyme complexes, uses of enzymes in solution. Commercial production of enzymes- amylases, proteases , pectinases, cellulases.

#### Unit V: APPLICATIONS OF ENZYMES

Uses of enzymes in analysis - enzyme electrodes. Enzyme as biosensor, colorimetric biosensor, potentiometric biosensor, optical and industrial applications of enzymes. Commercial value: steroidal conversions, penicillin and antibiotic conversion, immunosensor. Recent advances and future prospects of enzyme engineering; artificial enzymes. Enzymes in organic solvents, enzyme targeting using liposomes, isoenzymes.

BMS C010	<b>Molecular Physiology and Cell Signaling</b>	3	Core	Dr. P.Kalaiselvi
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- Unit I: Chloroplast and Photosynthesis : Structure of Chloroplasts – Photosynthesizing prokaryotes and eukaryotes, light reaction – photosystems, plastoquinone, plastocyanin, cyclic and non-cyclic photophosphorylation, dark reactions – carbon cycle and the energetic reactions in CO<sub>2</sub> fixation. - Nitrogen fixation system : Nitrogen fixing organisms (eg. Azetobacter, Clostridium, Rhizobium), Symbiotic relationship in leguminous plants. Nitrogen fixation, Molecular nitrogen to ammonia through the intermediate formation of di-imide and hydrazine. Conversion of nitrate to ammonia by Nitrosomonas and Nitrobacter and metabolism of amino acids.
- Unit II: Gaseous transport, and Acid Base homeostasis : Molecular mechanism of the movement of O<sub>2</sub> and CO<sub>2</sub> through lungs, arterial and venous circulation. Bohr effect, Oxygen and CO<sub>2</sub> binding hemoglobin, pH maintenance by cellular and extracellular proteins, phosphate and carbonate buffers through the lungs and the kidney. Metabolic acidosis and alkalosis, Respiratory acidosis and alkalosis. Hormonal regulation of water balance in man.- Cell – Cell adhesion, Cell – matrix adhesion , Cell junctions, tight junctions, desmosomes, Gap junctions and communication between cells –
- Unit III: Sensory Transduction : Nerve impulse transmission – Nerve cells, synapses, reflex arc structure, Resting membrane potential, Nernst equation, action potential, voltage gated ion-channels, impulse transmission, neurotransmitters, neurotransmitter receptors, Synaptosomes, synaptogamin - Rod and cone cells in the retina, Biochemical changes in the visual cycle, photochemical reaction and regulation of rhodopsin. Odor receptors, Learning and memory - Chemistry of muscle contraction – actin and myosin filaments, theories involved in muscle contraction, mechanism of muscle contraction, energy sources for muscle contraction.
- Unit IV: Cell signaling - Different types of signaling, cell surface receptors, G protein coupled receptors and Receptor tyrosine kinases, Spatial arrangement of receptor, a protein, protein kinase, adenylate cyclase in the cell membrane, their stimulation and inhibition, signaling molecules, cAMP and MAP kinase pathways - Metabolic pathways for the formation of Inositol triphosphate from phosphatidyl inositol diphosphate, formation of DAG, Ca<sup>2+</sup> channel activation, ryanodine receptors, Receptor activation and phosphoregulation of inositol and the calcium channel activation, activation and translocation of protein kinase C in the cell membrane. cAMP and CREB, JAK-STAT pathway, Smads - Interaction between various signaling pathways
- Unit V: Cell cycle : Growth factors, different phases of cell cycle, cyclin dependant kinases – check points in the cell cycle – yeasts and mammalian cell cycle regulation. Polypeptide growth factors, signals for the stimulation of DNA synthesis and cell division. Developmental control genes of nematode worm - Apoptosis – pro-apoptotic regulators and caspase activation Mitogens, mutations causing loss of cell cycle – oncogenic mutations affecting cell proliferation – mutations affecting genome stability.

BMS C011	<b>Medical Biotechnology</b>	3	Core	Dr. C. Panneerselvam
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- Unit I: Restriction and modification systems - restriction enzymes. Other DNA modifying enzymes and their uses like end labelling, nick translation, random primer labelling, dephosphorylation, phosphorylation, blunting, end filling etc. Cloning vectors - plasmids, phages, cosmids, phagemids, shuttle vectors, expression vectors, suicide vectors, runaway plasmids, YACs. Restriction, ligation, transformation, recombinant selection methods.
- Unit II: Genomic - and cDNA - library construction. High level expression of proteins. Production of insulin, interferon, interleukins, thrombolytic factors, tumour necrosis factor, human growth hormone and other rare biologicals. Production of peptide vaccines, novel antibiotics by gene manipulation. Transgenic animals and their uses.
- Unit III: DNA polymorphism - Mutation and Molecular basis of genetic diseases: Haemoglobinopathies, phenylketonuria, Lesch-Nyhan syndrome, Tay-Sachs disease, familial hypercholesterolemia, cystic fibrosis, muscular dystrophy. DNA and RNA probes and their uses in disease diagnosis and in forensics. RFLP, SSCP and their applications. DNA sequencing. PCR and its application in infections and genetic disorders. FISH and its uses. Human gene therapy.
- Unit IV: Human Genome Project - genome mapping - physical and genetic mapping of human genes. Application of human gene mapping - Bioinformatics, proteomics, pharmacogenomics and pharmacogenetics. Current status of human gene mapping. DNA finger printing, prenatal diagnosis of human disorders.
- Unit V: Production of monoclonal antibodies and their uses in diagnosis of diseases: sexually transmitted diseases, viral diseases, bacterial infections, cancer detection, pregnancy testing. Monoclonal antibody for preventive and therapeutic purposes. DNA vaccines. Protein engineering and its applications.

BMS C012	<b>Practicals III</b>	4	Core	Dr.C.Panneerselvam/Dr.P.Sachda nandam/Dr. P.Kalaiselvi
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1. Collection and preservation of urine and blood samples.
2. Liver Function test: Estimation of bilirubin – direct and indirect. Estimation of plasma protein, A/G ratio, Thymol turbidity test, Assay of serum glutamate oxaloacetate transaminase, alkaline phosphatase, lactate dehydrogenase. Isoenzyme separation of LDH by electrophoresis.

3. Renal Function test: Qualitative tests for normal and pathological component of urine. Estimation of blood and urine urea, creatinine, creatine and uric acid. Urea clearance test.
4. Estimation of blood glucose by orthotoluidine and glucose oxidase method. Determination of glycosylated Hb. Glucose Tolerance Test.
5. Lipid profile; Estimation of cholesterol by Zak's method, lipoprotein profile, estimation of ketone bodies, estimation of triglycerides, free fatty acids and phospholipids.
6. Endocrine function: Assay of insulin by ELISA, estimation of urinary excretion of VMA, 5-HIAA, 17-ketosteroids, 17-ketogenic steroids, plasma level of cortisol.
7. Electrolytes: Determination of serum calcium, sodium, potassium by flame photometer. Estimation of chlorides, phosphates. Estimation of Cu, Fe by colorimetric method.
8. Antioxidant status: estimation of LPO, assay of superoxide dismutase, catalase and glutathione peroxidase. Estimation of Vitamins A, E and C.
9. Haematology: RBC Count, WBC Count – total and differential count, ESR, PCV, MCV. Estimation of haemoglobin.

BMS C013	<b>Hormonal Biochemistry</b>	3	Core	Dr. D. Sakthisekaran
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- Unit I: Hormones of the hypothalamus and the pituitary – organisation of hypothalamus and hypophysis: chemical nature, biosynthesis, secretion and biochemical action of adeno-hypophysial hormones (GH, TSH, ACTH, LH, FSH, MSH and prolactin) and neurohypophysial hormones (oxytocin and anti-diuretic hormone), hypophysial releasing and inhibiting factors
- Unit II: Hormones of the adrenals – hormones of the adrenal cortex. Chemical nature, biosynthesis and mechanism of action of glucocorticoids, mineralocorticoids. Hormones of the medulla – chemical nature, biosynthesis and mechanism of action of catecholamines (epinephrine and norepinephrine). Endocrine function of the kidney – renin – angiotensin system
- Unit III: Sex hormones – hormones of the testes and ovaries – chemical nature and biosynthesis of androgens, estrogens and progesterone. Metabolic fate and mechanism of action of androgens, estrogens and progesterone. Hormones of the corpus luteum and reproductive cycle. Disorders of the male and female reproductive system. Endocrine Responsive Cancer - Breast, Endometrial and Prostate Cancers.
- Unit IV: Pancreatic hormones and other gastro-intestinal hormones – chemical nature of insulin and glucagon. Biosynthesis and regulation of secretion of insulin and glucagon. Effect of insulin and glucagon on carbohydrates, lipids and protein metabolism. Somatostatin and pancreatic polypeptides. Gastro-intestinal hormones – gastrin, enterogastrin, secretin and cholecystokinin.
- Unit V: Hormones of the thyroid, parathyroid and prostaglandins – chemical nature and biosynthesis of thyroid hormones – structure and metabolic effect. Effect on calorogenesis and induction of amphibian metamorphosis. Parathyroid hormones and calcitonin and calcium level and kidney function. Prostaglandin – chemical nature and biosynthesis, biological action of prostaglandins. Cyclooxygenase and lipoxygenase pathways, cAMP, a second messenger of hormone action.

BMS C014	<b>Metabolic and Gene Regulation</b>	3	Core	Dr. P. Kalaiselvi
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- Unit I: Principles of metabolic control – hormonal control of metabolism – modulation of enzyme activity – non-covalent and covalent regulatory mechanisms, identification of rate limiting enzymes in metabolic pathways - Glycolysis and Gluconeogenesis : Cori's cycle and Alanine cycle, Phosphofructokinase as the key enzyme in glycolysis, role of fructose 2,6 diphosphate, hexokinase and pyruvate kinase as regulatory enzymes in glycolysis - Glycogen synthesis and degradation : cAMP and its co-ordinated control of glycogenesis and glycogenolysis – Phosphorylase activation and inactivation, role of calcium and phosphoinositide cascade. HMP shunt : G6PD as a regulatory enzyme. Role of NADPH in metabolism
- Unit II: Lipid metabolism : Fatty acid biosynthesis, control of acetyl CoA carboxylase, role of hormones in lipid metabolism, effect of diet on fatty acid synthesis, Eicosanoid biosynthesis - Biosynthesis and regulation of triacyl glycerol, cholesterol, phosphatidyl choline, phosphatidyl ethanolamine and sphingomyelin - Fatty acid mobilization from adipose tissues, degradation, role of carnitine. Ketogenesis and its regulation - Pyruvate dehydrogenase complex and its regulation. TCA cycle – citrate synthase, ICDH and  $\alpha$  - KGDH as regulatory sites
- Unit III: Nitrogen Metabolism : Key role of glutamate dehydrogenase and its regulation, Urea cycle and its regulation - Biosynthesis and degradation of purine and pyrimidine nucleotides and their regulation - Key junctions in metabolism : Glucose –6-phosphate, pyruvate and acetyl CoA - Starve –Feed Cycle. Mechanisms involved in switching the metabolism of liver between the well-fed state and the starved state. Metabolic interrelationships of tissues in various nutritional and hormonal states.
- Unit IV: Regulation of the activity of genes and gene products in prokaryotes - Types of regulation of transcription – positive and negative regulation -Jacob and Monod model of Operon concept – Lactose system – purification and structure of the repressor – effect of glucose on lac operon – regulatory region of the DNA of the lac operon – Mutants and gratuitous inducers of lac operon. Galactose operon, arabinose operon, tryptophan operon and their regulation - Regulons – HTP regulon, Pho regulon and SOS regulon - Regulation of synthesis of ribosomes. Unregulated changes in gene expression- Flagellin synthesis - Life cycle of Bacteriophage  $\lambda$  - Lytic and lysogenic cycles,  $\lambda$  genetic switches.

Unit V: Regulation in Eukaryotes: - Differences in the genetic organization of prokaryotes and eukaryotes - Gene Families : Simple, multigene, complex multigene and developmentally controlled complex gene families - Regulatory strategies in eukaryotes – gene alteration, gene loss, gene amplification and gene rearrangement - Regulation of synthesis of primary transcript Response elements – Promoters, enhancers, DNA binding domains – Zinc finger motif, Homeodomains, Helix Loop Helix, Leucine zipper. Transcriptional control by hormones, regulation mediated through transcription factors, Histone acetylation and deacetylation, demethylation of DNA - Regulation of processing and polyproteins : Translational control: life time of m-RNA – control of initiation – regulation of rate of overall protein synthesis – regulation of the synthesis of vitellogenin.

BMS C015	<b>Molecular Basis of diseases</b>	3	Core	TRF
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UnitI: Disorders of carbohydrate metabolism  
Diabetes Mellitus and its metabolic complications, GTT, assay of insulin, glycosylated haemoglobin. Glycogen storage diseases, galactosemia, fructosuria, pentosuria, mucopolysaccharidosis, Disorders of lipid metabolism  
Sphingolipidosis, hypercholesterolemia and atherosclerosis - Lipoproteins and hyperlipoproteinemia, LCAT deficiency, gall stones, gout, tropical sprue.

UnitII: Disorders of amino acid, protein and nucleic acid metabolism  
Inborn errors of amino acid metabolism, rheumatoid factors, multiple myeloma, glutathioneuria, Hartnup disease, hyperuricemia and gout, adenosine deaminase, orotic aciduria, Lesch Nyhen syndrome - Prenatal and postnatal diagnosis of inborn errors using enzyme assays, PCR, ARMS. RT-PCR, DHPLC in amniotic fluid, Chorionic villi.  
Disorders of blood  
Blood Agranulocytosis, Thrombocytopenia,  $\beta$  Thalassemias, anemias, haemoglobinopathies, disorders of blood clotting mechanism, laboratory test to measure coagulation and thrombolysis

Unit-III : Organ function tests  
Liver function test with special reference to hepatitis and jaundice, renal function test and gastric function test - Diagnostic significance of serum enzymes - Routine urine analysis and stone analysis,

UnitIV: Free radicals and anti-oxidants : chemistry of free radicals and reactive oxygen species-superoxide, hydroxyl peroxy,alkoxy, non radicals-hydrogen peroxide, reactive nitrogen species, role of nitric oxide, role of metals, generation of free radicals by one electron reduction, Detection of free radicals, trapping and fingerprinting methods: Lipid peroxidation, protein damage by ROS/RNS, DNA damage by ROS/RNS and repair mechanisms. Anti-oxidant defense enzymes-Superoxide dismutase,catalases, glutathione peroxidase, Glutathione reductase, glutathione-S-transferases.Free radical scavengers-Vitamins C,E, carotenoids, reduced glutathione, uric acid etc. Free radicals in health and disease. Reactive species as useful biomolecules, Origin of oxidative stress, consequences, Implications of free radicals in Atherosclerosis. Hypertension, Diabetes, Ischemia- reperfusion, Arthritis, Cancer, aging and Xeroderma pigmentosum.

UnitV: Cancer Biology- Characteristics of tumor cells, cell culture and transformation, characteristics of transformed cells, changes in cell-cell interaction - Etiology of cancer- Agents of transformation –viruses as agents and oncogenes, DNA viruses, RNA viruses-retro viruses, chemical carcinogenesis and radiation carcinogenesis - Growth pattern, immortalization, angiogenesis. Molecular basis of cancer- apoptotic and tumor suppressor gene.Chemotherapy of cancer and other contemporary therapies- immunotherapy and gene therapy.

#### ELECTIVES

BMS E001	<b>Principles of Biochemistry I</b>	3	Elective	All Faculty
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Unit I: Classification of carbohydrates and their elementary reactions  
Unit II: Lipids-Classification, Structure and Function  
Unit III: Aminoacids, Proteins and their structure, enzymes  
Unit IV: Purines, pyrimidines, nucleosides, nucleotides and Nucleic acids  
Unit V: Inborn errors of metabolism-Glycogen storage diseases, enzymes in clinical diagnosis

BMS E002	<b>Principles of Biochemistry II</b>	3	Elective	All Faculty
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Unit I: Classification of enzymes, enzyme mechanism, active site. Inhibition, competitive, uncompetitive noncompetitive and allosteric inhibitions, Co-enzymic of vitamins.  
Unit II: Glucose metabolism - glycolysis, gluconeogenesis and glycogenesis, pentose phosphate pathway and gluconeogenesis, UDP hexoseamines and uronic acids and conversion of galactose to glucose.  
Unit III: Fatty acids breakdown, phospholipid hydrolysis, cerebroside and ganglioside biosynthesis and breakdown, cholesterol biosynthesis and bile acid production, ketone bodies.  
Unit IV: Tricarboxylic acid cycle, biological oxidation and mitochondrial energy metabolites, oxidative deamination, transamination, decarboxylation, formation of urea, glycamine, creatinine ketogenic and glycolytic aminoacid., transmethylation, lipotropic factors.

Unit V: Caloric requirement, recommended dietary allowances of vitamins mineral and proteins, Biological role of proteins, essential amino acids and fatty acids - Vitamin deficiency states and the mechanism of action of fat and water soluble vitamins, hormonal actions.

BMS E003	<b>Intermediary Metabolism</b>	3	Elective	Dr. P.Kalaiselvi
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Unit I: Classification of enzymes, enzyme mechanism, active site, inhibition, competitive, uncompetitive, noncompetitive and allosteric inhibitions, co-enzymic of vitamins.

Unit II: Glucose metabolism: Glycolysis, glycogenesis and glyconeogenesis, pentose – phosphate pathway and gluconeogenesis, UDP hexoseamines and uronic acids and conversion of galactose to glucose.

Unit III: Fatty acid breakdown, phospholipid hydrolysis, cerebrosides and ganglioside biosynthesis and break down, cholesterol biosynthesis and bile acid production, ketone bodies.

Unit IV: Tricarboxylic acid cycle, biological oxidation and mitochondrial energy metabolics, oxidative deamination, transamination, decarboxylation, formation of urea, glytamine creatine, ketogenic and glycolytic aminoacid transmethylation, lipotropic factors.

Unit V: Biosynthesis of purine and pyrimidine nucleotides. End product of purine and pyrimidine, catabolism.

BMS E004	<b>Applied Microbial Biochemistry</b>	3	Elective	TRF
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Unit I: Characteristics and classification of microbes, Morphological characteristics, chemical, cultural, metabolic, antigenic, genetic, microbial classification, Taxonomic groups and general methods of classifying bacteria.

Unit II: Industrial microbiology: Ethanol fermentation, lactic acid and citric acid, acetone-butanol fermentation.

Unit III: Antibiotics-Riboflavin, Vitamin B<sub>12</sub>, Pencillin enzyme production, immobilized enzyme technology.

Unit IV: Microorganisms in domestic, wastewater marine water, water purification, waste water characteristics-BOD, COD,THOD, effluent water treatment processes.

Unit V: Aerobic and anaerobic composting, utilization of cellulose, bioremediation, Microbial degradation of Xenobiotics, biodegradation of oil spills.

#### M.Sc. ENVIRONMENTAL TOXICOLOGY

Course Code	Title of the Course Code	C/E	Credits				Course Faculty
			L	T	P	C	
<b>I SEMESTER</b>							
BMS C501	General Principals of Toxicology	C	3	1	0	4	Prof. R.Venkata Krishna Murali
BMS C502	Aquatic Toxicology	C	3	1	0	4	Prof. S.L.Maheswari
BMS C503	Pesticide Toxicology	C	3	1	0	4	Prof. M.P.Balasubramanian
BMS C504	Instrumentation in Toxicological Analysis	C	3	1	0	4	Guest faculty from T.N. Forensic Science Department
BMS E501	Drug Therapy	E	3	0	0	3	Prof. R.Venkata Krishna Murali
<b>II – SEMESTER</b>							
BMS C505	Forensic Toxicology	C	3	1	0	4	Guest faculty from T.N. Forensic Science Department
BMS C506	Food Toxicology	C	3	1	0	4	Dr. S.Karthikeyan
BMS C507	Practicals in Environmental Toxicology-I	C	0	0	4	4	Guest faculty from T.N. Forensic Science Department
BMS E502	Insecticides	E	3	0	0	3	Prof. M.P.Balasubramanian
BMS E503	Toxicity of Food Additives	E	3	0	0	3	Dr. S.Karthikeyan
<b>III – SEMESTER</b>							
BMS C508	Systemic Pharmacology and Toxicology	C	3	1	0	4	Prof. R.Venkata Krishna Murali
BMS C509	Advances in Toxicology	C	3	1	0	4	All Faculty
BMS C510	Practicals in Environmental Toxicology-II	C	0	0	4	4	All Faculty



BMS E504	Fundamentals of Environmental Toxicology	E	3	0	0	3	Prof. R.Venkata Krishna Murali
BMS E505	Neurotoxicology	E	3	0	0	3	Prof. S.L.Maheswari
IV – SEMESTER							
BMS C511	Industrial Toxicology	C	3	1	0	4	Guest Faculty from CLRI, RLI & IGCAR
BMS C512	Practical in Environmental Toxicology – III	C	0	0	4	4	All Faculty
BMS C513	Practical Training	C	3	3	0	6	All Faculty
BMS E506	Genetic Toxicology	E	3	1	0	3	Dr. S.Karthikeyan

<b>BMS C501</b>	<b>GENERAL PRINCIPLES OF TOXICOLOGY</b>	C	3	1	0	4	Prof. R. VENKATA KRISHNA MURALI
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1. Introduction – Different areas of toxicology – classification of toxic agents – toxicity – hazard – risk; Routes of exposure – duration and frequency of exposure.
2. Chemobiokinetics – Transport across membranes – absorption and factors that affect it – distribution – biotransformation – excretion.
3. Chemobiodynamics – Mechanisms of action – receptors; dose-response relationship - interaction between chemicals. Factors influencing toxicity.
4. Spectrum of toxic effects – Allergic reaction – idiosyncratic reaction – immediate and delayed toxicity – reversible and irreversible toxicity – local and systemic toxicity; Treatment of poisoning.
5. Toxicity testing – Toxicity testing in animals; Interpretation of laboratory data.

<b>BMS C502</b>	<b>AQUATIC TOXICOLOGY</b>	C	3	1	0	4	<b>Prof. S.L.MAHESWARI</b>
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1. General principles of aquatic toxicology – major issues – dose/concentration-response, interactions, exposure routes. Types of toxicity testing and LD<sub>50</sub> statistics.
2. An introduction to the sources, cycling and impact of toxicants on aquatic systems, including acid rain, ground water, fresh water rivers, lakes, estuaries and the ocean.
3. Chronic, early life stage and whole life cycle tests. Contaminant distribution/biomagnifications and bioconcentration responses.
4. Levels of biological response – behavioural, physiological, histopathological and biochemical responses.
5. Sources and uses of bioactive compounds from aquatic plants and animals.

Bms C503	Pesticide Toxicology	C	3	1	0	4	Prof. M.P. Balasubramanian
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1. Introduction – historical development – classification of pesticides – (a) by their target: insecticides, fungicides, herbicides, algicides, nematocides, rodenticides; (b) by their chemical nature: natural organic compounds, inorganic compounds, chlorinated hydrocarbons, organophosphates, carbamates, etc; (c) by their physical state: dust, solutions, suspensions, volatile solids, aerosols, etc; (d) by their mode of action: stomach poison and fumigants-repellants.
2. Definition of terms used in pesticide formulations – recent trends. Mode of action of various groups of pesticides – mode of entry and metabolism of pesticides in mammals and arthropods – degradation and metabolism of pesticides – oxidation, reduction, isomerization, hydrolysis and dealkylation, etc.
3. Pesticide interaction – additive effect, potentiation, synergism and antagonism – resistance to pesticides. Human hazards in the use of pesticides and safety measures – pesticide laws
4. Pesticide as pollutants in environment – residues – their toxicity to biological systems in invertebrate of water, soil and surface – in cold and warm-blooded vertebrates
5. Ecological impact of pesticide use – predator-prey relationship – creation of pests – transferred effect of chemical – secondary poisoning delayed expression, faunal displacement – Integrated pest management – a viable and ecologically alternative to unilateral use of chemical pesticides – basic principles and its various compounds.

Bms C504	Instrumentation in Toxicological Analysis	C	3	1	0	4	Guest faculties of T.N.forensic science department
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1. Chromatography – paper chromatography, thin layer chromatography, gas chromatography, high performance liquid chromatography, paper electrophoresis.

2. Spectrophotometry – ultra-violet absorption spectrophotometry, infra-red absorption spectrophotometry, NMR spectrophotometry, mass spectrometry.
3. Radio-immunoassay.
4. X-ray diffraction - Electron probe application in toxicology
5. Elemental analysis

BMS E501	DRUG THERAPY	E	3	0	0	3	Prof. R. VENKATA KRISHNA MURALI
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1. Introduction – description of essential terms.
2. Pharmacokinetics – routes of administration – absorption – distribution – biotransformation – excretion.
3. Pharmacodynamics – effects of drugs – interaction between drugs.
4. Drug therapy – drugs used in different clinical conditions.
5. Drug evaluation – laboratory testing in animals – clinical evaluation.

BMS C505	Forensic Toxicology	C	3	1	0	4	Guest faculties of T.N.forensic science department
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1. A study of the poisons – corrosive poisons, metals and their salts, gaseous poison, non-metallic element, volatile poisons, insecticides, synthetic drugs, plant poisons, poisons of animal origin, mechanical irritants.
2. Methods of extraction and purification in toxicological analysis.
3. Screening test for common poisons – detection and estimation of toxic gases and common volatile poisons, ethyl alcohol analysis, metallic poisons.
4. Screening test for - pesticides and insecticides, glycosides, alkaloids, barbiturates, anti-histaminics, and other synthetic drugs.
5. Metabolism of toxicants in human systems.

BMS C506	Food toxicology	C	3	1	0	4	Dr.S.Karthikeyan
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1. Naturally occurring food toxins – lathyrism, favism, protease inhibitors, hemeagglutinins, saponins, glucosinolates, pyrrolizidine alkaloids – secondary toxicosis.
2. Food allergens – toxicity and mechanism of food allergy – prevention and management.
3. Microbial food poisoning – bacterial, fungal – food toxicity outbreaks – management and control – malnutrition.
4. Nitrosamines and their food toxicity – food additives – food colours, preservatives, flavouring agents, artificial sweeteners – toxicity and management.
5. Food adulteration – toxicity of food adulterants – toxicity of packaging materials – food laws/regulation – control authorities.

BMS C507	Practicals in environmental toxicology – i	C	0	0	4	4	Guest faculties of T.N.Forensic Science Department
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1. Spot test for alkaloids, glycosides and drugs.
2. Paperchromatography and TLC of insecticides, drugs and narcotics
3. Estimation of lead in blood and urine
4. Estimation of copper in biological fluids
5. Detection and estimation of arsenic and mercury
6. Gas chromatography of alcohols and drugs
7. Determination of blood alcohol level by chemical methods
8. Detection and estimation of methyl alcohol
9. Detection and estimation of cyanide, parathion, carbon monoxide, zinc phosphide
10. UV and IR spectrophotometry of drugs
11. Electrophoresis of alkaloids.

BMS E502	INSECTICIDES	E	3	0	0	3	Prof. M.P. BALASUBRAMANIAN
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1. Introduction – classification of insecticides.
2. Hazards in the use of insecticides

3. Insecticides as pollutants in environment
4. Impact of insecticides on commercially important species.
5. Influence of insecticides on estuarine animals

<b>BMS E503</b>	<b>TOXICITY OF FOOD ADDITIVES</b>	E	3	0	0	3	<b>Dr.S.KARTHIKEYAN</b>
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1. Food additives – classification, use of food additives.
2. Food colours – use, classification and toxicity.
3. Food preservatives – use, classification and toxicity.
4. Flavoring agents – monosodium glutamate – use and toxicity.
5. Non-nutritive sweeteners – saccharin, cyclamate, aspartame – use and toxicity

<b>BMS C508</b>	<b>SYSTEMIC PHARMACO-LOGY AND TOXICOLOGY</b>	C	3	1	0	4	<b>Prof. R. VENKATA KRISHNA MURALI</b>
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1. Drugs acting on the central nervous system – (i) Central nervous system – general anesthetics – alcohols – sedative hypnotics – drugs used in mental illness – therapy of epilepsies – therapy of parkinsonism – opioid analgesics – CNS stimulants. (ii) Autonomic nervous system – cholinergic agonist – cholinergic antagonists – adrenergic agonists – drugs acting on autonomic ganglion. (iii) Somatic nervous system – skeletal muscle relaxants – local anesthetics.
2. Drugs used in the gastrointestinal tract and respiratory disorders – (i) Agents acting on gastrointestinal tract – emetics – drug therapy of vomiting – pharmacotherapy of constipation and diarrhea – agents used in the treatment of peptic ulcer. (ii) Agents used in respiratory disorders – therapy of bronchial asthma – agents used in the management of cough.
3. Drugs affecting renal and cardiovascular function – (i) Drugs affecting renal function – diuretics. (ii) Drugs affecting cardiovascular function – antianginal drugs – antihypertensive agents – treatment of congestive heart failure – antiarrhythmic drugs – therapy of shock.
4. Pharmacology and toxicology of other therapeutic agents – (i) Drugs affecting blood and blood coagulation – drugs effective anemias. (ii) Hormones and related drugs – anterior pituitary hormones – Oxytocin and related agents – thyroid and anti-thyroid drugs – insulin and oral anti-diabetic drugs – adrenal cortical steroids – gonadal hormones – drugs affecting calcium balance. (iii) vitamins. (iv) immunomodulators – immunosuppressive agents and immunostimulants – vaccines and globulins. (v) pharmacotherapy of inflammation – anti-inflammatory agents – treatment of gout.
5. Chemotherapy – (i) chemotherapy of parasitic infections - drugs used in protozoal infections - drugs used in helminthiasis. (ii) chemotherapy of microbial infections – general consideration – sulphonamides – beta lactam antibiotics – other antibiotics. (iii) chemotherapy of neoplastic diseases – antineoplastic agents – adverse effects.

<b>BMS C509</b>	<b>ADVANCES IN TOXICOLOGY</b>	C	3	1	0	4	<b>ALL FACULTY</b>
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1. Drug Development and safety
2. Drugs and chemicals induced hepatotoxicity
3. Drugs and chemicals induced genotoxicity
4. Molecular neurotoxicity
5. Combined effect of xenobiotics on physiology and biochemistry of aquatic organisms

<b>BMS C510</b>	<b>PRACTICALS IN ENVIRONMENTAL TOXICOLOGY - II (PRACTICALS IN TOXICOLOGY)</b>	C	0	0	4	4	<b>ALL FACULTY</b>
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1. Estimation of total protein.
2. Estimation of activity of transaminases – AST and ALT.
3. Estimation of activity of phosphatases – Acid phosphatase and Alkaline phosphatase.
4. Water analysis – (i) pH, (ii) turbidity, (iii) salinity, (iv) chlorides, (v) sulphates, (vi) hardness, (vii) nitrites and nitrates, (viii) carbohydrates, (ix) proteins, (x) lead, (xi) copper, (xii) mercury, (xiii) zinc, (xiv) chromium (xv) BOD, (xvi) COD etc.
5. Isolated tissue preparation

<b>BMS E504</b>	<b>FUNDAMENTALS OF ENVIRONMENTAL TOXICOLOGY</b>	E	3	0	0	3	<b>Prof. R.VENKATA KRISHNA MURALI</b>
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1. Introduction – (i) description of essential terms. (ii) routes of exposure/administration. (iii) absorption, (vi) distribution, (v) biotransformation, (vi) excretion, (vii) effects of xenobiotics, (viii) interaction between xenobiotics.

- Toxicity testing – (i) laboratory animals, (ii) toxicity testing in animals, (iii) toxicological field studies, (iv) priorities in the selection of chemicals for testing.
- Interpretation of laboratory data – (i) distinction between adverse and non-adverse effects.
- Human data – (i) ethical consideration, (ii) need for human investigation (iii) clinical toxicology.

<b>BMS E505</b>	<b>NEUROTOXICOLOGY</b>	E	3	0	0	3	<b>Prof. S.L.MAHESWARI</b>
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- Basic principles in toxicology.
- Major classes of toxic agents.
- Synthesis, degradation and uptake of neurotransmitters.
- Impact of environmental pollutants on neurotransmitter metabolism.
- Xenobiotic effects on learning, memory, aging and behavior.

<b>BMS C511</b>	<b>INDUSTRIAL TOXICOLOGY</b>	C	3	1	0	4	<b>GUEST FACULTY FROM – CLRI, RLI &amp; IGCAR, Kalpakkam</b>
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- Air pollution. Water pollution.
- Types and characteristics of solid waste.
- Environmental microbiology. Microbes of the environment.
- Heavy metal industrial pollution.
- Thermal pollution. Noise pollution. Radiation toxicology.

<b>BMS C512</b>	<b>PRACTICAL IN ENVIRONMENTAL TOXICOLOGY - III</b>	C	0	0	4	4	<b>All Faculty</b>
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- Animals and animal handling, methods of drug/toxin administration in experimental animals.
- Identification of toxicologically important plants.
- Analgesics studies.
- Spontaneous motor activity.
- Isolated frog heart – perfusion In Situ.
- Isolated guinea pig ileum.
- Local anaesthetic studies-frog abdomen pouch method.
- Isolated rat uterus.
- Chemical assay of drugs.
- Spot tests.
- Chemical test
- LC<sub>50</sub> estimation
- Estimation of activity of acetylcholine esterase

<b>BMS C513</b>	<b>PRACTICAL TRAINING</b>	C	3	3	0	6	<b>ALL FACULTY</b>
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- Practical training in Radiation Toxicology
- Practical training in Industrial Toxicology
- Practical training in Aquatic Toxicology
- Practical training in Pesticide Toxicology
- Practical training in bio-informatics in toxicology

<b>BMS E506</b>	<b>GENETIC TOXICOLOGY</b>	E	3	0	0	3	<b>Dr.S.KARTHIKEYAN</b>
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- Fundamentals of genetics
- Chemical nature of genetic material - DNA, RNA; types of RNA-mRNA, tRNA, rRNA.
- Mutations - Variation in chromosome number - chromosomal aberrations – mutagenicity testing.
- Carcinogenesis - (i) Environmental carcinogens, (ii) chemical carcinogens, (iii) mode of action of carcinogens, (iv) screening tests for carcinogenicity.
- Radiation as mutagens – (i) radiation induced genetic damage, (ii) radiation sensitizers, (iii) radiation protectors.

**M.Sc. ANATOMY – FACULTY OF MEDICINE**

Semester	Code	Course Title	L	T	P	C	Faculty
I	BMS C701	Human Anatomy – I	2	1	0	3	TRF / Guest Lecturer
	BMS C702	Human Histology	2	1	0	3	Dr.S.Prakash
	BMS C703	Human Physiology – I	3	1	0	4	Faculty, Dept. of Physiology
	BMS C704	Practical – I: Human Anatomy Practical I	0	0	3	3	TRF / Guest Lecturer
	BMS C705	Practical – II: Human Physiology Practical II	0	0	3	3	Faculty, Dept. of Physiology
		Elective	2	1	0	3	Faculty of concerned Dept.
		Elective	2	1	0	3	Faculty of concerned Dept.
II	BMS C706	Human Anatomy – II	2	1	0	3	TRF / Guest Lecturer
	BMS C707	Human Physiology – II	3	1	0	4	Faculty, Dept. of Physiology
	BMS C708	Practical – III: Human Anatomy Practical II	0	0	3	3	TRF / Guest Lecturer
	BMS C709	Practical – IV: Human Physiology Practical II	0	0	3	3	Faculty, Dept. of Physiology
		Elective	2	1	0	3	Faculty of concerned Dept.
		Elective	2	1	0	3	Faculty of concerned Dept.
	III	BMS C710	Human Physiology – III	3	1	0	4
BMS C711		Research Methods in Anatomy	2	1	0	3	Dr.S.Prakash
BMS C712		Practical V: Research Methods in Anatomy	0	0	3	3	Dr.S.Prakash
		Elective	2	1	0	3	Faculty of concerned Dept.
		Elective	2	1	0	3	Faculty of concerned Dept.
		Elective	2	1	0	3	Faculty of concerned Dept.
IV	BMS C713	Advanced Research Methods	2	1	0	3	Dr.V.Sankar Dr.S.Prakash
	BMS C714	Animal Experimentation	2	1	0	3	Dr.V.Sankar
	BMS C715	Practical : VI Advanced Research Methods	0	0	3	3	Dr.V.Sankar Dr.S.Prakash
	BMS C716	Practical VI: Animal Experimentation	0	0	3	3	Dr.V.Sankar
		Elective	2	1	0	3	Faculty of concerned Dept.
		Elective	2	1	0	3	Faculty of concerned Dept.
V	BMS C717	Gross Anatomy – I	2	1	0	3	Dr.V.Sankar
	BMS C718	Neuro Anatomy – I	2	1	0	3	Dr.R.Muthusamy
	BMS C719	Histology and Embryology – I	2	1	0	3	Dr.S.Prakash
	BMS C720	Dissertation work	0	0	6	6	Concerned Faculty serving as Guide and Supervisor
VI	BMS C721	Gross Anatomy – II	2	1	0	3	Dr.V.Sankar
	BMS C722	Neuro Anatomy – II	2	1	0	3	Dr.R.Muthusamy
	BMS C723	Histology and Embryology – II	2	1	0	3	Dr.S.Prakash
	BMS C724	Surgical Anatomy and Operative Surgery	2	1	0	3	Dr.R.Muthusamy Dr.V.Sankar
	BMS C725	Practical VII: Anatomy Practical-Spotters and Viva	0	0	3	3	Dr.R.Muthusamy Dr.V.Sankar Dr.S.Prakash
	BMS C726	Practical VIII: Anatomy Practical – Cadaver Dissection	0	0	3	3	Dr.R.Muthusamy Dr.V.Sankar Dr.S.Prakash

**DETAILED SYLLABUS**
**ELECTIVE(S) TO BE OFFERED BY DEPARTMENT OF ANATOMY**
**In Odd Semesters**

1. BMS E701 Human systemic anatomy
2. BMS E702 General Human Embryology
3. BMS E703 Medical Imaging and Radiology

In Even Semesters

1. BMS E704 Systemic Human Embryology

RECOMMENDED ELECTIVES FOR THE STUDENTS OF M.SC.ANATOMY

In Odd Semesters

Name of the Elective	Offered By
BMS E705 General Human Embryology	Dept. of Anatomy
BMS E706 Principles of Bio-Chemistry-I	Dept. of Bio-Chemistry
BMS E707 Principles of Endocrinology	Dept. of Endocrinology
BMS E708 Principles of Genetics	Dept. of Genetics

In Even Semesters

Name of the Elective	Offered By
BMS E709 Systemic Human Embryology	Dept. of Anatomy
BMS E710 Principles of Bio-Chemistry-II	Dept. of Bio-Chemistry
BMS E711 Principles of Endocrinology-II	Dept. of Endocrinology
BMS E712 Human pathology	Dept. of Pathology
BMS E713 Medical Imaging and Radiology	Dept. of Anatomy

<b>BMS C701</b>	<b>Human Anatomy – I</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>TRF / Guest Lecturer</b>
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- UnitI: Overview of Anatomy - Medical and Anatomical terminology - The Anatomical position - The Anatomical Plans - Sections of the body - Terms of relationship - Terms of comparison - Terms of movement - Anatomical Variations - Diagnostic Imaging.
- UnitII: Introduction to Systemic Anatomy - Types of bone – Joints - Classification of joints - innervation of joints - Muscle tissue and muscular system - Types of muscle - Blood vessels and cardiovascular system - Lymphatic and the Lymphatic system - Functions of the lymphatics - Nervous tissue and nervous system.
- UnitIII: Upper limb - Bones of upper limb - pectoral Girdle - pectoral muscles - axilla, Brachial plexus - back and shoulder region - Muscles connecting upper limb to vertebral column - scapular muscles - arm - Humerus - brachial fascia and intermuscular septum - Muscles of arm cubital fossa - Forearm - Muscles in cubital region - bones of wrist and hand - Muscles of forearm - Nerves of forearm - Arteries of forearm - extensor muscles of forearm - posterior nerves of forearm - posterior arteries of forearm - Wrist and Hand - hand - Joints of upper limb - Patient oriented problem - Discussion of patients problems.
- UnitV: Lower Limb - Hip and thigh areas - bone and surface anatomy of hip - bones and surface anatomy of thigh - fascia of thigh thigh muscles - femoral triangle - - Gluteal Region gluteal nerves - gluteal arteries Gluteal veins - Posterior thigh muscles - Popliteal fossa - leg -Bones of leg Surface anatomy of leg - Bones of Foot - Crural Fascia Compartments of Leg- - Foot Muscles of foot - Nerves of foot -Arteries of foot -Veins of foot- -Joints of Lower Limb Hip joint - knee joint - Tibiofibular joints ankle joint Joints of foot Arches of foot- -Patient Oriented Problems Discussion of Patient's problems.
- UnitV: Thorax - Thoracic Wall Skin and Fascia of Thoracic Wall - Bones of Thoracic Wall - Surface Anatomy of Anterior Thoracic Wall - Breasts -Movements of Thoracic Apertures - Muscles of Thorax - Intercostal Spaces Intercostal Nerves Intercostal Arteries Intercostal Veins - Internal Thoracic Vessels - - Thoracic Cavity -Pleurae and Pleural Cavities - Lungs- - Mediastinum Pericardium - Heart - Superior Mediastinum Posterior Mediastinum Anterior Mediastinum- - Patient's Oriented Problems Discussion of Patient's Problems.

<b>BMS C702</b>	<b>Human Histology</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>Dr.S.Prakash</b>
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Cell structure and function - Cell cycle and application - Basic tissue types - Blood- - Connective tissue -Epilial tissue - Muscle - Nervous tissue - Organ systems - Circulatory system - Skin - Skeletal tissue - Immune system - Respiratory system - Oral tissue - Gastro intestinal tract- - Liver and pancrease - Urinary system - endocrine glands - Male reproductive system - Female reproductive system - Central nervous system - Special sense organs

<b>BMS C704</b>	<b>Practical – I: Human Anatomy Practical I</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>TRF / Guest Lecturer</b>
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Demonstration of various Regions in Human Cadaver – Human Bones – Identification of the same – Demonstration of histological pictures and their identification as spotters

<b>BMS C703</b>	<b>Human Physiology – I</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>	<b>Faculty, Dept. of Physiology</b>
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Refer Physiology Department Syllabus for Details and Suggested Text Books

<b>BMS C705</b>	<b>Practical – II: Human Physiology Practical I</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>Faculty, Dept. of Physiology</b>
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Refer Physiology syllabus for details

<b>BMS C706</b>	<b>Human Anatomy – II</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>TRF / Guest Lecturer</b>
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UnitI: Head - skull - Bones of skull- face Muscles of face -Arteries of face -Veins of face -Lymphatic Drainage of face - parotid Gland - Scalp Layers of Scalp Nerves of Scalp Arteries of Scalp Veins of Scalp Lymphatic Drainage of Scalp - Cranial Fossae Anterior Cranial Fossae Middle Cranial Fossae Posterior Cranial Fossae-Cranial Meninges and Cerebrospinal Fluid - Brain main parts of brain Ventricular System and CSF- Orbit orbital contents orbital muscles

UnitII: Head - parotid region - temporal region - temporal fossae infratemporal fossa- temporomandibular joint - oral region oral cavity palate tongue - salivary glands - pterygopalatine fossa - nose paranasal sinuses - ear external ear middle ear - internal ear - Patient Oriented Problems Discussion of Patient's Problems-

UnitIII: Neck - Surface Anatomy of Neck Superficial Neck muscles - Triangles of Neck Posterior triangle of neck Anterior triangle of neck - cervical viscera -Fascial planes of neck- Larynx -Muscles of pharynx Interior of pharynx- Larynx - Patient Oriented problems Discussion of patient's problems-

UnitIV: Cranial nerves - olfactory nerve - optic nerve - oculomotor nerve - trochlear nerve - trigeminal nerve - abducent nerve - facial nerve - vestibulocochlear nerve - Glossopharyngeal nerve - vagus nerve - accessory nerve - hypoglossal nerve-

UnitV: Back - - vertebral column Normal curvatures of vertebral column Palpation of vertebral column - vertebrae -Joints of vertebral column -Muscles of back Extrinsic back muscles intrinsic back muscles - suboccipital region - Spinal cord and Meninges - Patient Oriented Problems Discussion of Patient's Problems

<b>BMS C708</b>	<b>Practical – III: Human Anatomy Practical II</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>TRF / Guest Lecturer</b>
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Demonstration of various Regions in Human Cadaver – Human Bones – Identification of the same – Demonstration of histological pictures and their identification as spotters

<b>BMS C709</b>	<b>Human Physiology – II</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>	<b>Faculty, Dept. of Physiology</b>
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Refer Physiology Department Syllabus for Details and Suggested Text Books

<b>BMS 1080</b>	<b>Practical – IV: Human Physiology Practical II</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>Faculty, Dept. of Physiology</b>
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Refer Physiology Department Syllabus for Details and Suggested Text Books

<b>BMS C710</b>	<b>Human Physiology – III</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>	<b>Faculty, Dept. of Physiology</b>
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Refer Physiology Department Syllabus for Details and Suggested Text Books

<b>BMS C711</b>	<b>Research Methods in Anatomy</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>Dr.S.Prakash</b>
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UnitI: **Fixation** – Definition – aims and effects of fixation – types of fixatives with examples for each type – post chromification – freeze drying – parameters used in choosing a fixative – possible artefacts that may arise due to improper fixation – commonly used fixatives, their advantages and disadvantages.

UnitII: **Tissue processing** - Various types of waxes used for section cutting, their choice steps involved in paraffin processing and the principle behind each step – vacuum embedding – processing for cryosectioning.

UnitIII: **Section cutting** - Introduction to various microtomes and a brief account of their parts – knives, honing and stropping – art of sectioning – fixing the sectioned tissue to slides – troubleshooting sectioning problems - art of cryosectioning. **Staining** - Theory of staining – impregnation versus staining – brief account about chemistry of stains – metachromasia – general precautions during the preparation and usage of stains – progressive and regressive staining techniques – basic staining and mounting procedures – working knowledge of commonly employed staining methods.

UnitV: **Special Staining** – Neurohistology – methods used for various CNS components – interpretation of results – principles involved in neurohistology. **Special procedures** – Decalcification – fluorescent labelling and other tracers – immunohistology: introduction, applications, tissue preparation and usage – autoradiography – vital staining – corrosion casting; introduction, agents employed, usage.

UnitV: **Microscopy** – Different types of microscopes, their working principles, specific applications, their limitations.

<b>BMS C712</b>	<b>Practical V: Research Methods in Anatomy</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>Dr.S.Prakash</b>
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#### LIST OF PRACTICAL CLASSES

1. Perfusion fixation of a rat
2. Tissue processing and embedding in paraffin wax
3. Section cutting of a paraffin block
4. Tissue preparation and sectioning using cryostat
5. Toluidine blue staining
6. Haematoxylin & Eosin staining.
7. Masson's trichrome staining
8. Mallory's trichrome staining
9. PAS Staining
10. CFV staining
11. Loyez's method of staining
12. Glees and Marshland's modification of Bielchowsky's silver staining
13. Golgi-cox method of impregnation
14. Modified PTAH staining
15. Viability estimation using Trypan Blue exclusion method
16. Gastrocnemius innervation in frogs – DiI tracer injection
18. Stereological& Morphometry – I. Estimation of gross anatomical parameters such as weight, gross measurements, volume and specific gravity of various organs.
19. Stereological & Morphometry – II. Estimation of various microanatomical parameters such as area, volume density, numerical density, axial ratio of different tissue components of various organs
20. Reconstruction techniques – usage of camera lucida of drawing
22. Macro Photography
23. Photomicrography – light and fluorescent microscopy

<b>BMSC713</b>	<b>Advanced Research Methods</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>Dr.V.Sankar Dr.S.Prakash</b>
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UnitI: Neurophysiology: EMG – EEG – SEP – MEP

UnitII: Neuron Tracing: Use of fluorescent tracers – non-fluorescent tracers – theoretical background of neuron tracing mechanisms

UnitIII: Estimation Techniques: Estimation of Neurotransmitters and others through HPLC – ELISA

UnitIV: Histochemistry: Histochemical procedures in quantifying substances such as alkaline phosphatase – histamine etc in tissue sections

UnitV: Immunohistology: Polyclonal –monoclonal antibody production – primary – secondary antibodies – antibody tagging – antigen retrieval – using different primary and secondary antibodies for selective staining of tissue components.

<b>BMSC715</b>	<b>Practical : VI Advanced Research Methods</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>Dr.V.Sankar Dr.S.Prakash</b>
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#### List of Practical

1. Recording EMG, EEG, SEP and MEP
2. Tracing spinal neurons innervating gastrocnemius muscle in rats
3. Demonstration of estimation of dopamine / any other transmitter using HPLC and others by ELISA
4. Staining tissues for the presence of alkaline phosphatase, histamine etc
5. Using primary and secondary antibodies to label selective tissue components in both paraffin and cryosections.

<b>BMSC714</b>	<b>Animal Experimentation</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>Dr.V.Sankar</b>
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UnitI: Introduction: Animal experimentation - need and importance – limitations – legal and ethical issues in animal experimentation – rules / orders pertaining to animal experimentation

UnitII: Animal Maintenance: Maintenance and breeding conditions for commonly used laboratory animals such as rats, mice, dogs, rabbits, and non-human primates

UnitIII: Animal Anesthetic Techniques: Fundamentals of anesthesia – various anesthetic, analgesic medication for animals - Animal Training and Behaviour Study: Training animals for neurological testings – basis and fundamentals of animal behaviour studies – objective scoring methods



- UnitV: Animal Surgery: Fundamentals of experimental animal surgery – surgical approaches such as laprotomy – craniotomy – laminectomy – vascular access – osmotic pump installation
- UnitV: Animal Euthansia: Acceptable methods of animal euthanasia - Alternate Methods to Animal Experimentation: Need to find alternate methods – advantages and limitations

<b>MSC716</b>	<b>Practical VI: Animal Experimentation</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>Dr.V.Sankar</b>
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**List of Practical**

1. Maintenance practice of rats in the department's animal house
2. Demonstration of animal anesthesia
3. Demonstration of animal surgeries / invasive procedures
  - a. Venupuncture and blood sampling
  - b. Drug administration – oral, para entral
  - c. Craniotomy
  - d. Laminectomy
  - e. Laprotomy
  - f. Stereotaxic lesioning techniques
4. Training an animal for a particular motor / memory skill test
5. Animal behavior testing and scoring methods

<b>BMSC717</b>	<b>Gross Anatomy – I</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>Dr.V.Sankar</b>
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Detailed syllabus shall be the same as given for Human Anatomy I and II and Human Histology papers given under Semester I and II. However the standard of teaching will be of “Gray’s Anatomy” Level and as per the PG level of teaching recommended by Prof.A.Krishnamurti committee appointed by “Anatomical Society of India” to frame the syllabus to teach anatomy.

<b>BMSC718</b>	<b>Neuro Anatomy – I</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>Dr.R.Muthusamy</b>
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Detailed syllabus shall be the same as given for Human Anatomy I and II and Human Histology papers given under Semester I and II. However the standard of teaching will be of “Gray’s Anatomy” Level and as per the PG level of teaching recommended by Prof.A.Krishnamurti committee appointed by “Anatomical Society of India” to frame the syllabus to teach anatomy.

<b>BMSC719</b>	<b>Histology and Embryology – I</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>Dr.S.Prakash</b>
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Detailed syllabus shall be the same as given for Human Anatomy I and II and Human Histology papers given under Semester I and II. However the standard of teaching will be of “Gray’s Anatomy” Level and as per the PG level of teaching recommended by Prof.A.Krishnamurti committee appointed by “Anatomical Society of India” to frame the syllabus to teach anatomy.

<b>BMS C720</b>	<b>Dissertation work</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>6</b>	<b>Concerned Faculty serving as Guide and Supervisor</b>
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Valuation of the of the Dissertation and Viva Voce:

Periodic presentation of learning	20 Marks
Concise Dissertation	60 Marks
Viva Voce	20 Marks

The dissertation will be evaluated jointly by the supervisor and two other examiners from the same department.

<b>BMSC721</b>	<b>Gross Anatomy – II</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>Dr.V.Sankar</b>
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Detailed syllabus shall be the same as given for Human Anatomy I and II and Human Histology papers given under Semester I and II. However the standard of teaching will be of “Gray’s Anatomy” Level and as per the PG level of teaching recommended by Prof.A.Krishnamurti committee appointed by “Anatomical Society of India” to frame the syllabus to teach anatomy.

<b>BMS C722</b>	<b>Neuro Anatomy – II</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>Dr.R.Muthusamy</b>
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Detailed syllabus shall be the same as given for Human Anatomy I and II and Human Histology papers given under Semester I and II. However the standard of teaching will be of “Gray’s Anatomy” Level and as per the PG level of teaching recommended by Prof.A.Krishnamurti committee appointed by “Anatomical Society of India” to frame the syllabus to teach anatomy.

<b>BMSC723</b>	<b>Histology and Embryology – II</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>Dr.S.Prakash</b>
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Detailed syllabus shall be the same as given for Human Anatomy I and II and Human Histology papers given under Semester I and II. However the standard of teaching will be of “Gray’s Anatomy” Level and as per the PG level of teaching recommended by Prof.A.Krishnamurti committee appointed by “Anatomical Society of India” to frame the syllabus to teach anatomy.

<b>BMS C724</b>	<b>Surgical Anatomy and Operative Surgery</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>Dr.R.Muthusamy Dr.V.Sankar</b>
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Surgical and operative surgery aspects of the following:

1. Patient preparation, anesthesia, fluid management, surgical incisions, sutures, wound care
2. Postoperative care – antibiotics, pain relief, special requirements
3. Fractures, dislocations and their management
4. Wound management through skin grafting and flaps
5. Amputations
6. Vascular repair
7. Anterior abdominal wall – special reference to hernias
8. Abdominal viscera – stomach, biliary system, excretory system, intestinal system, pancreas, spleen
9. Surgical and operative surgery aspects of cardiac problems
10. Surgical and operative surgery aspects of thoracic interventions
11. Principles of neurosurgery
12. Surgical and operative surgery aspects of eye, ear, nose and throat
13. Organ transplantations and reconstructive surgery

<b>BMSC725</b>	<b>Practical VII: Anatomy Practical- Spotters and Viva</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>Dr.R.Muthusamy Dr.V.Sankar Dr.S.Prakash</b>
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Identification and discussion of spotters from gross anatomy – neuro anatomy – osteology – radiology – histology – embryology – surface anatomy and neuroanatomical techniques

<b>BMSC726</b>	<b>Practical VIII: Anatomy Practical – Cadaver Dissection</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>Dr.R.Muthusamy Dr.V.Sankar Dr.S.Prakash</b>
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Dissection and displaying a given area / structure in human cadaver

#### **M.S. NEUROSCIENCE (Faculty of Medicine)**

Semester	Course code	Title	L	T	P	Cre dit	Faculty
I	BMS C601	Human Anatomy I	2	1	0	3	Guest Faculty
	BMS C602	Human histology	2	1	0	3	Dr.prakash
	BMS C603	Human Physiology I	3	1	0	4	Physiology
	BMS C604	Practical I Human Anatomy I	0	1	2	3	Dr. Muthusamy
	BMS C605	Practical II Human Physiology I	0	1	2	3	Physiology
		*Elective	2	1	0	3	
		*Elective	2	1	0	3	
II	BMS C606	Human Anatomy II	2	1	0	3	Guest Faculty
	BMS C607	Neuro Anatomy	2	0	1	3	Dr.R.Muthusamy
	BMS C608	Research Method in Neuroscience	2	0	1	3	Dr.V.Sankar Dr.S.Prakash
	BMS C609	Human Physiology II	3	1	0	4	Physiology
	BMS C610	Practical III Human Anatomy II	0	1	2	3	Dr.R.Muthusamy
	BMS C611	Practical IV Research Method in Neuroscience	0	1	2	3	Dr. V.Sankar Dr.S.Prakash
	BMS C612	Practical - V Human Physiology II	2	0	1	3	Physiology
		Elective	2	1	0	3	
		Elective	2	1	0	3	

III	BMS C613	Neuro Physiology	2	1	0	3	NIMHANS Bangalore
	BMS C614	Neuro Pathology	2	1	0	3	Dr. Sarasa Barathi
	BMS C615	Neuro Chemistry and Molecular Neurobiology	2	1	0	3	NIMHANS Bangalore
	BMS C616	Practical VI Neuro Physiology		1	2	3	NIMHANS Bangalore, Anatomy & Physiology
	BMS C617	Practical VII Neuro pathology	0	1	2	3	Dr.Sarasa Barathi
	BMS C618	Neuro Microbiology, Neuro Virology, Neuro Immunology	2	1	0	3	Dr. P. Rajendran
	BMS C619	Bio Physics, Psycho Pharmacology	2	1	0	3	NIMHANS Bangalore
	BMS C620	Medical Imaging and Radiology	2	0	1	3	MMC Chennai
		Elective	0	0	3	3	
IV	BMS C621	Clinical Neurology	1	1	1	3	VHS Chennai
	BMS C622	Clinical Neuro surgery, Neurological Treatment and Rehabilitation	1	1	1	3	VHS Chennai
	BMS C623	Research Project and Dissertation	0	0	6	6	All Faculty
	BMS C624	Clinical Examination & Final Viva	0	1	1	2	VHS & Dr.R.Muthusamy
		Total Core Elective				68 21	

<b>BMS C601</b>	<b>Human Anatomy</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>Guest Faculty</b>
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(Upper limb, Lower Limb and Thorax)

- Unit I: Overview of Anatomy  
Medical and Anatomical terminology The Anatomical position The Anatomical Plans Sections of the body Terms of relationship- Terms of comparison Terms of movement Anatomical Variations - - Diagnostic Imaging
- UnitII: Bones and the skeletal system Types of bone - Joints Classification of joints innervation of joints- - Muscle tissue and muscular system- Types of muscle - Blood vessels and cardiovascular system Lymphatic and the Lymphatic system Functions of the lymphatics Nervous tissue and nervous system-  
The upper limb - Bones of the upper limb The pectoral Girdle- - The pectoral muscles - The axilla The Brachial plexus - - The back and shoulder region Muscles connecting the upper limb to the vertebral column The scapular muscles - - The arm The Humerus The brachial fascia and intermuscular septum - Muscles of the arm
- Unit III: The Forearm The cubital fossa- Muscles in the cubital region -bones of the wrist and hand - Muscles of the forearm- - Nerves of the forearm -Arteries of the forearm The extensor muscles of the forearm- The posterior nerves of the forearm The posterior arteries of the forearm -- The Wrist and Hand The hand- - Joints of the upper limb - Patient oriented problem Discussion of patients problems-  
( st mid term examination )
- UnitIV: The Lower Limb - The Hip and thigh areas The bone and surface anatomy of the hip - The bones and surface anatomy of the thigh -The fascia of the thigh The thigh muscles -The femoral triangle - -The Gluteal Region the gluteal nerves -The gluteal arteries The Gluteal veins - The Posterior thigh muscles -The Popleteal fossa -The leg -Bones of the leg Surface anatomy of the leg
- UnitV: Bones of the Foot - The Crural Fascia Compartments of the Leg- -The Foot Muscles of the foot - Nerves of the foot -Arteries of the foot -Veins of the foot- -Joints of the Lower Limb The Hip joint -The knee joint - The Tibiofibular joints The ankle joint Joints of the foot The Arches of the foot- -Patient Oriented Problems Discussion of Patient's problems-  
(nd mid term examination) (End Semester Examination - including all the Units)

<b>BMS C602</b>	<b>Human Histology</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>Dr. S. Prakash</b>
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- Unit I: 1.Cell structure and function 2. Cell cycle and application Basic tissue types. 3. Blood. 4. Connective tissue 5.Epithelial tissue 6. Muscle 7. Nervous tissue .
- UnitII: 8. Circulatory system 9. Skin 10. Skeletal tissue 11. Immune system
- UnitIII: 12. Respiratory system 13. Oral tissue 14. Gastro intestinal tract. 15. Liver and pancrease.
- UnitIV: 16. Urinary system 17. The endocrine glands 18. Male reproductive system 19. Female Reproductive system
- UnitV: 20. Central nervous system 21. Special sense organs

<b>BMS C603</b>	<b>Human Physiology</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>Faculty, Dept. of Physiology</b>
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For details of syllabus and List of Reference Books, please refer syllabus of Dept. of Physiology

<b>BMS C604</b>	<b>Practical - I Human Anatomy- I</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>Guest Faculty</b>
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Gross Anatomy –

Demonstration of various Regions in Human Cadaver.  
Upper Limb and Lower Limb

<b>BMS C605</b>	<b>Practical II - Human Physiology-I</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>Faculty, Dept. of Physiology</b>
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For details of syllabus and List of Reference Books, please refer syllabus of Dept. of Physiology

<b>BMS C606</b>	<b>Human Anatomy - II</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>Guest Faculty</b>
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(Head and Neck)

- UnitI: The Head - The skull - Bones of the skull-The face Muscles of the face -Arteries of the face -Veins of the face -Lymphatic Drainage of the face -The parotid Gland -The Scalp Layers of the Scalp Nerves of the Scalp Arteries of the Scalp Veins of the Scalp Lymphatic Drainage of the Scalp -
- UnitII: The Cranial Fossae The Anterior Cranial Fossae The Middle Cranial Fossae The Posterior Cranial Fossae-0-Cranial Meninges and -Cerebrospinal Fluid
- UnitIII: The Orbit The orbital contents The orbital muscles - The parotid region - The temporal region - The temporal fossae The infratemporal fossa- The temporomandibular joint - The oral region The oral cavity The palate The tongue - The salivary glands -The pterygopalatine fossa - 0-The nose The paranasal sinuses The ear The external ear The middle ear - The internal ear - Patient Oriented Problems Discussion of Patient's Problems-
- UnitIV: The Neck - Surface Anatomy of the Neck Superficial Neck muscles - Triangles of the Neck Posterior triangle of the neck Anterior triangle of the neck - The cervical viscera -Fascial planes of the neck--The Larynx -Muscles of the pharynx Interior of the pharynx- The Larynx - Patient Oriented problems Discussion of patient's problems- The Cranial nerves- The olfactory nerve -The optic nerve -The oculomotor nerve -The trochlear nerve -The trigeminal nerve -The abducent nerve -The facial nerve -The vestibulocochlear nerve -The Glossopharyngeal nerve 0-The vagus nerve -The accessory nerve --The hypoglossal nerve-
- UnitV: The Back - The vertebral column Normal curvatures of the vertebral column Palpation of the vertebral column -The vertebrae -Joints of the vertebral column -Muscles of the back The Extrinsic back muscles The intrinsic back muscles - The suboccipital region - Spinal cord and Meninges - Patient Oriented Problems Discussion of Patient's Problems-

<b>BMS C607</b>	<b>Neuro Anatomy</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>Dr. R. Muthusamy</b>
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- UnitI: The Brain The main parts of the brain Ventricular System and CSF- The organization of the nervous system- Gross anatomy and microanatomy
- UnitII: The Meninges and the cerebro spinal fluid - Gross Anatomy of the brain- Spinal cord - Gross anatomy and internal structure- Tracts of the spinal cord
- Unit III: The Medulla - The Pons -The Mesencephalon - The Cerebellum
- UnitV: -The Diencephalon - The Hypothalamus - Corpus striatum and related nuclei - Olfactory pathways Hippocampal formation and Amygdala - The cerebral cortex
- UnitV: - The Blood supply of the central nervous system blood brain barrier - The autonomic nervous system - Histogenesis of the nervous system-- Role of apoptosis; trophic factors; Neurotransmitters; Extra-cellular matrix in nervous system development and differentiation - Neurons and glia interaction in development Biochemistry of CNS development

<b>BMS C608</b>	<b>Research methods in Neuroscience</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>Dr.V. Sanakar Dr.S.Prakash</b>
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- Unit I: Protocol of Research: Theory Identifying broad area of research search for lacunae review of literature Identifying the problem for research Designing of research protocol-Selection of experimental animal/ subject/ area of research Methods of experimentation research tools sample size time of experimentation/ survey/ field work Collection of data / information / Observation- Analysis of the results- Statistical evaluation Test of significance ummary of the results- Futurology-
- UnitII: Research methods - Neuro Histological Techniques

- Fixation – Definition – aims and effects of fixation – types of fixatives with examples for each type – post chromatization – freeze drying – parameters used in choosing a fixative – possible artefacts that may arise due to improper fixation – commonly used fixatives their advantages and disadvantages-Tissue processing - Various types of waxes used for section cutting their choice steps involved in paraffin processing and the principle behind each step – vacuum embedding – processing for cryo sectioning-
- UnitIII: Section cutting - Introduction to various microtomes and a brief account of their parts – knives honing and stropping – art of sectioning – fixing the sectioned tissue to slides – troubleshooting sectioning problems - Cryostate various parts and functioning of Cryostate- Art of cryosectioning and trouble shooting in cryosections-
- UnitIV: Staining - Theory of staining – impregnation versus staining – brief account about chemistry of stains – metachromasia – general precautions during the preparation and usage of stains – progressive and regressive staining techniques – basic staining and mounting procedures – working knowledge of commonly employed staining methods-  
Special Staining – Neurohistology – methods used for various CNS components – interpretation of results – principles involved in neurohistology-  
Special procedures – Decalcification – fluorescent labelling and other tracers – immunohistology: introduction applications tissue preparation and usage – autoradiography – vital staining – corrosion casting; introduction agents employed usage-
- UnitV: Microscopy – Different types of microscopes their working principles specific applications their limitations-

<b>BMS C609</b>	<b>Human Physiology - II</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>Faculty, Dept. of Physiology</b>
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For details of syllabus and List of Reference Books, please refer syllabus of Dept. of Physiology

<b>BMS C610</b>	<b>Practical -III - Human Anatomy II</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>Guest Faculty</b>
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Gross Anatomy - Demonstration of various Regions in Human Cadaver.

#### **Demonstratiopn of Human brain and dissected brain.**

<b>BMS C611</b>	<b>Practical - IV - Research methods in Neuroscience</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>Dr.V. Sanakar Dr.S.Prakash</b>
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- UnitI: Demonstration of perfusion and fixation of animals - Tissue procession of a given tissue piece up to blocking.
- UnitII: Demonstration of microtome parts and their working, working - Demonstration of sectioning of the paraffin blocks. - Demonstration of cryostat, and cryosectioning of a given tissue.
- UnitIII: Staining the paraffin sections with H & E, Masson's trichrome, Mallory' trichrome, PAS CFV and Toluidine blue - Staining the given sections for Neural cells, myelin, axons and glia using CFV, LFB, Loyex, Weigert & Pal, Bielchowsky's silver and modified PTAH methods - Loyez's method of staining. Gleys and Marshland's modification of Bielchowsky's silver staining - Golgi-cox method of impregnation
- UnitIV: Fluorescent tracer study using DiI – tracing a neural pathway in an animal cadaver. Gastrocnemius innervation in frogs – DiI tracer injection
- UnitV: Demonstration of Nikon microscopes and their accessories. - Fluorescent Microscopy for DiI labelled tissues - Stereological& Morphometry – I. Estimation of gross anatomical parameters such as weight, gross measurements, volume and specific gravity of various organs - Stereological & Morphometry – II Estimation of various microanatomical parameters such as area, volume density, numerical density, axial ratio of different tissue components of various organs. - Reconstruction techniques – usage of camera lucida of drawing - Isolation of cells from tissues using trypsinization for cell culture studies, Viability estimation using Trypan Blue exclusion method - Light and fluorescent microscopy - Macro Photography, Photomicrography.

<b>BMS C612</b>	<b>Practical - V: Human Physiology II</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>Faculty, Dept. of Physiology</b>
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For details of syllabus and List of Reference Books, please refer syllabus of Dept. of Physiology

<b>BMS 1078</b>	<b>Basic Pathology</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>Faculty, Dept. of Pathology</b>
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- UnitI: Acute and Chronic inflammation - Tissue repair, Cellular growth, wound healing,
- UnitII: Hemo dynamic disorder, thrombosis and shock Genetic diseases
- UnitIII: Diseases of Immunity Neoplasia
- UnitIV: Infectious Diseases Environmental and Nutritional Pathology Diseases of Infancy & Childhood
- UnitV: Practical - Ways of identifying healthy, sick and dead cells – Causes of cell death – Type of ulcers / wounds – Mechanisms and stages of wound healing – infiltrations – histology of cancers neuropathology Slides of

the Condition to be shown and explained - Relevant Specimens to be studied - Relevant stains to be studied  
- Diseases of the specific organs.

<b>BMS</b>	<b>C613</b>	<b>Neuro Physiology</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>NIMHANS Bangalore</b>
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UnitI: Neurobiology of sensation and sensory processing; mechanism of movements and its regulations; neurobiology of emotion; motivation; leaning and memory and neural substrate of different states of consciousness.

UnitII: 1. Trophic factors, extra cellular matrix components in nervous system development.  
2. Neuron-Glia interactions in development.  
3. Cellular neurophysiology - synapses and neuronal signaling.

UnitIII: 4. An over view of the neurobiology of sensation and sensory processing.  
5.. Principal mechanisms of movement and its central control.  
6. Neurobiology of emotion and motivation.

UnitIV: 7. Neural substrates regulating the states of consciousness.  
8. Neurobiology of learning and memory.

UnitV: 9. Neuro physiological basis of psychiatric disorder.  
10. Neuro physiological basis of neurological disorders.

<b>BMS</b>	<b>C614</b>	<b>Neuro Pathology</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>Dr. Sarasa Barathi Guest Faculty</b>
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UnitI: 1. Organization of the nervous system macroscopic and histological features  
2. Fine structural features of the nervous system  
3. Cytogenesis of brain cells

UnitII: 4. Blood Brain Barrier - structural and functional aspects  
5. Morphological histochemical and ultra structural aspects of skeletal muscle  
6. Peripheral nerves - structure, development and diseases

UnitIII: 7. Dystrophinopathies and congenital myopathies  
8. Regeneration of the nervous system

UnitV: 9. Neuropathology of infections of nervous system - Tissue reaction  
10. Neuropathology of ischemia - evolution of lesions

Unit V: 11. Neuro-Oncology - Cellular and molecular aspects  
12. Neuro degeneration

<b>BMS</b>	<b>C615</b>	<b>Neuro Chemistry and Molecular Neurobiology</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>NIMHANS Bangalore</b>
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UnitI: a)Signal transduction, Cellular neurochemistry, neurotransmitters and receptors, biochemical mechanisms of higher brain functions.

Introduction to Molecular Neurobiology

1. Signal Transduction -a) Synaptic transmission and cellular signaling -i) Neurotransmitter synthesis and metabolism ii) Peptides and growth factors-b) Receptors, effector system, G-protein -c) Intracellular messengers i) Phosphoinositides ii) Cyclic nucleotides & calcium

UnitII: 2. Cellular Neurochemistry (4 hrs)-i) Energy metabolism/glycolysis -ii) Lipids of CNS-iii) Carbohydrates, proteins , aminoacids  
3. Neural processing and behaviour (4 hrs)-i) Endocrine effects on brain ii) Learning , memory and behaviour-4. Development and differentiation (2 hrs) -i) Biochemistry of CNS development -ii) Biochemistry of ageing and age related disorders.

UnitII: Applied Neurochemistry

5. Inherited and Neurodegenerative diseases (6 hrs) - i) Disorders and carbohydrate , lipids and mitochondria metabolism ii) Disorders of muscle iii) Disorders of aminoacid metabolism iv) Disorders of basal ganglia v) Biochemistry of dementia.

UnitIV: 6. Neuropsychiatric disorder (4 hrs) - i) Neurochemistry of schizophrenia ii) Biochemistry of mood and anxiety disorder -

iii) Neurochemical aspects of drug of abuse

7. Neuroimmunology - Immune system and brain; Immuno pathological mechanism operative in brain disease.

UnitV: Practical exposure

i) Clinical Biochemistry--Automated analysis, Blood profile, CSF profile - ii) Neurochemistry - Protein estimation , electrophoresis HPLC exposure , radio ligand binding , Fluorescence ELISA , RIA , Enzymes.

<b>BMS</b>	<b>C616</b>	<b>Practical VI Neuro Physiology</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>NIMHANS Bangalore</b>
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Unit I: 1. Demonstration of different structures of human brain.  
2. Demonstration of nerve action potential.  
3. Demonstration of primary neuronal culture technique.

- UnitII: 4. Stereotaxic technique to demonstrate the effect of lesioning and stimulation of various brain regions.
- Unit III: 5. Polysomnographic recording to study sleepwakefulness cycle.  
6. In vivo and in vitro recording of single and multi unit activity.
- UnitV: 7. Demonstration of EEG, EMG and Evoked Potentials will be carried out in collaboration with the Department of Neurology.
- UnitV: 8. Evaluation of motor,skills, learning and memory in experimental animals

<b>BMS</b>	<b>C617</b>	<b>Practical VII Neuro Pathology</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>Dr. Sarasa Barathi Guest Faculty</b>
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- UnitI: Demonstration various histopathological slides
- UnitII: special stains Neurohistological stains
- UnitIII: Histochemistry
- UnitIV: Immunohistochemistry
- UnitV: Brain Cutting Electron Microscopic techniques

<b>BMS</b>	<b>C618</b>	<b>Neuro microbiology, Neuro Virology and Neuro immunology</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>Dr. P.Rajendran &amp; NIMHANS Bangalore</b>
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- UnitI: 1.Principles of general Microbiology.  
2. Microbes and man.  
3. Host-Microbe relationship.  
4. Infectious diseases.  
5. Laboratory Diagnosis of Infections: its realities and myths.  
6. Principles of neuro microbiology
- UnitII: 7. Blood barrier and CNS infections.  
8. Pathogenesis of CNS microbial infections.  
9. Laboratory diagnosis of CNS infections.  
10. Neuro tuberculosis and Neuro cysticercosis.  
11. Antibiotics and Microbes.  
12. Prevention, control and public health aspects of CNS infections.
- UnitIII: 1. Preparation of culture media, stains etc.  
2. Isolation of bacteria, mycobacteria and funji.  
3. Biochemical characterization and antibiogram.  
4. Immunological diagnosis of infectious diseases.  
5. Serological assays.  
6. Use of PCR in the diagnosis of Infections.
- UnitIV: Neurovirology (10 hrs)  
1. Viral infections of CNS  
2. Viral Neurotropism  
3. Pathogenesis of viral infection of CNS.  
4. Lab diagnosis of viral infections of CNS.  
5. Prevention and control of viral infections of CNS.  
6. HIV and the nervous system Prions.  
7. Japanese encephalitis Rabies.
- UnitV: Neuroimmunology  
1. Fundamentals of neuroimmunology  
2. Viral Immunopathology in CNS  
3. Psychoneuro immunology  
4. Immunology : Basic techniques - Elisa, IFA, Western Blot, Virus Neutralization.  
5. Cell Culture: Growth and maintenance of cell culture, storage and revival of cell lines, lymphocyte cultures  
6. Virology: Virus growth and titration animal

<b>BMS</b>	<b>C619</b>	<b>Neuro Biophysics, Psychopharmacology</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>NIMHANS Bangalore</b>
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- UnitI: 1. Neuronal membrane structure and ion permeability  
2. Resting and action potentials, Nernst equation, Goldman-Hodgkin-katz equation, ionic conduction. Equivalent electrical circuits.  
3. Structure and properties of ion channels, voltage and patch clamp techniques.  
4. Synaptic transmission - central synapses and neuromuscular junctions, excitatory and inhibitory post-synaptic potentials.  
5. Signal transduction-intracellular calcium signaling, synaptic transmission regulated by second messenger

6. Basics of EEG and evoked potential
  7. Introduction to neural networks
  8. Role of ion-channels in brain pathology
- UnitII: Practical Exposure :  
Demonstration of fluorescence spectroscopic and imaging techniques to study
1. Membrane Structure.
  2. Membrane potentials.
  3. Ion channel activity.
  4. Apoptosis.
- UnitIII: Psychopharmacology  
 Mechanism of action of important drugs used to treat Psychiatric and Neurological disorders , Pharmacokinetics and adverse drug reactions.
- UnitIV: Lectures specific to the research programme in the Department
- UnitV: Practical Exposure - Animal models of amnesia, learning and recall - Animal models of anxiety and depression - Animal models for the assessment of functioning of neuroreceptor

<b>BMS C621</b>	<b>Clinical Neurology</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>T.S. Srinivasan Center for Clinical Neurosciences V.H.S. Chennai</b>
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- UnitI: Essentials of Clinical Neurology (16 hours) - Symptoms in neurological disease - The Neural examination - Common diagnostic tests in Clinical neurology - Special diagnostic approaches & their appropriate use - Clinical case presentation & discussion
- UnitII: Neurological Disorders manifesting in childhood ( 16 hours) - Disorders due to birth injury and impaired neurodevelopment  
 Genetic diseases of the central nervous system - Mitochondrial and Neurocutaneous syndrome - Disorders of nerve and muscle in childhood - other hereditary disorders
- UnitIII: Clinical Neurological syndrome ( Including clinical case presentation) ( 28 hours) - Stroke - Headache & other pain syndromes- Epilepsy - Movement disorders – Infections - Demyelinating disorders
- UnitIV: Disorders of nerve & Muscle in adults - Neurobehavioral syndromes - Autonomic Nervous system syndromes - Environmental, occupational, Iatrogenic & system neurological disorders - Alcohol & Drug dependence - Iatrogenic neurological disease
- UnitV: Occupational & Environmental neurology - Endocrinal and metabolic neurology - Systemic neurological syndromes and the interface between general medicine and neurology

<b>BMS C622</b>	<b>Clinical Neuro Surgery Neurological Treatment and Rehabilitation</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>T.S. Srinivasan Center for Clinical Neurosciences</b>
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- UnitI: Clinical neurosurgery - Essentials of Neurosurgery - Trauma - Diagnosis and management - Tumours - Diagnosis and Management  
 Common neurosurgical procedures - Novel Neurosurgical therapies - clinical case presentation
- UnitII: Neurological treatment and Rehabilitation - The principles of neurological and neurosurgical treatment - Prescribing for neurosurgical illness.
- UnitIII: The treatment of medical & psychiatric co – morbidity - The six friendly men of neurosurgery : who, what, why, when , where & how?  
 understanding and evaluating disablement in neurological disorders
- UnitIV: Physical therapy - Occupational therapy - speech therapy
- UnitV: Cognitive & neurobehavioral rehabilitation - Psychological therapies for neurological diseases - An evidence based approach to the patient with a neurological illness - Neurological & Neuro surgical Research : Principle and Practice

<b>BMS C623</b>	<b>Research Project and Dissertation</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>6</b>	<b>All Faculty</b>
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<b>BMS C624</b>	<b>Clinical Examination and Final Viva Voce</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>T.S. Srinivasan Center for Clinical Neurosciences and Dr. R .Muthusamy</b>
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**Elective Courses offered by Department of Anatomy**

<b>BMS E702</b>	<b>Human Embryology - General Embryology</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>Dr.S.Prakash</b>
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## Human Embryology

General Embryology :

- UnitI: 1. Gameto genesis - Development of gametes. 2. First week of Development - Ovulation to Implantation.  
 UnitII: 3. Second week of Development - Bi-laminar Germ disc.  
 Unit III: 4. Third week of Development of tri-laminar germ disc. 5. Third to eighth week- The embryonic period  
 Unit IV: 6.Third month to Birth. The fetal Period and Birth Defects.  
 UnitV: 7. Foetal membranes and placenta. .

BMS E704	Human Systemic -Embryology	3	0	0	3	Dr.S.Prakash
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- Unit I: 1. Development Skeletal system-2. Development of Muscular system- 3. Development of Body cavities and serous membrane  
 UnitII: Development of Cardiovascular system-Development of Respiratory system  
 UnitIII: Development of Digestive system-Development of Urogenital sytem  
 UnitIV: Develoment of Head,and neck, Ear, Eye-Development of Integumentary system  
 UnitV: Development of Nervous system

Both in Odd and Even Semester

<b>BMS E703</b>	<b>Medical Imaging and Radiology</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>Guest Faculty MMC. Chennai.</b>
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- UnitI: Details about the techniques used in medical imaging and radiology:- Plain X rays  
 UnitII: Special x-rays such as angiography, urography, -barium meal, barium enema etc,  
 UnitIII: ultrasound scan, CT-scan, MRI scan - and echo cardiography. Demonstration of these procedures.  
 UnitIV: Using these techniques in studying normal structures and pathological signs elucidated using these techniques with respect to problems of skeletal system, GI system, Circulatory system,  
 UnitV: Genito-urinary system and nervous system

## M.Sc. MEDICAL MICROBIOLOGY

Semester I						
Core code	Title	L	T	P	Credit	Faculty
BMS C301	Human anatomy I	2	1		3	Dept.Anatomy
BMS C302	Human histology & Embryology*	2	1		3	Dept.Anatomy
BMS C303	Human physiology*	2	1		3	Dept Physiology
BMS C304	Practical I (anatomy)*			3	3	Dept.Anatomy
BMS C305	Practical II (Physiology)*			2	3	Dept Physiology
	Elective 1 *				3	
Semester II						
BMS C306	Human Anatomy II*	2	1		3	Dept of Anatomy
BMS C307	Human physiology II*	2	1		3	Dept of Physiology
BMS C308	Practical III (Anatomy)*			3	3	Dept of Anatomy
BMS C309	Practical IV (Physiology)*			3	3	Dept of Physiology
	Elective 2*				3	Dept of Biochemistry
Semester III						
BMS C310	General Microbiology	2	1		3	Dr.P.Rajendran
BMS C311	Molecular Microbiology	2	1		3	Dr.Thangam Menon
BMS C312	Practical V				3	Dr.Padma Krishnan
BMS C313	Practical VI				2	Dr.Thangam Menon
BMS C314	Practical VII				2	Dr.Elanchezhian
BMS C315	Practical VIII				2	Dr.Sundararaj
	Elective 3	2	1		3	Dr.Elanchezhian
	Elective 4	2	1		3	Dr.Sundararaj
Semester IV						
BMS C316	Parasitology	2	1		3	Dr.P.Rajendran
BMS C317	Medical Mycology	2	1		3	Dr.Thangam Menon
BMS C318	Practical IX		1	2	3	Dr.Sundararaj
BMS C319	Practical X		1	2	3	Dr.Thangam Menon
	Elective 5 *				3	Dept of Pathology

Semester V						
BMS C320	Systematic bacteriology	2	1		3	Joint Faculty
BMS C321	Practical XI		1	2	3	Dr.Elanchezhian
BMS C322	Practical XII		1	2	3	Dr.Thangam Menon
	Elective 6	2	1		3	Dr.Padma Krishnan
	Elective 7 *				3	Dept of Statistics
Semester VI						
BMS C323	Virology I	2	1		3	Dr.P.Rajendran
BMS C324	Virology II	2	1		3	Dr.Elanchezhian
BMS C325	Practical XIII		1	2	3	Dr.P.Rajendran
BMS C326	Practical XIV		1	2	3	Dr.Elanchezhian
BMS C327	Project with Dissertation				6	Faculty
	Elective 8	2	1		3	Dr.Elanchezhian
	Elective 9	2	1		3	Dr.Thangam Menon

1. BMS E301 Basic immunology (Elective3 )
2. BMS E302 Handling and use of laboratory animals (elective 4 )
3. BMS E303 Clinical bacteriology(elective 6)
4. BMS E304 Applied immunology(elective 8)
5. BMS E305 Molecular diagnostic methods (elective 9)

BMS C310	General Microbiology	2	1		3	Dr.P.Rajendran
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UnitI: Introduction to Microbiology, Discovery of Microbes General biology of bacteria: Classification of bacteria Structure of Bacteria and Function

UnitII: Microscopy I- Basic Principles of microscopy. Microscopy II Different types of bright field Microscopy III - Phase contrast and Dark field. Microscopy IV - Fluorescence microscopy. Microscopy V: Electron microscopy

UnitIII: Bacterial resistance to Physical and Chemical agents. Sterilization & Disinfection, types, evaluation, quality control. Basic principles, types, techniques and mechanisms of different staining methods in bacteriology

UnitIV: Cultivation methods. Physiology of bacteria I –Growth. Physiology of bacteria II -Metabolism Physiology of bacteria III – Nutrition, bacteriology of water, food, milk

UnitV: Antimicrobial agents. Mechanisms of action of various antibiotics, their evaluation. Quality control

BMS C311	Molecular Microbiology	2	1		3	Dr.Thangam Menon
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Unit I: Structure of Prokaryotic DNA and replication, Enzymes involved in replication and its control. Metabolic regulation – Operon concept, Lactose, Tryptophan operons and their control, Mutations, types and agents

UnitII: Bacterial genetics: Organization, alterations and expression of nucleic acids of bacteria. Bacterial variations, metabolic regulations, genetic transfers, genetic manipulations,

UnitIII: Different techniques of Amplification (nucleic acids and signal), Hybridizations (Southern, Northern, Western), Restriction enzymes, Gene cloning and their role in vaccine developments and development of diagnostic tests.

UnitIV: Bacteriophages: Phage genetics, phage conversions and their use in bacterial conversion. Plasmids / cosmids

UnitV : Gene transfer in bacteria, ( Transformation, conjugation, transductions, transfection,), Transposable elements

BMS C312	Practical V General Microbiology				3	3	Dr.Padma Krishnan
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Microscopy, Staining, Sterilization and washing of glassware - Preparation of culture media, Cultivation of bacteria, Total and viable counts - Tests for identification of bacteria, Demonstration of bacterial enzymes - Antibiotic sensitivity tests, Bacteriological analysis of food water and milk

BMS C313	Practical VI Molecular Microbiology				2	3	Dr. Thangam Menon
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Gel electrophoresis- serum , antigens, others. Isolation of plasmids, Transformation experiments, Separation and analytical techniques (chromatography)

Preparation and standardization of bacterial suspensions for immunizations Eg : Salmonella, Vibrio etc

BMS C314	Practical VII Basic Immunology				3		Dr.Elanchezhian
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Preparation and titration of immune sera ex: Anti sheep cell antibodies / antisera against bovine serum, Peripheral blood T cell enumeration est for immediate and delayed hypersensitivities in animals

BMS C315	Practical VIII Animal experiments				2	Dr.Sundararaj
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Rising immune sera, Pyrogen testing of parenteral solution - Virulence and toxigenicity tests Eg: Tetanus toxin, Cholera toxin - Bleeding different animals for various experiments - Animal autopsy for evidence of pathogenicity

BMS C316	Medical Parasitology	2	1		3	Dr.P.Rajendran
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Includes the study of life cycle, pathogenesis, pathology, laboratory diagnosis, epidemiology, treatment, prevention etc of the following:

- UnitI: Introduction to host parasite relationship - Aerobic, Anaerobic, Pathogenic & Non Pathogenic Amoebae (E.histolytica) - Flagellates, ciliates, Haemoflagellates -I - Leishmania - Haemoflagellates -II- Trypanosomes
- UnitII: Sporozoites- Plasmodium and others, Toxoplasma - Parasites associated with AIDS
- UnitIII: Cestodes infecting man, (Taenia, Echinococcus, Multiceps, Hymenolepis, Dipilidium, and others, Trematodes infecting man, chistosomes, Gastrodiscoides, Fasciola, Clonorchis, Opiarhoexhia, Hetwrophyes, Metagonimus, Paragonimus)
- UnitIV: Nematodes infecting man (ascaris, Ancylostoma, Necator, Strongyloides, Trichinella, Capillaria, Enterobius, Trichiuris, All filarial worms
- UnitV: Immunology of parasitic infections, Vaccine Strategies for Parasitic diseases

BMS C317	Medical Mycology	2	1		3	Dr.Thangam Menon
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Includes the study of general and growth characteristics , pathogenesis, pathology, laboratory diagnosis, epidemiology, treatment, prevention etc of the following:

- UnitI: Mycology Classification, Lab methods - Etiopathogenesis, epidemiology and lab diagnosis of the following: Piedra, M.fur fur, exophiala, Dermatophytes-other superficial fungal infections
- UnitII: Subcutaneous mycosis-I Chromoblastomycosis - Subcutaneous mycosis-II mycetoma - Subcutaneous mycosis-III rhinosporidiosis and others - Actinomycosis and actinomycetoma
- UnitIII: Deep mycosis- I (Histoplasmosis, coccidioidomycosis - Deep mycosis - II(paracoccidioidomycosis, Blastomycosis ect) - Candidiasis and cryptococcosis
- UnitV: Opportunistic mycosis
- UnitV: Immunology of fungal infections

BMS C318	Practical IX Parasitology & Helminthology		1	2	3	Dr.Sundararaj
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Microscopic examination of stool specimens for ova and parasites and determination of size by micrometry, Concentration techniques. Determination of Worm burden, Determination of Malarial filarial Parasites in blood, Special Staining techniques for Sporozoan parasites in Stool (AIDS),Cultivation of parasitesand their examinations

BMS C319	Practical X Medical Mycology		1	2	3	Dr.Thangam Menon
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Collection of specimens for fungal identification - Isolation and identification of common pathogenic fungi, Dermatophytes, Eumycotic agent, Actinomycotic agent, Fermentation and assimilation tests for yeasts - Slide culture technique, Study of common laboratory contaminants

BMS C320	Systematic bacteriology	2	1		3	Joint Faculty
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General characteristics, pathogenicity, pathology, infections caused, laboratory diagnosis and prevention of the following:

- UnitI: Staphylococcus, Streptococcus , Other Gram Positive Cocci ( both aerobic & anerobic) Neisseria and Corynebacterium, Mycobacterium - I M.tuberculosis - Mycobacterium - II MOTT Bacilli, M.leprae
- UnitII: Salmonella , E.coli, Shigella, Neo enteric pathogens - Pseudomonads, Other enterobacteriaceae, (kleb, proteus etc) - Vibrios, Halophilic vibrios, Aeromonas, Non fermentors
- UnitIII: Emerging pathogens, Brucella, Yersinia pestis - Haemophilus, Bordetella, Bacillus, Clostridium,
- UnitIV: Spirochetes General features, Borrelia, Treponema, Leptospira and others Nonsporing anaerobes,
- UnitV: ycoplasma and Miscellaneous organisms - Rickettsiae, Ehrlichiae, Chlamydiae

BMS C321	Practical XI Systematic Bacteriology		1	2	3	Dr.Elanchezhian
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Pure culture study of pathogenic bacteria and their isolation and identification from clinical specimens – Salmonella, E.coli, Shigella, Other enterobacteriaceae, (kleb, proteus etc) Pseudomonads, Vibrios

BMS C322	Practical XII Clinical Bacteriology		1	2	3	Dr.Thangam Menon
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Study of pathogenic bacteria and their isolation and identification from clinical specimens – Staphylococcus, Streptococcus, Neisseria and Corynebacterium, M.tuberculosis enterobacteriaceae

BMS C323	Virology I Theory	2	1		3	Dr.P.Rajendran
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UnitI: Viruses structure and composition, DNA viruses, RNA viruses, Viral replication  
UnitII: Cultivation of viruses (cell cultures, animals, eggs), Virus cell interactions, CPE, inclusion bodies, Viral assays,  
Unit III: Viral genetics, various types of mutants and their importance / General Characteristics & Non human Viruses  
UnitIV: Pathogenesis,pathology, clinical manifestations,and lab diagnosis of: Adeno virus, Herpes virus,  
UnitV: Pox virus, Papova Virus, Hepadna Virus, Parvo virus

BMS C324	Virology II Theory	2	1		3	Dr.Elanchezhian
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UnitI: Picorna virus, Ortho and Paramyxo viruses, Arbo viruses – Alpha, Flavi and Bunya viruses  
UnitII: Toga viruses and Hepaciviruses, Arenaviruses and Filoviruses, Reoviruses, Retroviruses  
UnitIII: Calciviruses and Astroviruses, Coronaviruses,  
UnitIV: Rabdoviruses, Prion Diseases  
UnitV: New Emerging Viral infections, Immunology of viral infections

BMS C325	Practical XIII Virology		1	2	3	Dr.P.Rajendran
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Chick embryo inoculation techniques - Tissue culture techniques - Plaque Assay - Preparation of Media for Vertebrate Cell culture Staining of Cell lines - Giemsa Staining - Observation of Different types of CPE's - Storage of cell lines in liquid Nitrogen. - Inclusion bodies staining - Serological tests for diagnosis of viral infections - Viral Haemagglutination test - ELISA (bioelisa HbsAg) - Bacteriophage - Assay

BMS C326	Practical XIV Applied Immunology		1	2	3	Dr.Elanchezhian
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Agglutination tests- slide and tube tests - Precipitation tests - Serological tests for diagnosis for microbial infections – Widal, VDRL, Brucella, Paul Bunnell, Rose Waller, Latex agglutination, ELISA, - Complement and amboceptor titration

BMS C327	Project with Dissertation				6	Faculty
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To plan and design statistically, retrieve relevant literature, organized and conduct, process the data, photograph relevant observations, evaluate by statistical programmes, present the project in any regional/national conference/seminar during the third year of the course and submit for final semester examinations. The work has to be conducted in the department under the guidance of the project supervisor. Interdisciplinary collaborations from external departments/institutions can be organized only for certain essential areas of the project. The project will be evaluated based on CBCS norms. The project should be submitted at least 15 days prior to evaluation and will be sent to the members for them to read.

Electives offered in the department of Microbiology

BMS E301	Basic Immunology Theory				3	Faculty
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Unit I : Introduction to immunology, Organs and cells of the immune system,  
UnitII: Antigen, Hapten, Antigen processing and presentation ,  
UnitIII: Antibody structure, production, purification, function, Theories of antibody production.  
UnitIV: Antigen – antibody interactions- Agglutination, Precipitation - Neutralization and Labeled antibody techniques ( immunofluorescence, ELISA, RIA etc)  
UnitV: Interleukins, Complement, c' deficiency and CFT

BMS E302	Handling & use of Laboratory Animals				3	Faculty
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- UnitI: Animal house and the equipments, Feeding and breeding methods, Gnotobiotic, Germ free animals,  
UnitII: Handling of animals, Common diseases of the different species of laboratory animals like mice, rats, rabbits, guinea pigs, monkeys.  
UnitIII: germ free animals, Gnotobiotic animals, gene knock out animals, transgenic animals  
Unit IV: Microbiological animal experiments , LD-50 determination  
UnitV: Various use of different Lab, animals, post mortam examination and disposal of used animals

BMS E303	Clinical Bacteriology Theory				3	Faculty
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- Unit I : Collection Storage & Transport of Clinical Specimen - Infection of the Urinary Tract Bacterial infection - Salmonella, E.coli, Pseudomonads, Klebsiella, Proteus , Staphylococcus Streptococcus, Others - Infection of the Central Nervous System - Bacterial infection - Neisseria, Haemophilus, Streptococcus, Listeria, Spirochetes Others - Viral infection - Enteroviruses, Mumps, Herpes simplex viruses, Varicella zoster - Arbo viruses, Others - Fungal infection - Cryptococcus neoformans - Parasitic infection - Acanthamoeba naegleria, Toxoplasma gondii, Cysticercosis - Others  
UnitII: Infection of the Gastro Intestinal Tract - Bacterial Infection - Salmonella, E.coli, Shigella, Staphylococcus, Bacillus, Clostridium - ibrios, Campylobacter, others - Viral infection - Rotaviruses, Astro viruses, Caliciviruses - Parasitic infection - Protozoan infections, Cryptosporidium, Entamoeba histolytica, Giardia lamblia etazoan infection  
Unit III: Infection of the Genito Urinary Tract - Bacterial Infection - Neisseria, Treponema palladium, Ureaplasma - Parasitic infection Trichomonas - Viral infection - HSV, HIV - Infections of Skin - Bacterial Infection - Treponema pallidum, streptococcus, Staphylococcus and others - Fungal infection – Dermatophytes - Infections of Eye - Bacterial Infection - Corynebacterium, Staphylococcus, Nonhemolytic Streptococcus - Moraxella, anaerobic organisms - Viral infection - HSV  
Unit IV: Infections of Respiratory Tract - Bacterial Infection - Staphylococcus, Streptococcus, Mycobacteria, Neisseria, Mycoplasma Corynebacterium, Haemophilus, Chlamydiae, Bordetella, Others - Fungal infection - Candida, Histoplasma, Blastomyces, others, Pneumocystis - Viral infection - Adeno, Corona, Coxsackie, , HSV, Influenza, Myxo viruses - Rhinoviruses, others  
UnitV: Zoonotic Infections - Bacterial zoonosis - Bacillus, Brucella, Chlamydia, Coxiella, Francisella, Leptospira, Rickettsia Salmonella, Yersinia, others - Fungal zoonosis - Epidermophyton, Microsporium, Trichophyton - Parasitic zoonosis Plasmodium, Toxoplasma gondii, Trypanosoma other metazoan parasites - Viral zoonosis - Arboviruses, Influenza, Rhabdoviruses , others - Food borne infections, food poisoning - Water borne infections - Air borne infections

BMS E304	Applied immunology Theory				3	Faculty
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- Unit I: Hybridoma technology, Hypersensitivity I and II, Hypersensitivity III and IV  
Unit II: Autoimmunity, Immunodeficiency  
Unit III: Immunogenetics, IR genes, Regulation of immune Response  
Unit IV: Tumor immunology, MHC and Transplantation  
Unit V: Vaccines, Immunizing agents, preparation, standardization, Vaccine strategy

BMS E305	Molecular Diagnostic techniques				6	Faculty
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- Unit I: Electrophoretic technique, Ultracentrifugation  
UnitII: Gene amplification, Hybridization  
Unit III: Chromatographic technique  
UnitIV: Restriction Analysis, Finger Printing  
UnitV: Molecular epidemiology , DNA sequencing

## M.Sc. PHYSIOLOGY

### SEMESTER I

Core code	Title	L	T	P	Credit
BMS C801	Human Physiology I	3	1	0	4
BMS C802	Human histology	2	1	0	3
BMS C803	Human Anatomy I	2	1	0	3
BMS C804	Human Anatomy Practical I	0	1	2	3
BMS C805	Human Physiology Practical I	0	1	2	3
*Elective	Biochemistry/ Anatomy	2	1	0	3

SEMESTER II

BMS C806	Human Physiology II	3	1	0	4
BMS C807	Human Anatomy II	2	1	0	3
BMS C808	Human Anatomy Practical II	0	1	2	3
BMS C809	Human Physiology Practical II	0	1	2	3
*Elective	Biochemistry/ Anatomy	2	1	0	3

SEMESTER III

BMS C810	Human Physiology III	3	1	0	4
BMS C811	Human Physiology IV; General Physiology	3	1	0	4
BMS C812	Research methods in Anatomy	2	1	0	3
*Elective	Institute of Radiology, GH Chennai/Endocrinology	2	1	0	3
*Elective	Endocrinology/Genetics	2	1	0	3

SEMESTER IV

BMS C813	Human Physiology V Research methods in Physiology I	3	1	0	4
BMS C814	Human Physiology VI Research methods in Physiology II	3	1	0	4
BMS C815	Physiology Practical III	0	1	2	3
*Elective	Biostatistics/	2	1	0	3
*Elective	Endocrinology/Genetics	2	1	0	3
*Elective	Pathology	2	1	0	3

SEMESTER V

BMS C816	Dissertation	0	0	7	7
BMS C817	Physiology Practical IV	0	1	3	4
*Elective	Genetics/Physics	2	1	0	3
*Elective	Pharmacology	2	1	0	3

SEMESTER VI

BMS C818	Human Physiology VII Advances in Physiology 1	3	1	0	4
BMS C819	Human Physiology VIII Advances in Physiology 2	3	1	0	4
BMS C820	Human Physiology IX Advances in Physiology 3	3	1	0	4
BMS C821	Human Physiology Practical V	0	1	3	4
BMS C822	Final viva vice	0	0	0	3

\* Offered by other departments

Elective courses recommended for the 1<sup>st</sup> Semester

BMS Principles of Biochemistry I (theory), BMS General Human Embryology I (theory)

Elective courses recommended for the 3<sup>rd</sup> Semester

BMS Medical Imaging and Radiology, BMS Reproductive Endocrinology -

BMS Principles of Genetics I, BMS Molecular and Cellular Endocrinology

\*\*Project Work will be assigned in the beginning of 3<sup>rd</sup> Semester. The candidate will complete their project work and submit their Dissertation on 15<sup>th</sup> November in the 5<sup>th</sup> Semester.

Electives courses recommended for the 4<sup>th</sup> semester

MSI Bio statistics, BMS Reproductive Endocrinology, BMS Basic Pathology, BMS Principle of Genetics -I

Elective courses recommended for the 5<sup>th</sup> semester

BMS Principles of Genetics I, PHY Biomedical Instrumentation, BMS Drug Therapy

BMS Fundamentals of Environmental Toxicology / Neurotoxicology

\* Project Work will be assigned in the beginning of 3<sup>rd</sup> Semester. The candidate will complete their project work and submit their Dissertation on 15<sup>th</sup> of November in the 5<sup>th</sup> Semester.

BMS C801	Human Physiology I	3	1	0	4
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UnitI: Cell Physiology – cell as the living unit of the body - Extra cellular fluid Automaticity of body – Membrane structure of the cell- Digestion of Pinocytosis and Phagocytosis – function of lysosomes

UnitII: Muscle Physiology – Physiologic anatomy of skeletal muscle skeletal muscle fibre – Mechanism of muscle contraction- Excitation of skeletal muscle - Neuromuscular junction and Excitation – contraction and coupling.

Unit III: Contraction and excitation of smooth muscle – Neural and hormonal control of smooth muscle contraction-

Unit IV: Blood : RBC – Anemia and polycythemia – Leukocyte – Platelet – Blood grouping – Haemostasis

UnitV: Respiratory Physiology: Pulmonary ventilation – Volume and capacity – Physical principles of gas exchange of O<sub>2</sub> and CO<sub>2</sub> - Regulation of respiration – High altitude and deep sea physiology.

BMS C803	Human Anatomy I	2	1	0	3
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(Upper limb, Lower Limb and Thorax)

UnitI: Overview of Anatomy

1. Medical and Anatomical terminology, The Anatomical position, The Anatomical Plans, Sections of the body, Terms of relationship. Terms of comparison, Terms of movement, Anatomical Variations. 2. Diagnostic Imaging, 3. Bones and the skeletal system, Types of bone, 4. Joints, Classification of joints, innervation of joints. 5. Muscle tissue and muscular system. Types of muscle, 6. Blood vessels and cardiovascular system, Lymphatic and the Lymphatic system, Functions of the lymphatics, Nervous tissue and nervous system.

UnitII: The upper limb

1. Bones of the upper limb, The pectoral Girdle. 2. The pectoral muscles, 3. The axilla, The Brachial plexus . 4. The back and shoulder region Muscles connecting the upper limb to the vertebral column, The scapular muscles . 5. The arm , The Humerus, The brachial fascia and intermuscular septum,6. Muscles of the arm The cubital fossa. 7. The Forearm, Muscles in the cubital region, 8.bones of the wrist and hand 9. Muscles of the forearm. 10. Nerves of the forearm, 11.Arteries of the forearm, 12 The extensor muscles of the forearm,13. The posterior nerves of the forearm , The posterior arteries of the forearm .14. The Wrist and Hand , The hand. 15. Joints of the upper limb , 16. Patient oriented problem, Discussion of patients problems.

UnitIII: The Lower Limb

1. The Hip and thigh areas , The bone and surface anatomy of the hip , 2. The bones and surface anatomy of the thigh, 3.The fascia of the thigh, The thigh muscles , 4.The femoral triangle . 5.The Gluteal Region, the gluteal nerves, 6.The gluteal arteries, The Gluteal veins , 7. The Posterior thigh muscles , 8.The Popteal fossa , 9.The leg, 10.Bones of the leg , Surface anatomy of the leg ,

UnitIV: 11. Bones of the Foot, 12. The Crural Fascia, Compartments of the Leg. 13. The Foot, Muscles of the foot, 14. Nerves of the foot, 15.Arteries of the foot, 16.Veins of the foot. 17. Joints of the Lower Limb, The Hip joint, 18.The knee joint, 19.The Tibiofibular joints, the ankle joint, Joints of the foot, The Arches of the foot. 20. Patient Oriented Problems, Discussion of Patient's problems.

UnitV: The Thorax

1. The Thoracic Wall, Skin and Fascia of the Thoracic Wall, 2. Bones of the Thoracic Wall , 3. Surface Anatomy of the Anterior Thoracic Wall , 4.The Breasts 5.Movements of the Thoracic Apertures , 6. Muscles of the Thorax , 7.The Intercostal Spaces , The Intercostal Nerves , The Intercostal Arteries , The Intercostal Veins , 8.The Internal Thoracic Vessels . 9.The Thoracic Cavity , 10.Pleurae and Pleural Cavities , 11.The Lungs. 12.The Mediastinum , The Pericardium , 13.The Heart , 14. The Superior Mediastinum , The Posterior Mediastinum , The Anterior Mediastinum. 15. Patient's Oriented Problems , Discussion of Patient's Problems .

BMS C802	Human histology	2	1	0	3
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Cell structure and function -Cell cycle and application - Basic tissue types- Blood. - Connective tissue - Epithelial tissue - Muscle - Nervous tissue - Organ systems -. Circulatory system – Skin-. Skeletal tissue - Immune system - Respiratory system - Oral tissue - Gastro intestinal tract. - Liver and pancreas - Urinary system - The endocrine glands - Male reproductive system -. Female reproductive system - Central nervous system - Special sense organs

BMS C805	Human Physiology Practical I	0	1	2	3
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Haematology particles:

1. R.B.C count
2. Total leukocyte count
3. Estimation of Haemoglobin concentration
4. Determination of packed cell volume (PCV)
5. Blood Indices
6. Differential Leukocyte count
7. Determination of Blood groups
8. Determination of bleeding time and clotting time.

BMS C806	Human Physiology II	3	1	0	4
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UnitI: Cardiovascular system: Heart muscle property – Cardiac cycle – conductive system of heart – Heart sounds - ECG .

UnitII: Blood pressure and its regulation –measurement - Cardiac out put and its regulation – method to measuring cardiac out put - UnitIII:Special senses: Eye structure, errors of refraction, acuity, receptor - dark and light

adaptation, pathway – Auditory system - middle ear mechanics, endo-cochlear potential organ of corti, pathway – Taste receptor -pathway - Smell receptor and pathway

UnitIV: Central Nervous system: Organisation of the Nervous system ascending and descending tracts – Basic function of synapses and transmitter substances – sensory receptors – Somatic sensations

UnitV: Spinal cord reflexes – muscle tone -motor cortex areas– cerebellum – Basal ganglia – Autonomic nervous system - CSF – EEG.

BMS C807	Human Anatomy II	2	1	0	3
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Unit I: 1. The skull , 2. Bones of the skull. 3.The face , Muscles of the face , 4.Arteries of the face , 5.Veins of the face , 6.Lymphatic Drainage of the face , 7.The parotid Gland . 8.The Scalp , Layers of the Scalp , Nerves of the Scalp , Arteries of the Scalp , Veins of the Scalp , Lymphatic Drainage of the Scalp . 9. The Cranial Fossae , The Anterior Cranial Fossae , The Middle Cranial Fossae , The Posterior Cranial Fossae. 10.Cranial Meninges and 11.Cerebrospinal Fluid ,

Unit II: 12. The Orbit, The orbital contents, The orbital muscles. 13. The parotid region, 14. The temporal region , 15. The temporal fossae, The infratemporal fossa. 16. The temporomandibular joint , 17. The oral region , The oral cavity , The palate The tongue , 18. The salivary glands, 19.The pterygopalatine fossa. 20.The nose, The paranasal sinuses. 21. The ear, the external ear, the middle ear, 23. The internal ear. 24. Patient Oriented Problems, Discussion of Patient's Problems.

UnitIII: The Neck

1. Surface Anatomy of the Neck , Superficial Neck muscles . 2. Triangles of the Neck , Posterior triangle of the neck Anterior triangle of the neck , 3. The cervical viscera , 4.Fascial planes of the neck. 5.The Larynx , 6.Muscles of the pharynx , Interior of the pharynx. 7. The Larynx , 8. Patient Oriented problems , Discussion of patient's problems.

The Back

1. The vertebral column , Normal curvatures of the vertebral column , Palpation of the vertebral column , 2.The vertebrae , 3.Joints of the vertebral column . 4.Muscles of the back , The Extrinsic back muscles , The intrinsic back muscles ., The suboccipital region 5. Spinal cord and Meninges , 6. Patient Oriented Problems , Discussion of Patient's Problems.

UnitIV: The cranial nerves

1. The olfactory nerve, 2.The optic nerve, 3.The oculomotor nerve, 4.The trochlear nerve, 5.The trigeminal nerve, 6.The abducent nerve, 7.The facial nerve 8.The vestibulocochlear nerve, 9.The Glossopharyngeal nerve, 10.The vagus nerve, 11.The accessory nerve, 12..The hypoglossal nerve.

UnitV: The Brain, The main parts of the brain , Ventricular System and CSF. The organization of the nervous system- Gross anatomy and microanatomy

1.The Meninges and the cerebro spinal fluid 2. Gross Anatomy of the brain3. Spinal cord - Gross anatomy and internal structure. 4. Tracts of the spinal cord 5. The Medulla 6. The Pons 7.The Mesencephalon 8. The Cerebellum 9.The Diencephalon 10. The Hypothalamus 11. Corpus striatum and related nuclei 12.Olfactory pathways, Hippocampal formation and Amygdala 13. The cerebral cortex

BMS C808	Human Anatomy and Neuroanatomy Practical II	2	1	0	3
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Gross Anatomy - Demonstration of various Regions in Human Cadaver. - Demonstration of Human brain and dissected brain.

BMS C809	Human Physiology Practical II	3	1	0	4
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#### Haematology

1. Erythrocyte sedimentation rate
2. Osmotic fragility of red blood cells
3. Specific gravity of blood by copper sulphate
4. Platelet count
5. Reticulocyte count
6. Absolute Eosinophil count

BMS C810	Human physiology III				4
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Unit1: Urinary system: Structure of urinary system and its histology with reference to its function. Blood supply and its peculiarities with reference to its function. Types of nephrone - Mechanism of urine formation: Glomerular Filtration Rate - Factors responsible for Glomerular Filtration - Filtration fraction - Filtration coefficient - Factors regulating GFR Tubular reabsorption: Proximal convoluted tubule - renal tubular maxima – renal thresh hold

UnitII: Loop of Henle: Components in counter current mechanism - Role of exchanger and multiplier system - Distal convoluted tubule (DCT): Juxta Glomerular Apparatus - Renin angiotensin system - Reabsorption and secretory process in the DCT. - Collecting duct: Anti diuretic hormone function - Role in the maintenance of medullary interstitial fluid - Ureter –urethrenal reflex - Vesicourethral reflex. - Bladder:



- Structure and innervations with reference to the function - cystometrogram - Micturition reflex - urine volume and composition.
- UnitIII: Gastro intestinal system (GI): Structure of GIT - intrinsic and extrinsic nervous system of GI tract. - Salivary gland: composition of saliva - it's functions. - Stomach: Parts and types of glands in stomach - composition of gastric juice and their functions.
- UnitIV: Liver: Bile composition and functions - role in digestion - enterohepatic circulation.  
Pancreas: Pancreatic juice composition and it functions. Digestion and absorption of fat, carbohydrate and proteins.
- UnitV: Endocrinology and Reproduction: Pituitary hormone - Adrenal hormone – Thyroid hormone – Parathyroid hormone – Insulin – Glucocagon - Male and Female sex hormone.

BMS C811	Human physiology IV: General Physiology				4
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- Unit I: Function of cell organelles. Membrane structure – Transport across biological membrane. Simple diffusion, Facilitated diffusion, transport through channels and gating of channels, active transport, osmosis – method of studying channels.
- UnitII: Receptors: Sensory receptors - up and down regulation of hormonal receptors - Generator potential.
- UnitIII: Ionic basis of cell membrane potential – Nernst equation - Goldman Hodgkin equation - generation of action potential - components of action potential - types of action potential - methods of studying membrane potential and recording of action potential.
- UnitIV: Homeostasis: definition, Regulatory mechanism – positive and negative feed back mechanisms. Blood volume – Blood glucose and their regulations - Acid base balance
- Unit V: Protein synthesis – Temperature regulation – Skin and its function

BMS C812	Research methods in Anatomy, Practical				4
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Demonstration of perfusion and fixation of animals - Tissue procession of a given tissue piece up to blocking. - Demonstration of microtome parts and their working, working - Demonstration of cryostat, and cryosectioning of a given tissue - Demonstration of sectioning of the paraffin blocks.- Staining the paraffin sections with H & E, trichrome, PAS and Toluidine blue. - Staining the given sections for Neural cells, myelin, axons and glia using CFV, LFB, - Loyex, Weigert & Pal, Bielchowsky's silver and modified PTAH methods - Fluorescent tracer study using DiI – tracing a neural pathway in an animal cadaver - Demonstration of Nikon microscopes and their accessories - Photomicrography.

#### LIST OF PRACTICAL CLASSES

1. Perfusion fixation of a rat
2. Tissue processing and embedding in paraffin wax
3. Section cutting of a paraffin block
4. Tissue preparation and sectioning using cryostat
5. Toluidine blue staining
6. Haematoxylin & Eosin staining.
7. Masson's trichrome staining
11. Mallory's trichrome staining
12. PAS Staining
10. CFV staining
11. Loyez's method of staining
12. Glee's and Marshland's modification of Bielchowsky's silver staining
13. Golgi-cox method of impregnation
14. Modified PTAH staining
15. Viability estimation using Trypan Blue exclusion method
16. Gastrocnemius innervation in frogs – DiI tracer injection
17. Fluorescent Microscopy for DiI labelled tissues
18. Stereological & Morphometry – I. Estimation of gross anatomical parameters such as weight, gross measurements, volume and specific gravity of various organs.
19. Stereological & Morphometry – II. Estimation of various microanatomical parameters such as area, volume density, numerical density, axial ratio of different tissue components of various organs
20. Reconstruction techniques – usage of camera lucida of drawing
21. Isolation of cells from tissues using trypsin for cell culture studies
22. Macro Photography
23. Photomicrography – light and fluorescent microscopy

BMS C813	Human Physiology V: Research Methods in Physiology I				4
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- UnitI: Cell : Methods of recording of action potentials - method of studying the channels - Clinical disorder with reference to cell division Turner's Syndrome -Klinefelter syndrome - Down syndrome (trisomy 21) non disjunction
- UnitII: Blood: Plasma protein - normal value - separation – its function- Plasmapheresis to show origin - Variation in Health and disease. Erythrocytes: Morphology -Variation in Physiological and Pathological condition - Factor regulation RBC production - Diseases affect RBC production - Anemia & its classification - determination of Anemia - Determination Life span of RBC. Jaundice: classification of Jaundice – Diagnosis - Clinical importance. Reticulocyte counts. Coagulation disorders and diagnostic test - Clotting time - Prothrombin time - Blood grouping – typing – its importance - Coombs test –direct and indirect methods. WBC: Function- Variation in Physiological and Pathological condition - Immune mechanism and antibody formation. Platelets: Origin –morphology – function – variation – disorders.
- UnitIII: Blood volume regulation – dehydration - edema – plasma volume expanders. Diathesis - Some heritable disorders of blood coagulation associated with bleeding - Genetic disorders - Classic Hemophilia (factor VIII deficiency) - Von Willebrands disease (factor VIII deficiency, platelet abnormalities) - Christmas disease (factor IX deficiency) – Thalassemia - Sickle cell anemia .
- UnitIV: Gastro Intestinal system: Gastrointestinal movement - Jakson's Enterograph - Endoscopy - Fractional test meal - Different classical pouches to study HCL secretion. Liver function tests.
- UnitV: Kidney: Tubular function studies –Composition - Urine abnormal constituents - Kidney function tests based on the kidney function.

BMS C814	Human Physiology VI: Research Methods in Physiology II				4
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- UnitI: Properties of Cardiac Muscle - General Principle - Einthovan law-Recording - Vector analysis - Diagnostic importance of ECG – Abnormal ECGs .
- Unit II: Heart sound: Phonocardiogram - Abnormal heart sounds - thrills. Central venous pressure. Pulse – Recording - Clinical importance - Starling's law - Starling's heart lung preparation –
- Unit III: Principle and application – Laplace law-Application- Triple response: Blood flow measurement by dye dilution- Fick's principle and other methods
- UnitIV: Respiration: Physiological laws in respiration Mechanics of respiration, Lung volume and capacity, Compliance, Recording-Intrapulmonary pressure recording
- Unit V: Artificial respiration- pulmonary function tests - Blood gas analysis - Hyperbaric oxygen

BMS C815	Physiology Practical III- Research Methods in Physiology				3
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- Total count- -Arneth count- count-Peripheral smear study,
  - Recording mechanical action potential in frog, Effect of second stimulus, repeated stimulus Tetanus and fatigue, effect of ions, effect of temperature on frog muscle
  - Demonstrating Starling law
  - Recoding Intestinal movement and drug effect – EMG
- Isolated and intact frog's heart preparation: effect of ions and drug on heart - Stannius ligature - General conduction pathway.
  - ECG recording
  - Blood Pressure - Measurement – Effect of exercise and postural variation on BP.
  - Respiration - Spirometry - Stethograph- Peak flow meters-FEV<sub>1</sub>-FEV<sub>2</sub>-

BMS C816	Dissertation				7
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Project Work will be assigned in the beginning of 3<sup>rd</sup> Semester. The candidate will complete their project work and submit their Dissertation on 15<sup>th</sup> of November in the 5th Semester.

BMS C817	Physiology practical IV				4
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Clinical examination: General examination - Cardiovascular system – Respiratory system - motor and sensory nerve system testing.

BMS C818	Human Physiology VII				4
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- UnitI: Transport: Pinocytosis - transport within cells phagocytosis and exocytosis with special transport proteins involved
- UnitII: Digestive system: GI hormone - GI movements - dietary fibers constipation – Achalasia- Zollinger Ellison syndrome - reflux esophagitis diverticulities - Mega colon - Dumping syndrome - Appendicitis.

- Unit III: Respiration: - High altitude physiology - Hypoxia classification - Effect of hyperbaric oxygen therapy - Dyspneic Index – Cyanosis - Hypercapnia – Asphyxia - Emphysema – Peumothroax.- ARDS – Asthma - COPD
- Unit IV: Respiration effects on Deep sea diving and its effect on body gases - Pathological condition affecting gas exchange – cyanosis, Types of respirations - Types of muscle and exercise. Effect of different exercise mild -moderate and severe aerobic and anaerobic exercises
- UnitV: Kidney: Micturition reflex and disorders - cystic fibrosis - Fanconi syndrome - renal glycosuria - Acute and chronic renal failure - Diseases of kidney and Urinary system - Diuretics - Dialysis – Metabolic acidosis and alkalosis - Diabetic insipidus.

BMS C819	Human Physiology VIII				4
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- UnitI: CVS: blood flow factors affecting, theories for blood flow. - Poussiuille’s law- Pulmonary circulation, Coronary circulation, Lymphatic circulation, cerebral circulation, splanchnic circulation - shock classification
- Unit II: Endocrinology and Reproduction: Definition – Endocrine – Hormones - Methods of study – Alteration - Replacement - Bio assay – Role of second messengers and its types.
- UnitIII: Clinical disorders: Sheehan syndrome - Gigantism – Acromegali - Dwarf: Levi-Lorain dwarf/African dwarf - Diabetic mellitus – Piturary and adrenal diabetics - Insulin shock
- UnitIV: Addisonian crisis - Cushing syndrome – Conn syndrome – Tetany - Pheochromocytoma – Goiter and its types - Graves disease – Myxedema - Cretinism - Osteoporosis - Adrenogenital syndrome - In appropriate ADH syndrome - Houssay animal
- UnitV: Fertility control - Fertility clinical Ablation - Replacement therapy for male and females - Determination of ovulation time – Cloning - Super female - true Hermaphroditism - Gauchers disease

BMS C820	Human Physiology IX				4
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- Unit I: Muscle - Theories of muscle contract - General muscle power testing - Duchene Type muscular dystrophy, Becker’s muscular dystrophy - Grip dynamometer.
- UnitII: Special senses: Theories of colour vision - Color blindness and testing - Visual acuity – Perimetry - Errors of refraction - Glaucoma - Theories for hearing - deafness testing - Audiometry -Taste adaptation – Smell adaptation .
- Unit III: Role of environment on human system - Stress induced alteration in hormonal and factors stress management with respect to yoga and meditations
- Unit IV:CNS Central Nervous System: Nerve resting membrane potentials - Recording of nerve action potentials - Nerve conduction velocity – Property of Synapses -Muscle tone - Regulation of voluntary movement – rigidity – plasticity - Flaccidity –
- UnitV: Memory - Sleep – Learning - cerebral dominance - speech - Movement disorders due to Upper motor and Lower motor neuron lesion - Hemi section of spinal cord - Wallarian degeneration and regeneration - Basal ganglia disorders - Cerebellar disorders - Honer’s syndrome.

BMS C821	Human Physiology Practical V				4
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**Clinical examination: – Cranial nerve Testing:**

Olfactory, Optic, Occulomotor, Abducens, Trigeminal, Trochlear, Facial nerve, Vestibulocochlear, Glossopharyngeal, Vegas, Spinal accessory, Hypoglossal,

**Autonomic function test:**

Valsalva maneuver, Heart Rate Variability, Cold pressure response, Tilt table test.

BMS C822	Final viva voce				3
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**M.Sc. BIOMEDICAL GENETICS**

Course Code	Title of Course	Credits
I SEMESTER		
BMS C101	Cell Biology	3
BMS C102	Population Genetics	3
BMS C103	Human Cytogenetics	3
BMS C104	Practicals I	3
	Elective-1	
	Elective-2	

Course Code	Title of Course	Credits
II SEMESTER		
BMS C105	Eukaryotic Genome structure and Function	3
BMS C106	Microbial Genetics	3
BMS C107	Molecular Genetics	3
BMS C108	Practicals II	3
	Elective-3	
	Elective-4	
III SEMESTER		
BMS C109	Prenatal Diagnosis and Genetic counseling	3
BMS C110	Cancer Genetics	3
BMS C111	Biomacro Molecules	3
BMS C112	Practicals III	3
	Electives – 5	
	Electives - 6	
IV SEMESTER		
BMS C113	Environmental Genetics	3
BMS C114	Recombinant DNA Technology	3
BMS C115	Molecular Genetics of Development	3
BMS C116	Gene therapy	3
BMS C117	Project	6
Electives offered by the Department of Genetics		
BMS E101	Principles of Genetics I	3
BMS E102	Principles of Genetics II	3
BMS E103	Genetics of Metabolic and behavioral disorders	3
Elective Courses Offered by Department of Pathology		
BMS E901	Basics in Oncopathology	3
BMS E902	Basics in Pathology	3
BMS C101	Cell Biology	3

Development of cell doctrine, cell structure, cell cycle and stages of growth, continuous and synchronous culture, cell fractionation. Information flow, archae and eubacteria, eukaryotes, single cell to multicellular organisms - Molecular organization of cell, plasma membrane, lipid bilayer, membrane proteins, carbohydrates, transport of small and macro molecules-ectocytosis, endocytosis, cytosol, ribosomes rough and smooth endoplasmic reticulum - Mitochondria – origin, evolution, structure, chemiosmotic theory, electron transport chain, electrochemical protein gradient, respiratory chain, redox potential - Chloroplast; origin and evolution, structure, light absorption, production of ATP and conversion of  $CO_2$  to carbohydrate, carbon fixation, metabolic exchange by chloroplast membrane, Golgi apparatus, lysosome and microbodies - Nucleus, Nuclear envelope, cell growth and division control of cell division, events in S phase, logic of cell cycle. Cell growth and regulation – concept of oncogenes etc., in normal and neoplastic cell growth.

BMS C102	Population Genetics	3
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Hardy – Weinberg equilibrium – Properties of equilibrium populations – Extension of Hardy-weinberg equilibrium to multiple genes and sex-linked genes. Gene frequency estimation - Changes of gene frequency – Migration, mutation, selection, - balance between mutation and selection, stable equilibrium favoring heterozygotes – unstable equilibrium – selection against heterozygotes. - Genetic drift in small populations - Non-random mating in human populations – inbreeding coefficient – Genotypic frequencies in partially inbred population – consequences of inbreeding – genetic load - Characters showing continuous variation. Phenotypic values and Population mean – components of phenotypic value and variance. Degree of genetic determination, heritability and repeatability. Threshold characters – liability and threshold – two classes one threshold. Heritability estimation for threshold characters.

BMS C103	Human Cytogenetics	3
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Molecular structure of chromosomes – nucleosome, higher order structure , centromere, telomere, euchromatin and heterochromatin. Genomic imprinting – relevance to human diseases - Chromosome preparation methodologies from leucocytes, bone marrow, solid tissues, testicular and ovarian biopsies, amniocytes, chorionic villi samples and cord blood - Differential and selective banding techniques – QFQ-, GTG-, RFA-, CBG-, AgNOR, Giemsa-11, Cd and restriction endonuclease Giemsa staining, high resolution banding; Specialized techniques – differential replication banding, fragile sites, premature chromosome condensation - Variation in chromosome number and structure, human cytogenetic nomenclature. Chromosomal syndromes in man-trisomy 21, trisomy 18, trisomy 13, deletion 4p, deletion 5p, Turner, Klinefelter, Triple X, XYY and Fragile X. Chromosomal evolution in primates - Chromosome mapping-somatic cell hybridization , FISH methods. Chromosome analysis – microscopy and imaging, computer assisted image processing systems, flow cytometer.

BMS C104	Practicals I	3
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1. Preparation of rat liver homogenate - Isolation of rat liver mitochondria - Isolation of rat liver Nucleus
2. Isolation of chloroplast from leaves
3. Gene frequency estimation for autosomal and x-linked disorders - Estimation of inbreeding coefficient for specified pedigrees.
4. Culture of peripheral blood leukocytes and chromosome preparation. - Banding techniques such as GTG-, CBG-, and Ag NOR- banding techniques.
5. Human Karyotype. Chromosome abnormalities in certain human syndromes.

BMS C105	Eukaryotic Genome structure and Function	3
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An overview of genome anatomy – Genome of eukaryotes – Nuclear genomes – organization of coding and repetitive sequences (Ex. from plants, animals and human) and variations. Cytoplasmic organelle genomes – structure and function of mitochondrial and chloroplast genomes – interaction with nuclear genome – origin and evolution – Mitochondrial DNA – mutations and human health - Changes in genome organization – Transposable elements – Egs. from yeast and Drosophila – mammalian retroviruses – chromosome rearrangements – unequal crossing over and gene conversion - Meiosis and genetic recombination – overview of meiosis – molecular events – significance and regulation of meiosis – mechanism of genetic recombination – models – enzymes and factors - Regulation of gene expression – chromatin structure and gene regulation – Transcriptional control – cis, trans-regulatory sequences – posttranscriptional control – Eg. Sex determination in Drosophila – translational control and protein modification - Linkage and gene mapping ; Locating genes in chromosomes by two-factor, three-factor crosses – special eukaryotic – mapping techniques in fungi- tetrad analysis – for mapping and understanding mechanisms of recombination.

BMS C106	Microbial Genetics	3
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Growth of bacteria - Growth pattern - Growth media - Pure cultures, Isogenic strains - Nutritional and antibiotic markers - Mutagenesis in bacteria ; Types of mutants, mutagenic agents - Isolation and characterization of mutants - Reversion – Suppression - Plasmid biology - Types of Plasmids - F plasmids - R plasmids - Col plasmids - Ti plasmids - Degradative plasmids - Plasmid incompatibility

3. Bacterial transformation – Competence - DNA uptake, mechanism of transformation - Detection of transformants - Bacterial conjugation - Hfr transfer - Interrupted mating experiments - F' plasmids - Chromosome transfer by F' - Transduction - Generalised transduction - Co-transduction - and linkage - Mapping by co-transduction - Specialised transduction
4. Genetic recombination - Rec mutants - Rec A protein and its functions - Rec BCD protein complex - Role of rec genes in phage replication - Phage lambda genetics - Gene organization - The lytic cycle - The lysogenic cycle

BMS C107	Molecular Genetics	3
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Introduction – history-DNA as genetic material – Replication - Visualization of replication (eye, theta, D-loop, rolling circle mode

- 1) Semi conservative replication - Mechanism of replication - Enzymes involved in replication - Brief account of replication of DNA and RNA viruses – Transcription - Mechanism of transcription - Enzymes and proteins involved in transcription - Brief mention of promoters, enhancers, -10 and -35 sequences, up and down promoters - Posttranscriptional modifications – Translation - Biosynthesis of mRNA and tRNA - Ribosomes - Protein synthesis - Inhibitors of translation - Post translational modifications and signal hypothesis - Extra ribosomal protein synthesis

e.g. Gramicidin-S - Genetic code – History - Methods of deciphering the code - General features of the dictionary - Evolution of the genetic code - Regulation of gene expression - Concepts of enzyme induction, repression, co-ordinate induction, co-ordinate repression and catabolite repression  
Operon model, lac operon, CAMP and transcription. - Positive and negative control systems (lac, ara, arg, trp operons) - Regulation of transcription in Lambda. - Stringent and relaxed control.

BMS C108	Practicals II	3
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Eukaryotic Genome structure and Function - Study of mitotic stages/chromosomes from *Allium cepa* and mouse bone marrow, Meiotic preparation from grasshopper or mouse testis - Salivary gland chromosome preparation from *chironomus* or - *Drosophila* larva. Study of gastrulation in 24-hour whole mount chick embryo. (or) Dissection of imaginal discs from *Drosophila* larva.

3. Microbial Genetics - Isolation and purification of bacteria - Bacterial growth rate –
4. U.V. survival curves-LD50 - Selection for antibiotic resistance markers - Plasmid DNA isolation from bacteria
5. Molecular Genetics - Estimation of protein by Lowry method - Isolation of DNA & RNA - Estimation of DNA & RNA by spectrophotometry - Restriction digestion and agarose electrophoresis - PCR amplification

BMS C109	Prenatal Diagnosis and Genetic counseling	3
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Prenatal diagnosis – historical perspective – objectives and goals - Technological developments in prenatal diagnosis – ultrasonography, amniocentesis - Current knowledge of prenatally diagnosed genetic disorders - Treatment of genetic disorders – current practices and future prospectus - Genetic counseling – objectives and requirements – counseling to various genetic disorders – future trends in genetic counseling - ethical issues and impact on medical practice.

BMS C110	Cancer Genetics	3
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Cancer cell and its properties – clonal nature of cancer – proposed theories of carcinogenesis. Methods in cancer cytogenetics – chromosome preparation from bone marrow aspirates, peripheral blood and solid tumor samples – nomenclature - Radiation carcinogenesis – radiation and human cancer – temporal stages of radiation action – genetic effects of ionizing radiation. Chemical carcinogenesis – tumor initiation – tumor promotion - tumor progression. Viruses and human cancer – small and large DNA viruses – retroviruses – mechanism of virus – induced neoplasia - Inherited susceptibility to cancer – genetic markers of cancer predisposition – chromosome instability syndromes – familial cancer - Chromosome abnormalities in chronic myeloid leukemia – Philadelphia chromosome – clonal evolution. Cytogenetics of chronic - lymphocytic leukemia – B-CLL and T-CLL.- Chromosome abnormalities in acute non-lymphocytic leukemia – secondary acute leukemia. Non-random chromosome changes in acute lymphoblastic leukemia .Cytogenetics of preleukemia – myelodysplastic syndromes – myeloproliferative disorders. Cytogenetic findings in malignant lymphoma – Hodgkin’s disease – Burkitt’s lymphoma – non-Burkitt’s non-Hodgkin’s lymphoma. - Clonal chromosome aberrations in solid tumors. Oncogenes and human cancers – mechanisms of activation of oncogenes – tumor suppressor genes.

BMS C111	Biomacro Molecules	3
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Protein-chemistry-structure of amino acids, peptides and polypeptides, fibrous and globular proteins. Primary, secondary, tertiary and quaternary structure of proteins – alpha, helix, beta sheet, collagen structure, protein conformation, Ramachandran plot, bonds stabilizing protein structure, helix-coil transition, allosteric interactions, cooperative ligand binding in oxygen transporters, Michaelis-Menten equation - Nucleic acids-chemistry and properties of bases, nucleoside, nucleotide and nucleic acids, Watson and Crick model of DNA, sugar pucker, base stacking A,B, C and left handed Z form of DNA ; Linear, circular and supercoiled DNA nucleosome structure, denaturation of DNA, cot curves; C-value paradox; complexity of genomes - Lipids-classification, phosphoglycerides, prostaglandin, lipoprotein - Carbohydrates-mono, di and polysaccharides; storage and structural polysaccharide - Methods in structural Biology-An introduction to x-ray diffraction, NMR and spectroscopic technique principles of chromatography, electrophoresis, diffusion, sedimentation and ultra centrifugation.

BMS C112	Practicals III	3
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Prenatal diagnosis and Genetic counseling - Drawing pedigree charts with reference to specific genetic disorder - Risk estimation for single gene disorders and complex genetic disorders.

2. Problems in genetic counseling - case studies. DNA mutation detection method (self reading ) – Demonstration of ASO method in diagnosing affected.
3. Cancer Genetics : Chromosome preparation from leukemic bone marrow aspirates - Chromosome preparation from leukemic blood.

4. Guidelines for chromosomal analysis - Common chromosomal abnormal in human malignancies.
5. Biomacromolecules: Model building (ball and stick); bases, nucleosides, nucleotides, di nucleotides, AT and 6C base pairs - Absorption spectrum of protein and nucleic acid - Helix coil transition of DNA - Agarose gel electrophoresis of DNA (demonstration)

BMS C113	Environmental Genetics	3
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1. Mutagenesis – spontaneous and induced mutations – somatic and germ cell mutations; gene mutations and chromosomal mutations –
2. Mutagens – physical, chemical and biological agents – submalian systems for mutagenicity assessment salmonella (Ames test) E.coli, yeast and Neurospora. Drosophila – life cycle, culture and maintenance of the organism, Procedures for assessment of genotoxicity. Higher plants – gene mutations and chromosomal mutations – Allium test; somatic mutations in Tradescantia.
3. Mammalian system for mutagenicity assessment. Mouse – cytogenetic procedures and techniques to assess gene mutations. In vitro mammalian systems for mutagenicity evaluation – human lymphocytes, fibroblasts and chinese hamster cells in culture – unscheduled DNA synthesis, chromosomal aberrations, sister chromatid exchanges, gene mutations – HGPRT and TK.
4. Carcinogenesis and Teratogenesis. Interrelationship between mutagenesis and carcinogenesis – tests for evaluation. Teratogenesis – mouse as a test system congenital anomalies – teratogens in comparison with mutagens and carcinogens – birth defects in man.
5. Modification of mutagenic damage – antimutagenesis and desmutagenesis, molecular techniques to detect mutations, Interaction of chemical mutagens and radiation with genetic material – Electromagnetic spectrum – biological effects of ionising radiation and ultra violet rays – Radiosensitizers and radioprotectors. Mutations and human health – chromosomal and gene mutations – DNA repair defects in man -Biomonitoring of human population - chromosomal analysis, sperm morphology and epidemiology.

BMS C114	Recombinant DNA Technology	3
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1. Introduction Basic techniques - Cutting and joining DNA molecules; Plasmids as cloning vehicles for use in E.coli Bacteriophages and cosmid vectors for E.coli
2. Cloning strategies, gene libraries and C DNA cloning Recombinant selection and screening; Expression in E.coli of cloned DNA molecule; Analysing DNA sequences
3. The Polymerase chain reaction; Changing genes: site directed mutagenesis; Cloning in bacteria other than E.coli. Cloning in saccharomyces cerevisiae and other microbial eukaryotes Gene transfer to plants
5. Introducing genes into animal cells. Transferring genes into oocytes, eggs, embryos and specific animal tissues. The impact of recombinant DNA technology.

BMS C115	Molecular Genetics of Development	3
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Principles of development : Early embryonic development in animals – Differentiation and morphogenesis in Dictyostelium discoideum - Cellular basis of morphogenesis : Cell type specification – cell adhesion – Adhesion molecules – cell communication – signal transduction pathways - Early embryonic development : Genetics of axis specification in Drosophila and Amphibians – phenomenon of organizer – Regional specification and inductive interactions in Xenopus - Genetic analysis of development in C. elegans – cell lineages – types of mutation – Intercellular signalling and determination of vulval differentiation - Late embryonic development : Development of vertebrate eye – Development of tetrapod limb – sexual development pathways in C.elegans and Drosophila. Genes and development – Developmental mutants – screening and identification of genes from human developmental anomalies.

BMS C116	Gene therapy	3
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Introduction to : Human Genome project - Molecular medicine - Definition of Gene therapy : somatic and germ cell gene therapy - Gene therapy strategies : - Genetic intervention - Gene replacement - Mutation correction - Inhibition of gene expression - Targeted cell killing – prodrug activation, bystander effect - Immunomodulation

Gene transfer / delivery

- i) Principles of vivo and ex vivo transfer
- ii) Gene delivery systems – physical methods; - Calcium phosphate mediated transformation - Antibody mediated gene transfer - Cationic lipids and liposomes - Plicationic molecular conjugates - Gene gun and naked DNA administration – Nebulization – Microinjection - Electroporation
- iii) Gene delivery Vectors; Adenoviruses - Adenoassociated viruses - Herpes simplex viruses - Mammalian artificial chromosome vectors -  
Role of promoters in gene therapy –

i) Tissue targeted (tissue specified) gene therapy - Targeted diseases; - Cystic fibrosis – Haemophilia - ADA deficiency - Muscular dystrophy  
 Cardio vascular diseases - Cancer - Infectious diseases – HIV-1 infection. - Ethical considerations and limitations of gene therapy.

**Electives offered by the Department of Genetics**

Subject Code	Title of the course	Credits
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BMS E101	Principles of Genetics I	3
BMS E102	Principles of Genetics II	3
BMS E103	Genetics of Metabolic and behavioral disorders	3

BMS E101	Principles of Genetics I	3
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1. DNA as the genetic material, Basic structure of DNA and RNA - alternate and unusual forms of DNA. Physical and chemical - properties of nucleic acids – acid base Properties, denaturation and - renaturation, Tm and cot values, hybridization.
2. Molecular structure of chromosomes, eukaryotic genome - Organization. Variation in chromosome number and structure - Chromosome nomenclature, chromosomal syndromes.
3. Mendelian inheritance in human families. Mapping genes in - humans-linkage and recombination and genes in populations.
4. The biochemical and molecular basis of genetic disease and their - diagnosis – lysosomal storage disorders, - glycogen storage disorders, G6PD deficiency, hyperuricemia - Fragile X syndrome.
5. Prenatal diagnosis, carrier detection and genetic counseling.

BMS E102	Principles of Genetics II	3
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- Replication and transcription of DNA – Semi conservative - replication, mechanism of replication, mechanism of transcription and concepts of RNA processing. Translation and Genetic code - mechanism of protein synthesis, methods of deciphering the genetic code and general features of the code word dictionary - Genetic control of development in C. elegans and Drosophila - Developmental control genes and their mutations -Cell-Cell interaction and signalling pathways in - morphogenesis. Apoptosis and development.
3. Mutagenesis and carcinogenesis and their mechanisms; DNA - repair and repair mechanisms; variation in susceptibility to - DNA damage. Genotoxicity evaluation – assay systems and - methods – end points and their validations.
  4. Genetic recombination in bacteria and viruses, conjugation - transduction and transformation.
  1. Application of these recombinant processes in developing rDNA technology.

BMS E103	Genetics of Metabolic and behavioral disorders	3
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1. Introduction: - Important concepts about genetic and metabolic process in the inborn errors of metabolism and human behavioral development – some misconceptions about genes and their role in complex human behaviors – Diseases caused by genetic defects of specific enzymes and transport protein – primary consequences of inborn errors of metabolism.
2. Metabolic causes of mental illness :Errors in
  - a. aminoacid metabolism-phenylketonuria, Homocystinuria, Histidinemia and Tyrosinemia.
  - b. Carbohydrate metabolism – Galactosemia and glycogen storage disorders.
  - c. Lysosomal storage disorders – Mucopolysaccharidoses and Gaucher’s disorder.
  - d. Defects in purine salvage pathway – Lesh nyhan syndrome.
3. Complex Behavioral Traits  
 Alcoholism – Vulnerability to alcoholism, epidemiological findings, flushing reaction and genetic basis- neurochemical constitutional factors in the alcohol metabolism-enzymes of neuroendocrine responses to alcohol.
4. Language and Cognition - Language disorders-genetic basis-brain plasticity in language development. Impairments in learning and memory. Genetic approaches to cognitive abilities, disabilities and memory storage genes and behavior.



5. Behavioral disorders with childhood onset:
  - a. Stuttering as a complex behavioral trait-classification, types, genetic basis – management.
  - b. Autism: as a heterogeneous syndrome- genetics, risk, gender differences, association studies, management.
  - c. Dyslexia / specific reading disability – genetic basis and molecular approaches.
  - d. Attention deficit/hyperactivity disorder.

### M.Sc. MOLECULAR BIOLOGY

Sem	Code	Course Title	Cred- it	C/E	Faculty
<b>I</b>	BMS C201	Biomolecules	3	C	Guest Faculty
	BMS C202	Molecular Biology of the Cell	3	C	Guest Faculty
	BMS C203	Enzymology and Metabolism	3	C	Guest Faculty
	BMS C204	Laboratory Exercises	3	C	Dr.G.Jayaraman
		Elective Course	3	E	
<b>II</b>		Elective Course	3	E	
	BMS C205	Molecular Genetics	3	C	Dr.G.Jayaraman
	BMS C206	Gene Expression and Regulation	3	C	Dr.G.Jayaraman
	BMS C207	Molecular Biology of Development	3	C	Guest Faculty
	BMS C208	Laboratory Exercises	3	C	Dr.G.Jayaraman
<b>III</b>		Elective Course	3	E	
		Elective Course	3	E	
	BMS C209	Principles of rDNA Technology	3	C	Dr.G.Jayaraman
	BMS C210	Microbial, Plant and Animal Biotechnology	3	C	Guest Faculty
	BMS C211	Molecular Basis of Human Diseases	3	C	Guest Faculty
<b>IV</b>	BMS C212	Principles of Gene Therapy	3	C	Dr.G.Jayaraman
	BMS C213	Laboratory Exercises	3	C	Guest Faculty
		Elective Course	3	E	
	BMS C214	Molecular Diagnostics	3	C	Guest Faculty
	BMS C215	Genomics	3	C	Guest Faculty
<b>IV</b>	BMS C216	Proteomics	3	C	Guest Faculty
	BMS C217	Dissertation	6	C	Dr.G.Jayaraman
		Elective Course	3	E	

### ABSTRACT OF COURSES

BMS C201	BIOMOLECULES	C	2	1	0	3	GUEST FACULTY
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Pre-requisite: understanding of basic chemistry/biochemistry/biology

This course covers the chemistry, basic structure and functions of molecules present in a cell. While the course will address all major topics of importance, it will focus particularly on biomacromolecules like proteins, nucleic acids, carbohydrates and lipids. Where appropriate, emphasis will be given to structure -function relationship of biomolecules in the cellular metabolism.

BMS C202	MOLECULAR BIOLOGY OF THE CELL	C	2	1	0	3	GUEST FACULTY
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Pre-requisite: Bachelors level biology.

This course will provide the basic concepts in understanding the cell structure and function. Cell organelles, cell growth and division and cell counting procedures will also be dealt with. The course will also provide an outline on concepts relating to oncogenes and cellular transformation.

BMS C203	ENZYMOLGY AND METABOLISM	C	2	1	0	3	GUEST FACULTY
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Pre-requisite: basic biochemistry.

To have comprehensive idea on the enzyme structure, its kinetics, regulation, mechanism of action and immobilized enzymes with their applications and the principles of metabolic control, regulation of carbohydrates, lipids and nitrogen metabolism.

BMS C204	LABORATORY EXERCISES	C	0	0	3	3	G.JAYARAMAN
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Pre-requisite: Bachelors level biology and/or biochemistry  
Practicals pertaining to BMS C201 C202 C203

BMS C205	MOLECULAR GENETICS	C	2	1	0	3	G.JAYARAMAN
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Pre-requisite: Basic principles of genetics, BMS C201 C202

This course aims at exposing the students to the structure, perpetuation and expression of the genetic material. It provides an in-depth knowledge of both prokaryotic and eukaryotic mechanisms of DNA replication, transcription, splicing and processing of RNA, translation of the genetic material and deciphering the code word dictionary.

BMS C206	GENE EXPRESSION AND REGULATION	C	2	1	0	3	G.JAYARAMAN
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Pre-requisite: Basic principles of genetics, BMS C201 C202

This course explores the various strategies that have evolved to regulate gene expression. The greatest emphasis in the course is placed on understanding the diversity of regulatory strategies that have evolved and the mechanisms that underlie these strategies. This course helps to acquire knowledge about mechanisms of gene regulation.

BMS C207	MOLECULAR BIOLOGY OF DEVELOPMENT	C	2	1	0	3	GUEST FACULTY
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Pre-requisite: Basics of biochemistry/genetics and cell biology.

This course provides an insight into the role of molecular interactions to define developmental pathways. The mechanism basis of developmental events will be studied in developmental mutants of several model organisms: early patterning, hierarchy of gene expression in *Drosophila*, sex determination and dosage compensation in *C.elegans* and *Drosophila*, inductive interactions and cell signalling in *C.elegans*, *Drosophila* and *Xenopus laevis*. Cell aggregation and differentiation in *Dictyostelium discoideum* are some aspects covered in this course.

BMS C208	LABORATORY EXERCISES	C	0	0	3	3	G.JAYARAMAN
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Practicals pertaining to BMS C205 C206 C207

1. Restriction digestion of plasmid and genomic DNA; Transformation of ligated DNA into *E. coli*; Selection of recombinant clones.
2. Polymerase chain reaction – amplification of human genes. . Diagnosis of Genetic disorders using PCR.
3. Restriction fragment length polymorphism – a demonstration; Southern and Northern transfer-demonstration.
4. Western blotting and ELISA based detection of infectious agents.  
PCR-SSCP analysis of gene mutations: demonstration of Real Time PCR and dHPLC.

BMS C209	PRINCIPLES OF rDNA TECHNOLOGY	C	2	1	0	3	G.JAYARAMAN
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Pre-requisite: BMS C201 C202 205 C206

This course covers all aspects of gene manipulation and genetic engineering techniques. Use of restriction enzymes and DNA modifying enzymes, cloning of DNA fragments, construction of DNA libraries and their applications are taught in this course.

1. Introduction, Restriction and ligation of DNA molecules, Plasmids as cloning vehicles for use in *E. coli*, Bacteriophages and cosmid vectors for *E. coli*.

2. Cloning strategies, gene libraries and cDNA cloning, Recombinant selection and screening, Expression in *E. coli* of cloned DNA molecules.
3. DNA sequencing, the polymerase chain reaction and its applications, Changing genes: site directed mutagenesis and related strategies. Protein engineering.
4. Cloning in bacteria other than *E. coli*, Cloning in *Saccharomyces cerevisiae* and other microbial eukaryotes, Gene transfer to plants.
5. Introducing genes into animal cells, Transferring genes into oocytes, eggs, embryos and specific animal tissues; transgenic animals. The impact of recombinant DNA technology.

BMS C210	MICROBIAL, PLANT AND ANIMAL BIOTECHNOLOGY	C	2	1	0	3	GUEST FACULTY
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Pre-requisite: BMS C205 C206

Application of recombinant DNA methods and other related techniques in utilizing microbes, animals and plants to benefit humankind is discussed in this course.

1. Microbial production of vaccines, antibodies, interferon, somatostatin Single cell proteins – spirulina
2. Bacterial leaching and biomining; Biological nitrogen fixation Plant cell and tissue culture; Improving crop plants by introduction of isolated forcing genes
4. Monoclonal antibodies and their applications; Biotechnology application in `medicine
5. Application of biotechnology in animal sciences; Biotechnology: Regulation and role of society.

BMS C211	MOLECULAR BASIS OF HUMAN DISEASES	C	2	1	0	3	GUEST FACULTY
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Pre-requisite: BMS C205 C206 C207

The emphasis of this course is on our current understanding of molecular and cellular mechanisms in human diseases. Examples are used to illustrate the outcome at the organismal level of defects in these molecular mechanisms.

1. Molecular basis of genetic variation: Current theories of mutation, methodology of mutation detection. Variability of genes - sequence polymorphism. Genetic basis of susceptibility to diseases: genetic risk analysis.
2. Molecular basis of complex diseases: Diabetes – insulin dependent and independent diabetes; Hypertension : Molecular approach to dissect etiology. Identifying candidate genes.
3. HLA genes and rheumatoid arthritis susceptibility: molecular basis of RA; HLA association with RA, the shared epitope hypothesis.
4. Familial hyper cholesterolaemia: molecular basis of the disease, LDL receptor gene & mutations. Genetic basis of Glaucoma.; Pulmonary Emphysema: molecular biology of PE.  $\alpha$ 1-antitrypsin gene structure and mRNA species. Mutations associated with this gene.
5. Molecular oncology – oncogenes and tumour suppressor genes; Role of transcription factors – p53 – apoptosis – mutations in p53 and loss of cell cycle arrest.

BMS C212	PRINCIPLES OF GENE THERAPY	C	2	1	0	3	G.JAYARAMAN
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Pre-requisite: BMS C205 C206 C207

Application of molecular biology to medical problems has led to new understanding of genetic disorders and has helped to develop new corrective measures. Gene therapy is one of such molecular approaches, which is being developed currently. This course discusses current status of gene therapeutics.

1. Introduction to: Inherited Genetic disorders, Molecular medicine. Definition of Gene therapy: Somatic and Germ cell gene therapy.
2. Gene therapy strategies: Gene augmentation, Inhibition of gene expression, Targeted cell killing – Prodrug activation, bystander effect.
3. Gene transfer/delivery: Gene *delivery systems – physical methods*  
Calcium phosphate mediated transformation; Antibody mediated gene transfer Cationic lipids and liposomes; Gene gun and naked DNA administration; Nebulization; Electroporation; Gene delivery vectors; Adenoviruses;

Adeno associated Viruses; Mammalian artificial chromosome vectors. Animals models for gene therapy; Role of promoters in gene therapy: Tissue targeted (tissue specific) gene therapy. Targeted diseases: Cystic fibrosis, Hemophilia, ADA deficiency, Muscular dystrophy Ethical considerations and limitations of gene therapy.

BMS C213	LABORATORY EXERCISES	C	0	0	3	3	GUEST FACULTY
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Practicals pertaining to BMS C209M C210 C211 C212

BMS C214	MOLECULAR DIAGNOSTICS	C	2	1	0	3	GUEST FACULTY
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Pre-requisite: BMS C209 C211 C212 - This course introduces the student to the field of application of molecular tools for diagnosis of gene mutations, infections by pathogens and other anomalies.

BMS C215	GENOMICS	C	2	1	0	3	GUEST FACULTY
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Pre-requisite: BMS C205 C211

As a course in molecular biology should reflect the major research issues of the new millenium, this paper is offered to discusses the nature of the genomes (not individual genes), their structure, size and functional attributes.

BMS C216	PROTEOMICS	C	2	1	0	3	GUEST FACULTY
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Pre-requisite: BMS C205 C206 C207 C211

This course is intended to provide molecular biology students a basic understanding of technologies behind proteomics and their application to address biological problems. Topics covered include structural and functional proteomics, protein expression profiling, protein-protein interaction and proteome mining.

BMS C217	DISSERTATION	C	0	1	5	6	G.JAYARAMAN
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Each student will independently undertake a project work which may be wet laboratory experiments or in-silico experiments. At the end of the semester a dissertation will be submitted by the student and he/she should defend the same.

I	BMS C201	Biomolecules	3	C	Guest Faculty
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1. Protein chemistry – Structure of amino acids, peptides and polypeptide, fibrous and globular proteins. Primary, secondary, tertiary and quaternary structure of proteins-alpha helix, beta sheet, collagen structure; protein conformation angle-Ramachandran plot, bonds stabilizing protein structure, allosteric interactions, cooperative ligand binding in oxygen transporters.
2. Nucleic acids – chemistry and properties of bases, nucleoside, nucleotide and nucleic acids; short hand representation; Watson and Crick model of DNA, sugar puckering, base stacking; A, B, C and left handed Z form of DNA: Linear, circular and supercoiled DNA; nucleosome and chromosome structure, denaturation of DNA, cot curves; C-value paradox; complexity of genomes.- Lipids - classification, phosphoglycerides, prostaglandin, lipoprotein - Carbohydrates – mono, di and polysaccharide; Storage and structural polysaccharides; structure and function of arbohydrates. Bacterial and plant cell walls. - Vitamins - Fat soluble vitamins: Occurrence, properties, structure and functions of vitamin A, D, E and K. - Water soluble vitamins: Occurrence, properties, structure and functions of Thiamine, Riboflavine, pyridoxine, niacin, Biotin, Folic acid, B 12, ascorbic acid. Structure, classification and functions of coenzymes.

	BMS C202	Molecular Biology of the Cell	3	C	Guest Faculty
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1. Cell structure of archae and eubacteria, eukaryotes. Single cell to multicellular organisms, continuous and synchronous cell culture, cell fractionation. Experimental models: E.coli, yeast, slime mold, C.elegans, Drosophila and Arabidopsis thaliana.
2. Molecular organization of cell: plasma membrane, lipid bilayer, membrane proteins, carbohydrates, transport of small and macro molecules-ectocytosis, endocytosis, cytosol, ribosomes, rough and smooth endoplasmic reticulum, golgi, lysosomes and protein sorting and transporting.
4. Mitochondria-origin, evolution, structure, chemosmotic theory, electron transport chain, electrochemical protein gradient, respiratory chain, redox potential; chloroplast: origin and evolution, structure, light absorption and conversion of CO<sub>2</sub> to carbohydrate, carbon fixation, metabolic exchange by chloroplast membrane.
5. Nucleus, Nuclear envelope, cell cycle, cell growth and division, control of cell division, events in phases: G<sub>1</sub>, S, G<sub>2</sub>, M. Cytoskeleton and cell movement.
6. Concept of oncogenes ; neoplastic cell growth;tumour suppressor genes and their role in cell cycle.

	BMS C203	Enzymology and Metabolism	3	C	Guest Faculty
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2 + 1 + 0 = 3 Credits

1. Nomenclature and classification of Enzymes. Homogenization technique, Isolation and purification of enzymes. Criteria of purity; determination of enzyme activity. Mechanism of enzyme action. Active site of the enzymes, enzyme – substrate complex formation. DNA modifying enzymes and other enzymes used in molecular cloning.
2. Thermodynamics and Kinetics of enzyme catalysed reaction; Michaelis and Menton equation; Line – Weaver and Burk Plot, effect of change of temperature and pH on the rate of reaction, Inhibitors; sigmoid kinetics; multienzyme complexes; multisubstrate enzymes.
3. Carbohydrate metabolism: glycogenolysis, glycolysis, T.C.A cycle, HMP shunt, glycogenesis, gluconeogenesis, metabolism of non-carbon source substrates. Microbial anaerobic and aerobic metabolism.
4. Lipid metabolism: Oxidation of fattyacids and biosynthesis of fattyacids. Biosynthesis of triglycerides, phospholipids and steroidal hormones. Metabolism and function of cholesterol, bile acids, lipoprotein and glycolipids.
5. Nitrogen metabolism: Oxidative and non-oxidative deamination, transamination and urea cycle. Metabolism of ketogenic and glycolytic amino acids, essential and non essential amino acids, nitrogen balance. Biosynthesis and degradation of purine and pyrimidine ring and nucleotides.

	BMS C204	Laboratory Exercises	3	C	Dr.G.Jayaraman
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Good laboratory practices; Preparation of buffers and other solutions - Principles of: Centrifugation, Spectrophotometry, Fluorimetry, Luminometry, Chromatography, Electrophoresis, Radioisotope labeling, Microscopy – Light , Electron; X-ray diffraction, NMR, ESR, Autoradiography, Flow cytometry; Absorption spectra of proteins - Protein estimation by Bradford or Lowry's method - Demonstration of Mitosis and Meiosis stages using Allium cepa root tips and grass hopper testis or Tradescantia flower buds. - SDS-PAGE of proteins , TLC of lipids - Cell counting procedure using Haemocytometer- Study of human peripheral blood: Total count and differential count - Induction of calli by Ti plasmid; Mammalian cell culture - Isolation of cell organelles by differential centrifugation - Purification and Determination of optimum pH, temperature and  $K_m$  of any two enzymes.

<b>II</b>	BMS C205	Molecular Genetics	3	C	Dr.G.Jayaraman
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1. Mutations affecting structure and synthesis of proteins: Hemoglobin variants; Sickle cell disease – Thalassaemias. Alpha-I-antitrypsin deficiency.
1. Inborn errors of metabolism: In-born errors of aminoacid metabolism: Phenylketonuria, alkaptonuria, Ibinism, parkinson's disease. Disorders related to purine metabolism: Lesch Nyhan syndrome; G-6PD deficiency. Mucopolysaccharidosis- Glycogen storage disease: Von Gierke's disease, Apolipoproteinuria; Tay-Sach's disease, Gaucher's disease. Genetic disorders such as Duchenne and Becker's dystrophy.
1. Genes in pedigree: Mendelian pedigree patterns; Complementation tests to determine allelic genes; factors affecting gene frequencies; Hardy Weinberg law and gene frequencies; Non-Mendelian characters. Identifying human disease genes: positional cloning.
2. DNA as genetic material- central dogma and deviations; DNA sequences, specific domains, repetitive units, non-coding sequences, sequence overlap. Mechanism of replication. Models of replication (eye, O, D-loop, rolling circle model); replication of M13 and RNA viruses. DNA repair and DNA recombination
5. Ribosomes; Protein synthesis; inhibitors of translation; post translational modifications and signal hypothesis; Organelle protein synthesis ; Extra ribosomal protein synthesis e.g. Gramicidin – S Genetic code: Methods of deciphering the code; General features of the dictionary ; Evolution of the genetic code; Molecular evolution.

	BMS C206	Gene Expression and Regulation	3	C	Dr.G.Jayaraman
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1. Biosynthesis of mRNA, transcriptome; transcription inhibition ; RNA interference; anti sense RNA; ectopic transcription.
2. Structural features of prokaryotic genes. Co-ordinated regulation of prokaryotic gene expression; operon model; lactose operon; tryptophan operon; ara operon, attenuation. Gene expression in bacteriophage lambda. Translational regulation of the expression of some genes in prokaryotes.
3. Structure and expression of Class I, II, III genes. Interrupted genes and their expression. Differential expression of hemoglobin genes. Mobile genetic elements.
4. Promoters, enhancers and other regulatory sequences, termination sequences. Transcriptional factors of eukaryotes and prokaryotes . RNA processing; Ribozymes; Prions; protein folding; chaperons; Ubiquitination and proteasomes
5. Novel structural motifs in transcription factors: DNA binding domain & transcription regulatory domain. Global influences on gene expression: DNA methylation, regulated utilization of mRNA.

	BMS C207	Molecular Biology of Development	3	C	Guest Faculty
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1. The control of cell proliferation: Factors that regulate cell proliferation and function.
2. Cell to cell signaling. Cell differentiation and factors that control this process. Differential gene action.
3. Molecular control of morphogenesis: Slime mold as a model organism – diffusion of signals, morphogenic gradients, polarity, pattern formation.  
*C. elegans* – development control genes. Molecular basis of sperm/oocyte switch.
4. Drosophila: Molecular analysis of early pattern formation - Homeotic genes.  
Mouse: genes that control development; homeobox, paired box, ZFP, octamer binding proteins and genes.
5. Transgenic models for studies on molecular basis of development: Insertional mutagenesis, gene targeting and knock out mouse.

	BMS C213	Laboratory Exercises	3	C	Guest Faculty
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1. Genomic DNA isolation from human peripheral blood. Plasmid DNA isolation from bacteria
2. Absorption spectra of Nucleic Acids Determination of melting temperature of calf thymus DNA Agarose gel electrophoresis of DNA
3. Human Karyotyping, Preparation of polytene chromosomes from Chironomous or fruitfly. Drosophila culture and identification of different developmental stages.
4. Induction of *lac-Z* gene by IPTG T7 polymerase / T7 promoter based expression of proteins in *E. coli*
5. Determination of ABO, Rh blood groups (Haemagglutination)

	BMS C214	Molecular Diagnostics	3	C	Guest Faculty
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2 + 1 + 0 = 3 Credits

1. Polymerase Chain Reaction – Its applications in diagnosis of infectious diseases – eg: HIV, hepatitis B and tuberculosis. Identification of gene mutations and deletions – eg: p53 mutations. Use in solving paternity disputes and crime detection.
2. Restriction Fragment Length Polymorphism (RFLP) – DNA probes detection of mutations and deletions in gene. Eg: thalassemia, haemophilia, sickle cell anemia, retinoblastoma. DNA finger printing.
3. Prenatal diagnosis - Fluorescent in situ hybridization (FISH) – DNA probes – fluorescent labeling, chromosome painting and spectral karyotyping.
4. Diagnosis of single gene disorders – Spinal muscular atrophy, DMD and BMD, Fragile X syndrome.
5. Monoclonal antibodies (MAb) – Enzyme linked immunosorbent assay (ELISA) – Diagnosis of infectious diseases and cancer antigens, HIV detection. Recombinant virus vaccine – Vaccinia virus as a vector. Cloning of antibody producing genes and production of monoclonal antibodies in *E. coli*.

	BMS C215	Genomics	3	C	Guest Faculty
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1. Genome: Human genome project- organization of human genome- Eukaryotic and prokaryotic genomes. Mitochondrial and chloroplast genomes- organisation and function.
2. Mapping of human genome: mapping strategies- linkage maps- physical maps- low and high-resolution physical mapping.
3. Sequencing human genome: sequencing technologies. Partial sequencing for mapping. Gene identification. From sequence drafts to complete final sequences. Sequence based gene prediction.
4. Microarrays/ DNA chips and gene expression profiling. Gene cascades and molecular pathways: Cluster analysis and co-regulated genes. Application of microarrays.
5. Genetic testing and genetic risk analysis- personalized drugs- genetic discrimination and privacy- genetic enhancement-ethical, legal and social implications.

	BMS C216	Proteomics	3	C	Guest Faculty
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1. Proteomes: definition of proteomes; genome -proteome relationship; deducing proteome from genome. Role of protein in cells-structural proteins-functional protein families. Gene expression, codon bias and protein levels.
2. Tools of proteomics: Iso-electric focusing, two dimensional protein gels, high performance liquid chromatography, mass spectrometry, MALDI-TOF, tandem mass spectrometry and protein sequencing and peptide fingerprinting.
3. Protein structure prediction- threading methods. Three dimensional structures of proteins and comparison of protein structures-identical, homologous, unrelated structures. Multiple alignments for structural, functional and phylogenetic analysis of homologous sequences.
4. Data base search in proteomics: hidden Markov models-protein family based homology detection. Predicting secondary structure from amino acids sequences. conserved patterns in protein sequences and structures.
5. Proteomics applications: protein expression profiling. Protein- protein interactions *in vivo* - n-hybrid systems of mammalian and yeast cells. Applications in drug discovery.

### M.Phil. ENDOCRINOLOGY

Course Code	Title of the course	C/E	Credits				Faculty
			L	T	P	C	
First Semester							
BMS C001	Hormones: Synthesis-Secretion-Transport and Metabolism	C	4	1	0	5	M.Michael Aruldas N.Srinivasan / K.Balasubramanian J.Arunakaran
BMS C002	Hormones: Physiology and Molecular Mechanisms of action	C	4	1	0	5	M.Michael Aruldas / N.Srinivasan / J.Arunakaran K.Balasubramanian
BMS C003	Hormones: Pathophysiology and Research Methodology	C	4	1	0	5	M.Michael Aruldas N.Srinivasan / J.Arunakaran K.Balasubramanian
Second Semester							
BMS C004	Dissertation and Viva-voce	C	-	-	-	21	Supervisor & Dept. faculty members

### P.G.DIPLOMA IN APPLIED ENDOCRINOLOGY

Course code	Course Title	Credits				Course Faculty
		L	T	P	C	
	Semester-I					
BMS C476	Principles of Endocrinology	3	1	0	4	All faculty members
BMS C477	Hormones – Molecular aspects of synthesis and regulation	3	1	0	4	-do-
BMS C478	Hormones-Signal transduction	3	1	0	4	-do-
BMS C479	Practicals-1	0	0	6	6	-do-
	Semester-II					
BMS C480	Hormones-Physiological actions	3	1	0	4	-do-
BMS C481	Hormone Biotechnology	3	1	0	4	-do-
BMS C482	Endocrine Disorders	3	1	0	4	-do-
BMS C483	Practicals-2	0	0	6	6	-do-

BMS C476	Principles of Endocrinology	3	1	0	4	All faculty members
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Unit I: Endocrine organs-secretions- Homeostasis; Hypothalamo-hypophyseal axis, Hypothalamic hormones, Pituitary hormones and their target organs

Unit II: Thyroid gland and its hormones- parathyroid gland and its hormone Adrenal gland- Cortex and medulla – their hormones

Unit III: Islets of Langerhans- cell types- their hormones Gonads and their hormones

BMS C477	Hormones – Molecular aspects of synthesis and regulation	3	1	0	4	-do-
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UnitI: Peptide hormones: (ACTH, Calcitonin, GH, Glucagon, Insulin, Prolactin, PTH); Glycoprotein hormones (FSH, LH, TSH)

UnitII: Steroid hormones: (androgens, estrogens, progesterone, glucocorticoid & mineralocorticoid) and Thyroid hormones - synthesis, release and regulation

UnitIII: Amines: Catecholamines-indolamines

BMS C478	Hormones-Signal transduction	3	1	0	4	-do-
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UnitI: Peptide hormone receptors: Types of receptors- regulation, transmembrane signaling – adaptor proteins- second messengers- effector kinases- transcription factors

UnitII: Steroid/thyroid hormone receptors, structure, dimerization, translocation into the nucleus, interaction and regulation of target gene expression

UnitIII: Non-genomic actions of steroid hormones; Intracellular receptors for peptide hormones; cross-talk with peptide hormone signaling molecules.

BMS C479	Practicals-1	0	0	6	6	-do-
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**Credits - 6**

1. Good Laboratory Practices.
2. Animal cell and tissue culture – sterile working conditions

3. Radioisotopes handling; safety measures; labeling, RIA
4. ELISA
5. Microscopy: a) simple, compound, phase contrast .b) Histomorphometric analyses of major endocrine glands (permanent slides and fresh preparation)

BMS C480	Hormones-Physiological actions	3	1	0	4	-do-
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UnitI: Hormones in growth and development - GH and thyroid hormone. Hormones and Reproduction – Gonadotrophins, prolactin, sex steroids, non-classical hormones.

UnitII: Hormones and metabolism – carbohydrate, lipid and protein

UnitIII: Hormones in immunomodulation – cortisol, prolactin and sex steroids; thymic hormones

BMS C481	Hormone Biotechnology	3	1	0	4	-do-
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UnitI: Application of recombinant DNA technology in Endocrinology; industrial production of hormones (insulin, GH, FSH)

UnitII: Genetic manipulation of cells and animals. An overview of gene transfer technology – principles and gene transfer to study gene expression and function; Creating disease models using gene transfer and gene targeting technology with suitable endocrine examples.

UnitIII: Molecular approaches for treating endocrine diseases. Principles of gene therapy. Methods for inserting and expressing gene in a target cell or tissue. Methods for repairing or inactivating pathogenic genes in a cell or tissue. Prospects of gene therapy in treating endocrine diseases.

BMS C482	Endocrine Disorders	3	1	0	4	-do-
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UnitI: Growth disorders – growth hormone – IGFs axis. Dwarfism, cretinism, acromegaly Reproductive disorders- male and female infertility, and sexual dysfunctions.

UnitII: Metabolic endocrine disorders- hypo- and hyperthyroidism, Cushing's disease, Disorders of skeletal mineral metabolism – osteoporosis. Autoimmune endocrine disorders- diabetes mellitus, Graves's disease and thyroiditis

UnitIII: Endocrine cancers-prostate, breast ovary and the thyroid. Familial endocrine cancers – MEN-I and MEN-II; Hormone resistance syndrome.

BMS C483	Practicals-2	0	0	6	6	-do-
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DNA: a) isolation of DNA (nuclear and mitochondrial) restriction endonuclease digestions, b) Agarose gel electrophoresis.

RNA: Extraction-isolation- mRNA expression analysis using Northern blotting or RT-PCR - Translational analysis: Western blotting - Gene transfer techniques in mammalian cells

### M.Sc. PHOTONICS AND BIOPHOTONICS

Semester	Course No	Course Title	C/E	Credits	Course Faculty	
I	UFC C001	Photonics Introductory course	C	3	Dr.P. Ramamurthy & new faculty	
	BMS C201	Biomolecules	C	3	Molecular biology	
	BMS C402	Molecular Biology of the cell	C	3	Molecular Biology	
	UFC C002	Fundamentals of Spectroscopy	C	4	Dr.P. Ramamurthy & New Faculty	
			Elective	E	3	
II	UFC C003	Photochemistry and Photophysics	C	4	Dr.P.Ramamurthy & New Faculty	
	UFC C004	Lasers Theory & Principles	C	4	New Faculty & Guest Faculty	
	UFC C005	Practical – I	C	4	New Faculty	
			Elective	E	3	
		UFC E001	Fluorescence Spectroscopy for biologists	E	3	Dr.P. Ramamurthy
III	UFC C006	Optoelectronics and Fibre Optics	C	3	New Faculty & Guest Faculty	
	UFC C007	Biological Chemistry	C	3	Dr.P.Ramamurthy & New Faculty	
	UFC C008	Biophotonics	C	3	Dr.P. Ramamurthy & New Faculty	
	UFC C009	Practical – II	C	4	New Faculty	
	UFC C010	Seminar	C	1		
	UFC E002	Semiconductors & Devices	E	3	New Faculty & Guest Faculty	



IV	UFC C011	Laser Material Processing	C	3	New Faculty/Guest Faculty
	UFC C012	Photonics Materials	C	3	Dr.P. Ramamurthy & new Faculty
	UFC C013	Medical Applications of Lasers	C	3	Dr.P. Ramamurthy & Guest faculty
	UFC C014	Project and viva-voce	C	6	All faculty
	UFC E003	Crystal growth and Experimental techniques	E	3	New faculty & Guest Faculty

  

UFC C001	Photonics Introductory course	C	3	Dr.P. Ramamurthy & new faculty
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Introduction to photonics – Applications in our daily lives, career opportunities. The Nature of Light – Wave and light terminology, light spectra and sources, fluorescence and phosphorescence and black body radiation - Geometric Optics – Light as a ray, law of reflection including plane mirrors, law of refraction including optical fiber applications, prisms and thin lenses including Lensmaker’s equation, Lens problems and optical instruments using the thin lens equation. Wave Optics – wave descriptive terminology, wave superposition (interference) including double – slit interference, diffraction and diffraction gratings, interference applications, eg. Michelson, Mach Zender and Fabry Perot interferometers, Thin film interference and Fiber Bragg Gratings. Diffraction Effects including: airy disk, near far field effects. Polarization principles including scattering, reflection and birefringence - Introduction to Lasers – Basic terminology and theory of operation including specific requirements, principal types of lasers, optical detectors with low and high power laser applications in photonics. Laser radiation hazards including effects on the eye and skin. Laser safety standards and hazard classifications. Laser safety precautions and protective measures.- Fiber Optics – Optical fiber construction, system components and characteristics, Optical fiber types and their properties, Optical fiber light sources, optical sensors and connectors, Optical fiber measurement and testing terminology, fiber optic communications and non-communication fundamentals and applications.- Imaging and display devices and holography – Theory and basic principles, image and optical signal processing with applications in photonics.

BMS C201	Biomolecules	C	3	Molecular biology
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Protein chemistry – Structure of amino acids, peptides and polypeptide, fibrous and globular proteins. Primary, secondary, tertiary and quaternary structure of proteins alpha helix, beta sheet, collagen structure; protein conformation angle, Ramachandran plot, bonds stabilizing protein structure, helix-coil transition: allosteric interactions, cooperative ligand binding in oxygen transporters, Michaelis-Menten equation - Nucleic acids – Chemistry and properties of bases, nucleoside, nucleotide and nucleic acids; Watson and Crick model of DNA, sugar puckering, base stacking A, B, C and left handed Z form of DNA: Linear, circular and supercoiled DNA nucleosome structure, denaturation of DNA, cot curves; C-value paradox; complexity of genomes - Lipids classification, polyglycerides, prostaglandin, lipoprotein - Carbohydrates – mono, di and polysaccharide: Storage and structural polysaccharides; Thermodynamics, structure and function of proteins. Enzyme classification, Enzyme kinetics, Mechanism of enzyme action, structure and function of carbohydrates, Lipids and Nucleic acids - Vitamins: Fat soluble vitamins: Occurrence, properties, structure and functions of vitamin A, D, E and K. Water soluble vitamins: Occurrence, properties, structure and functions of Thiamine, Riboflavin, pyridoxine, niacin, Biotin, Folic acid, B12, ascorbic acid. Structure, classification and functions of coenzymes.

	BMS C402	Molecular Biology of the cell	C	3	Molecular Biology
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Cell structure, cell cycle and stages of growth, continuous and synchronous culture, cell fractionation. Information flow, archae and eubacteria, eukaryotes. Single cell to multicellular organisms - Molecular organization of cell: plasma membrane, lipid bilayer, membrane proteins, carbohydrates, transport of small and macro molecules-ecocytosis, endocytosis, cytosol, ribosomes rough and smooth endoplasmic reticulum - Mitochondria-origin, evolution, structure, chemosmotic theory, electron transport chain, electrochemical protein gradient, respiratory chain, redox potential, chloroplast; origin and evolution, structure, light absorption, production of ATP and conversion of CO<sub>2</sub> to carbohydrate, carbon fixation, metabolic exchange by chloroplast membrane. Golgi apparatus, lysosome and microbodies - Nucleus, Nuclear envelope, cell growth and division control of cell division, events in S phase, logic of cell cycle - Cell growth and regulation-concept of oncogenes etc. in normal and neoplastic cell growth.

UFC C002	Fundamentals of Spectroscopy	C	4	Dr.P. Ramamurthy & New Faculty
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Basic Principles: Electromagnetic radiation, interaction of electromagnetic radiation with matter-absorption, emission, transmission, reflection, refraction, dispersion, polarization and scattering. Uncertainty relation and natural line width and natural line broadening, transition probability, results of the time dependent perturbation theory, transition moment, selection rules, intensity of spectral lines, Born-Oppenheimer approximation, rotational, vibrational and electronic energy level.

2. **Vibrational Spectroscopy:** *Infrared spectroscopy*- harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant, bond strengths, anharmonicity, Morse Potential energy diagram, vibration – rotation spectroscopy, PQR branches, Hookes Law, Selection rules, normal modes of vibration, group frequencies, overtones and hot bands, factors affecting the band positions and intensities. Basics of IR instrumentation.

Raman Spectroscopy: Classical and quantum theories of Raman effect, Pure rotational, vibrational and vibrational-rotational Raman spectra, selection rules, mutual exclusion principle. Resonance Raman Spectroscopy and coherent anti-Stokes Raman Spectroscopy (CARS). Basics Raman instrumentation - Electronic Spectroscopy: Atomic spectroscopy: Energies of atomic orbitals, vector representation of moment and vector coupling, spectra of hydrogen atom and alkali metal atoms - Molecular Spectroscopy: Energy level, molecular orbitals, vibronic transitions, vibrational progressions and geometry of the excited states, Franck-Condon principle, electronic spectra of polyatomic molecules. Absorption laws- Beer-Lambert law, analysis of spectra – chromophore, auxochrome, blue and red shift, solvent effect and charge-transfer spectra. UV-vis spectrophotometer instrumentation - Nuclear Magnetic Resonance Spectroscopy: Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its measurements, factors influencing chemical shift, deshielding, spin-spin interactions, factors influencing coupling constant “J”. C-13, F-19 and P-31 NMR and advantages of FT NMR. NMR in medical diagnostics - X-ray diffraction: Bragg condition, Miller indices, Laue method, Bragg method, Debye-Scherrer method of X-ray structural analysis of crystals, index reflections, identification of unit cells from systematic absences in diffraction pattern. Structure of simple lattices and X-ray intensities, structure factor and its relation to intensity and electronic density. Description of the procedure for an X-ray structure analysis, absolute configuration of molecules, Ramachandran diagram.

UFC C003	Photochemistry and Photophysics	C	4	Dr.P.Ramamurthy & New Faculty
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Photochemistry: EMR, Basic laws, absorption spectrum and electronic transitions, Jablonski diagram, fluorescence, intersystem crossing, phosphorescence, lifetime and quantum yield. Photochemical reactions – electron transfer, proton transfer, addition reactions, elimination reactions, photoisomerisation, photosensitisation, Stern-Volmer equation and analysis. Norrish type reactions. Photochromism, singlet oxygen - Photochemical intermediates: Study using time resolved techniques – pump-probe methods and instrumentation: Lasers-nanosecond, picosecond and femtosecond. Photoionization – Single photon and Multiphoton - Techniques: CW photolysis, photoreactors, light sources, filters, photochemical quantum yield and intensity measurements, detectors-PMT, Diode-array, CCD, ICCD - Fluorescence spectroscopy: Basics and fluorescence-emission spectrum, Stokes’ shift, quenching of fluorescence, fluorescence lifetime, fluorescence quantum yield-method of determination, anisotropy, environmental influence on fluorescence properties and photo-bleaching, FRET, Ultrafast solvation dynamic - Fluorescence Instrumentation: Steady-state fluorimeter. Time-resolved fluorimeter-TCSPC and Frequency domain, ultrafast fluorescence, femto-upconversion. Basics of Fluorescence imaging.

UFC C004	Lasers Theory & Principles	C	4	New Faculty & Guest Faculty
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Radiation in a cavity: Black body radiation – Modes of oscillation – Einstein coefficients – relation between the absorption coefficients and Einstein coefficients – Life time of excited state – Line broadening mechanisms - Interaction of light with matter: Population inversion – Threshold condition-Gain profile – superradiance laser – rate equation for 3 level and 4 level systems – conditions for CW and pulsed laser action. - Optical resonators: General considerations – Laser resonators – Fox and Li theory – Fresnel number. Photon representation of cavity properties of a cavity – plane and spherical mirror cavities – general conditions of stability – lens sequence – matrix treatment of thin lens sequence – confocal resonator – Gaussian beam propagation – multimode oscillation – generacy - Gain and saturation effects: Theory of gain saturation – gain narrowing – effect of gain saturation on modes – power output – single mode operation – mirror transmission and power optimization – hole burning effects – Lamb dip – Gain saturation amplifiers with hole burning and cross relaxation – mode pulling and pushing - Types of Lasers – CW and Pulsed Laser – Theory of Q-switching and experimental methods – Theory of mode locking and experimental methods – cavity dumping - active and passive mode locking – Gas Laser, solid state lasers - Coherence of laser: Spatial and temporal coherence – auto and mutual correlation function – Analytical treatment of visibility.

UFC C005	Practical – I	C	4	New Faculty
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Estimation of Protein - Estimation of DNA - Cell counting using microscope - Recording of absorption and emission spectrum – Calculation of Stokes shift. Fluorescence quantum yield measurement - Polishing of Optics and measurement of surface flatness.- Flash Photolysis - measurement Triplet quantum yield - Laser Flash photolysis – Triplet quenching and Transient absorption spectrum. - Ultrafast Solvation Dynamics - Determination of excited state dipole moment using solvent effect - Stern-Volmer Analysis – Fluorescence quenching constant – Steady State experiments - Fluorescence lifetime measurement - Stern-Volmer Analysis – Fluorescence quenching constant – Life time analysis - Binding of fluorophore with micelle - Binding of fluorophore with DNA.

UFC E001	Fluorescence Spectroscopy for biologists	E	3	Dr.P. Ramamurthy
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Basics and fluorescence-emission spectrum, Stokes' shift, quenching of fluorescence, fluorescence lifetime, fluorescence quantum yield-method of determination, anisotropy, environmental influence on fluorescence properties and instrumentation - Fluorophores (Intrinsic, extrinsic, membrane and protein probes, DNA probes and biochemical sensing probes) Fluorescence quenching (protein accessibility, membrane quenching) Energy transfer- (FRET, protein folding, energy transfer in membranes, biopolymers, energy transfer and DNA hybridization)- protein fluorescence.- Fluorescence sensing- optical clinical chemistry-oxygen sensing-chloride sensors-glucose and ion sensing by energy transfer-optical detection of blood gases- Immunoassays. Fluorescent labels - Fluorescence spectroscopy and DNA technology- imaging techniques, photodynamic therapy-clinical applications of laser. Principles of flow Cytometer, real time PCR, D-HPLC.

UFC C006	Optoelectronics and Fibre Optics	C	3	New Faculty & Guest Faculty
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Photon absorption in semiconductors – Solar energy and solar cells - carrier transport across p-n junction solar cells - Heterojunction solar cells - Schottky barrier and MIS solar cells - Contacts and surface properties: Contact structures - Antireflection coatings - Surface - texturing - Grid design - Etching - Solar cell arrays - Radiation damage on solar cells - The calculation of solar efficiency. Some common and emerging solar cells - Fabrication process and photovoltaic performance of some standard solar cells like Silicon, Gallium arsenide (GaAs), Indium phosphide(InP), Copper indium selenide(CuInSe<sub>2</sub>), Cadmium Telluride (CdTe), Cu<sub>2</sub>S based solar cells and polycrystalline thin film silicon solar cells and amorphous silicon solar cells - Photonic devices: Light Emitting diodes – LED for fiber optics – LED performance – reliability – semiconductor lasers- Edge emitting, vertical cavity surface emitting and distributed feed back laser– Lasers for optical communication system – future trends in Fiber optic communication – photodetectors – photoconductor- photodiode – avalanche photodiode – phototransistor Semiconductor optical amplifiers - *Optical Fibres* Attenuation and dispersion. Chirp, dispersion management. Numerical aperture. Optical time domain reflectometry. Optical transmitters. Optical receivers. Fibre amplifiers: EDFA, PDFA & Raman. Digital systems. Analogue systems. Coherent systems. Public communication network. WDM and Filters: dielectric, AWG and fibre grating devices Nonlinear fibres: SPM, GVD. Fibre optic sensors.

UFC C007	Biological Chemistry	C	3	Dr.P.Ramamurthy & New Faculty
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Metal ions in biology: Essential and trace elements. Sodium and potassium pump. Metal ions in biological processes. - Enzymes and coenzymes: Introduction- Chemical and biological catalysts, properties of enzymes-catalytic power, specificity and regulation. Active site, inhibitors,enzyme kinetics – Michaelis-Menten equation. Enzyme action – mechanism. Ezyme catalysed reactions. Coenzyme: cofactors, prosthetic group. Enzyme Models- host-guest chemistry, biomimetic chemistry, crown ethers, cryptates. Cyclodextrins, calixarenes, ionophores, micells - Bioenergetics: Glucose storage, metal complexes in transmission of energy, chlorophylls, photosystem I and photosystem II. Standard free energy change in biochemical reactions, exergonic and endergonic. Hydrolysis of ATP, synthesis of ATP from ADP - Biopolymers: Biopolymer interactions- electrostatic charges and molecular expansion, hydrophobic and dispersion force interactions. Thermodynamics of biopolymer solutions, osmotic pressure, membrane equilibrium. Biopolymers and their molecular weights, size, shape, hydration - Oxygen transport and electron transfer: Heme proteins, oxygen uptake, structure and function of hemoglobin, myoglobin, hemocyanin and hemerythrin. Structure and function of metallo proteins in electron transport processes – cytochromes and iron-sulphur proteins.

UFC C008	Biophotonics	C	3	Dr.P. Ramamurthy & New Faculty
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Photobiology: Interaction of light with cells, tissues, non-linear optical processes with intense laser beams, photo-induced effects in biological systems - Bio-imaging: Imaging techniques:Microscopy, light microscopy imaging , wide-field, Laser scanning, confocal, multiphoton imaging, fluorescence lifetime imaging, FRET, FRET imaging, Frequency-Domain lifetime imaging. Cellular Imaging, Imaging of soft and hard tissues - Optical diagnostics: Biosensors, fluorescence immunoassay, flow cytometry, Fluorescence correlation spectroscopy, Fluorophores and labeling procedures, biosensors - Optical tweezers and scissors – Laser trapping and dissection for biological manipulation, single molecule biophysics , DNA – protein interactions. Light activated therapy- Low level light therapy and photodynamic therapy. nanotechnology and tissue engineering: Nanoprobes, nems, use of ultrashort pulse lasers for tissue welding, tissue contouring; tissue regeneration.

UFC C009	Practical – II	C	4	New Faculty
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Brewster Angle Determination - Measurement of Spatical and Temporal Coherence - Fraunhofer Diffraction Pattern.- Fourier Filtering Experiments - Acoustical Modulator - Measurement of Numerical Aperture of Optical Fibre - Transversely Pumped Dye Laser - Longitudinally pumped Dye Laser - NLO efficiency measurement - Measurement of Pulsewidth of a pulsed laser- autocorrelation - Laser Doppler velocimetry -Optical Modulation – Fiber Optics communication - Pulsed Laser alignment. - Stimulated Raman Scattering - Stimulated Brillouin Scattering

UFC C010	Seminar	C	1	
UFC E002	Semiconductors & Devices	E	3	New Faculty & Guest Faculty

Introduction: Elementary properties of semiconductors - Types of semiconductors - intrinsic and extrinsic semiconductors - p,n type semiconductors - Doping of semiconductors (High level and Low level) –Electronic band Structure - Electron transport phenomena: Theory of electron transport in crystalline semiconductors - Boltzmann's transport equation for Bloch states - relaxation time - relaxation time approximation to the low field transport coefficients - scattering mechanism - electron scattering by static defects - phonons - high fields effects - hot electron transport theory - Thermal effects in Semiconductors: Thermal conductivity - Thermo-electric power - Thermomagnetic effects - condition of degeneracy - strong magnetic fields - relative magnitudes of the magnetic effects. Methods of determining of characteristic properties of Semiconductors: The minimum energy gap - mobility of electrons and holes - carrier concentration - effective mass - energy levels in the forbidden band due to impurities - thermal methods - optical methods - minority carrier lifetime - injection ratio - Optical properties of semiconductors - Optical constants - Light absorption spectrum - Light absorption edge - Effect of free charge carriers on the absorption edge - Fundamentals of absorption and reflection - Absorption of light by lattice - Light absorption by free charge carriers - Intrinsic light absorber - Photo resistive effect - Demper effect - Photovoltaic effect - Faraday effect - Application of semiconductors: Use of Semiconductors in electrical technology - Rectifiers - Transistors - Photodiode - Photo-electric power generator - Photo cells - Infra-red detectors - Infra-Red and Microwave modulators - Thermopiles - Thermo-electric refrigerators - Thermistors,Varistors and Other non-linear resistor.

UFC C011	Laser Material Processing	C	3	New Faculty/Guest Faculty
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Industrial Laser Systems: Laser beam characteristics – beam focusing effects- focused spot size-power density-high power laser systes – focusing optics – steering optics – mechanisms – overview of industrial lasers – CW, pulsed – Q-switched and mode locked - Thermal process in interaction zone: Depth of penetration with respect to laser energy density – reflectivity of metals with respect to wavelength – Rate of heating and cooling. Maximum temperature and depth of hardened layer. Different gases used during laser material processing – optical regimes in laser material processing – key hole effect - Surface Treatment: Necessity for surface modification – surface cladding –surface alloying – hard facing – shock hardening – Typical laser variables in surface allying – processes variables – beam profiles used in surface alloying – different methods to obtain desired penetration depths – Laser cladding – experimentation- Different modes of laser beam welding – comparison between laser beam and electron beam welding – influence on different parameters – Absorptivity – Welding speed – Focussing conditions – Advantages and limitations of laser welding – Laser welding of industrial materials – Recent developments in laser welding techniques - Laser Cutting and Drilling: Laser energy density for cutting and drilling – Melt fleshing mechanism-different assisting gases and their importance – Advantages of laser cutting – Laser instrumentation for cutting and drilling- Factors affecting cutting rates – Effect of laser pulse energy on diameter and depth of drilled hole.

UFC C012	Photonics Materials	C	3	Dr.P. Ramamurthy & new Faculty
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Semiconductor Physics Band gaps, density of states, materials, optical and electronic properties, carrier generation and recombination, mobility and diffusion, low dimensional structures, quantum wells, wires and dots, heterostructures - Polymers and Liquid-Crystals Conducting polymers, Semiconducting polymers - photoluminescence and electroluminescence. Factors determining efficiency; light-emitting diodes, electroluminescent devices and field effect transistors. Liquid crystals - nematic, smectic and cholesteric phases; director and order-parameter; operation of twisted nematic display - Plasma CVD, photochemical deposition. Epitaxy, interfaces and junctions (advantages/disadvantages of growth methods, of interface quality, interdiffusion and doping. Quantum wells and bandgap engineering (examples of structures). Post-growth processing (patterning by photolithography, contacting, annealing) - Sensors: fluorescent sensors, metal ion sensors, biosensors, luminescent materials - Non-linear optical phenomenon and materials:Principle- SHG, THG, inorganic, organic materials and techniques of property characterization.

UFC C013	Medical Applications of Lasers	C	3	Dr.P. Ramamurthy & Guest faculty
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Fundamentals of Laser – Tissue Interaction: Laser characteristics as applied to medicine and biology – Laser tissue interaction – Photophysical processes – photobiological process- Absorption by biological systems – Different types of interaction – thermal, photochemical (one photon and multiphoton) – Electromechanical – Photoablative process - Laser photobiology and Medical Lasers: Studies of biological functions – microradiation of cells – optical properties tissues (normal and diseased state)-experimental methods to determine the reflectance, absorption, transmittance and emission properties of tissues – Laser systems in medicine and biology – Nd\_YAG, Ar ion, CO<sub>2</sub>, Excimer, N<sub>2</sub>, Gold Vapour Laser – Beam delivery and measuring systems - Thermal Applications: Surgical applications of lasers – sterilization – hermostasis – cancer liver stomach gynecological surgeries – performance evaluation etc. – Laser on ophthalmology – Dermatology – Dentistry - Non-thermal applications: Trace element

detection – Laser induced fluorescence studies – cancer diagnosis- phototherapy of tumors – lasers in endoscopy – lasers in trapping of cells and genetic engineering – biosimulation holographic and speckle application of lasers in biology and medicine -

UFC C014	Project and viva-voce	C	6	All faculty
UFC E003	Crystal growth and Experimental techniques	E	3	New faculty & Guest Faculty

Gel Method: History & Nature of the gel method – Different gel medium - specific gravity - Silica gel - Agar gel - Gelatin gel - poly acrylamide gel - tetra methoxy Silane gel - Tetra Ethoxy Silane gel - Basic growth procedures - Doble Diffusion Technique - Single Diffusion Technique - Reaction Method - Chemical Reduction method - Decomplexing method - Solubility Reduction method - doping - Liquid Phase Epitaxy: Introduction to Epitaxy - Phase equilibria - Basic concept of LPE growth process - Impurity segregation - Substrate surface preparation - Operational consideration - Physical principles of the LPE process - Equilibrium cooling - Step cooling - Super cooling - Two phase solution cooling - Electroepitaxy - Advantages and disadvantages of LPE as a growth technique for device materials - Methods of vapour phase growth – Physical Vapor Transport (PVT) – Physical Vapor Deposition (PVD) – Chemical Vapor Deposition (CVD) – Chemical Vapour Transport (CVT) – reaction types - thermodynamics, kinetics - transport processes - Thermodynamics of Chemical vapor deposition process – physical, thermo – chemical factors affecting growth process - Semiconductor Device Fabrication: Wafer Preparation: Bulk Crystal Growth - Cutting and Polishing - Surface Cleaning - Etching for oxide layer removal - Controlled dissolution of surfaces - Identification for batch processing - Deposition: Deposition processes - Silicon dioxide - Silicon nitride - Other materials - Plasma assisted deposition - Plasma Enhanced Chemical Vapour Deposition (PECVD) - Oxidation: Growth mechanism and kinetics - Oxidation techniques and systems - Oxide properties - Redistribution at interface - Oxidation induced defects.