

SYLLABUS FOR M.Sc. BIOTECHNOLOGY COURSE:

SEMESTER I (THEORY AND PRACTICALS)

THEORY

SEMESTER I

BT 11 Biological Chemistry I

BT 11,1: Physical biochemistry and Biochemical measurements (15L)

Physical interactions: viscosity, diffusion, osmotic pressure surface tension, pH.

Spectroscopy: UV-Vis, Fluorescence

SDS PAGE Electrophoresis: PAGE, isoelectric focussing, 2-D gels, agarose gel.

BT 11,2: Introduction to enzymology, metabolism and Bioenergetics (15L)

Enzymes: classification, catalysis, kinetics, regulation (fine, coarse and metabolic control), reaction mechanisms and immobilization of enzymes. Coenzymes and cofactors. Allosteric proteins

Metabolic pathways: glycolysis, Krebs cycle, pentose phosphate pathways, glycogen metabolism, fatty acids biosynthesis and oxidation, oxidative phosphorylation, decarboxylation, methylation and oxidation.

Thermodynamics in biological systems

Equilibria and energetics

BT 11,3: Biochemistry of macromolecules and building blocks (15L)

Macromolecules in biology, Properties of water

Chemical bonds.

Building blocks of macromolecules: amino acids, purine and pyrimidine bases, fatty acids and sugars, and small molecules of biological importance: vitamins and minerals.

Proteins, carbohydrates and lipids

Organic synthesis

BT 11,4: Central dogma of molecular biology (15L)

Structure and organization of genome: structure of globin, insulin, IgG and rDNA genes, structure and function of chromatin,

DNA replication

Concept of gene, transcription and translation

Post translational modification of protein

BT 12 Cell Biology

BT 12.1: cell structure and Methods in cell biology (1dL)

Cell: structural and functional organization

Ultrastructure and electron microscopy

Chromosomes

Fractionation of subcellular organelles

Cell division and cell cycle.

Microscopy, Morphometry, Cell counting

BT 12.2: electrophysiology, biomembranes and transmembrane signalling (1dL)

Biomembranes and electrophysiology: action potentials, mepp, single channel conductance, liposome.

Cell signaling: Cell surface, Hormone, receptors and signal transduction and second messengers

BT 12.3: Cell dynamics, cell cycle and cell death, transformation (1dL)

Cell dynamics, cytoskeleton and cell surface.

Extracellular matrix

Cell-cell interactions and cell matrix interaction

Cell differentiation, hormones and growth factors

Apoptosis

The transformed cell.

BT 12.4: The Plant cell (1dL)

Plant cell wall - primary and secondary

Plasmodesmata

Plastids - biogenesis, structure and types

Cytosenescence, cytoquiescence

BT 13 Quantitative Methods

BT 13,1: BIOStatistics (15L)

Statistical population, sample from population, random sample

Tabular and graphical presentation

Mean and standard deviation of group and ungrouped data

Probability, relative frequency, probability distribution

Binomial, poisson and normal distribution

Test of significance, test for proportion, means and standard deviations, F and t test, chi-square test for goodness of fit

Theory of errors, errors and residuals, precision, measure of precision, probable error of function, rejection of observation

Methods of averages and least squares

Correlation and linear regression, associated test of significance

Analysis of variance for one and two way classification

Design of experiments, randomization, replication, local control, completely randomized and randomized block design.

Nonparametric tests

BT 13,2: BIOMathematics (15L)

Differential and integral calculus

Derivative and its physical significance, basic rules for differentiation (without derivation) maxim and minima, their applications in chemistry, exact and inexact differentiation with specific emphasis on thermodynamic properties, partial differentiation.

Curve sketching.

Basic rules for integration (without derivations), definite and indefinite integrals, geometric meaning of integration, applications in the biology and chemistry.

Solutions to quadratic and cubic equations

Differential equations

Separable variable, homogeneous, exact and linear equation, equations of second order Applications of differential equations in chemistry.

Determinants evaluations of $n \times n$ determinants, matrices manipulations, simultaneous equations and inversion

Interpolation and polynomial fitting

BT 13,3: Computer languages (15L)

Overview of computers, microcomputers, VDU and printer

What is programming? Algorithms

Languages: Basic/C as options

Handling arrays, procedures

Color, sound and graphics

BT 13,3: Software's and packages (15L)

Use of standard operating systems: MS Dos and Windows

Use of standard packages and softwares: Sigma Plot, Origin, Antivirus (Virus monitoring) packages

PRACTICALS

SEMESTER I:

bt 14 biological chemistry I

BT 14,1: BIOLOGICAL CHEMISTRY I

1. Introduction to measurements: balances and pipetting Preparation of solutions of given normality and its standardisation
2. pH meter: buffering capacity of a buffer, Indicators. To determine the pKa value and hence the dissociation constant of a given acid by using pH meter. Determination of the amount of a α - amino nitrogen by formal titration method
3. Colorimetry: To determine the dissociation constant of a given indicator colorimetrically and to prepare the buffer solutions in the pH range of 7,2 to 8,2

4. Potentiometry: Redox potential of Fe^{+2} and Fe^{+3}

BT 14,2: BIOLOGICAL CHEMISTRY II

1. Conductivity meter: To determine the cell constant of 0,1 M KCl and perform the titration of strong acid vs strong base and to find out equivalent conductance of the salt formed.
2. Quality of water.
3. Viscometry: a) Radius determination: Glycerol molecule b) Molecular weight determination - Proteins and DNA
4. Radioactivity: To determine the half life, average life and decay constant of a given radioactive isotope

BT 14,3 BIOLOGICAL CHEMISTRY III

1. Thin layer chromatography : lipids, mixture of dyes

٢. Spectrophotometry: Double beam and recording spectrophotometry, Derivatives and difference spectra: Indicators, cytochromes , haemoglobin
٣. ELISA Reader and spectrophotometer: Estimation of protein by Lowry, Biuret and Bradford methods, Analysis of Standard curves, linear regression and assessment of ranges and reliability
٤. Spectrophotometry: To find out absorption spectrum of a given chromophore and/or oxidised and reduced forms (sodium nitrite and borohydrate). a) Haemoglobin and Methaemoglobin b) NAD and NADH

BT ١٤,٤ BIOLOGICAL CHEMISTRY IV

١. Enzyme assays β -galactosidase, time, temperature, protein concentration and cofactors.
٢. LDH : Km and Vmax, Various kinetic plots
٣. Use of computer packages for parametric and non-parametric methods and non-linear regression
٤. Liposome : Preparation of Uni and multilamellar vesicles, use of sonication Light scatter and Turbidity correction of multi and unilamellar vesicles

BT ١٤,٥ BIOLOGICAL CHEMISTRY V

١. Introduction to centrifugation
٢. Isolation of chloroplast
٣. Chlorophyll estimation: spectrum and light scatter turbidity correction in chloroplasts
٤. Use of computer for data analysis and spectral changes, difference and derivative spectra

BT ١٤,٦ BIOLOGICAL CHEMISTRY VI

١. Polyacrylamide gel electrophoresis : Native gel
٢. Isozymes and activity staining I
٣. Isozymes and activity staining II
٤. SDS-PAGE of proteins

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bt ١٥ (a) cell biology

BT ١٥,١: CELL BIOLOGY I

١. Microscopy: a) simple, b) compound c) phase contrast microscopes
٢. Cell motility and flagellar staining, Photography and videotaping (motility, morphometry)
٣. Micrometry: Calibration of stage and ocular micrometer and measurement of the given biological sample Haemocytometer: calibration and measurement of biological samples
٤. Electron microscopy : Demonstration and good photographs for interpretation

BT ١٥,٢ CELL BIOLOGY II

١. Blood cells: WBC: types of polymorphs
٢. Demonstration of animal handling for experimental purposes: cervical dislocation, dissection of rat: cardiac puncture, blood sample preparation and its handling, Osmotic fragility of RBC's
٣. Isolation of nuclei and number determination by Haemocytometer
٤. Density gradient: sucrose/percoll.

BT 15,3 CELL BIOLOGY III

1. Embryo development: permanent mounts
2. Developmental studies: chick: developmental stages and Gastrulation
3. Programmed cell death during embryonic development
4. Cell types of plants - maceration of various tissue explants and identification of xylem vessels, tracheids, stomata, root hair etc.

BT 15 (b) QUANTITATIVE METHODS

BT 15,4 BIOSTATISTICS

1. Descriptive statistics: systematic tabular summarisation of data (before analysis), measures of central tendency, measures of dispersion, measures of skewness (using calculators)
2. Correlations (product-moment coefficient, Spearman's rank coefficient) and regression (linear regression, curve fitting)
3. Data presentation (tables/figures): 1-D and 2-D bar charts, pie diagrams, graphs (using computer software packages)
4. Statistical distributions: fitting discrete uniform, binomial, Poisson and normal probability distributions to given data
5. Testing of hypotheses: Tests of significance (mean, Standard Deviation, Correlation coefficient)
6. Chi-squared test for goodness-of-fit, test for independence of attributes, non parametric tests (run test) using calculators and printed tables and computers
7. Sampling (drawing random samples using random number, tables, chits)
8. Computer programs for random number generation), Design of experiments, ANOVA (one-way and two-way)

BT 15,5 BIOMathematics

1. Ratio and proportion
2. Factorial notation, permutation and combination
3. System of algebraic equations (verification of consistency and finding solutions)
4. Round-off error and how to minimise it while evaluating algebraic expression (can be included in computer course)
5. Functions and their graphs, Concept of limit of function
6. Computing area under a curve of regular/arbitrary shape
7. Trigonometry
8. Calculus: i) Differentiation and higher order differentials ii) Application of derivatives iii) Integration: definite and indefinite iv) Differential equations v) Application of integration

BT 15,6 Computer

1. Introduction computers and its peripherals
2. Maintenance of computers using antivirus programs, formatting computers
3. Handling of computers files and folders, Use of Dos commands
4. Introduction to various packages and softwares
5. Use of MS Dos commands , Windows: Word and Excel
6. Introduction to programming languages
7. Basic C programming
8. Advanced C programming

SEMESTER II (THEORY AND PRACTICALS)

BT 21a Biological chemistry II

BT 21,1: Transport Techniques and Theory (15L)

Transport: theory and measurements.

Chromatography: gel permeation, adsorption (ion exchange, affinity), TLC, partition, HPLC, protein purification

Centrifugation and subcellular isolation

Energy transduction: redox enzymes, ATPases and photosynthesis

Radioactivity

Instrumentation, nucleids of use in biology, metabolic labeling, measurement of fluxes

BT 21,2: Advanced techniques in Biochemistry (15L)

IR, NMR, CD, X-ray diffraction

Biochemical structures: proteins, nucleic acids, and lipids

Secondary structure, tertiary structure

Ramachandran plots, structure - function correlations, anatomy of biological macromolecules

Sequencing of proteins and nucleic acids

BT 21b Genetics

BT 21,3: Mendelian Genetics (15L)

Mendelian principles, the concept of the gene, Dominance, multiple allelic systems, gene interaction, mutations, Linkage, diploid

Ploidy mutations deletions

Changes in gene frequency by mutation and selection against recessive allele.

Genetic death

Quantitative inheritance

Population genetics: Hardy-Weinberg law

Inbreeding and heterosis plant improvement, hybridization.

Chromosome alteration and sister chromatid exchanges

Lethals, Detection of genotoxicity,

Assays using cytogenetic analysis in mammalian cells.

In vitro and in vivo, host mediated assay

BT 21,2: Molecular Genetics (15L)

Gene mapping in phages, bacteria

Point mutations,

Isolation of auxotrophs, conditional lethals and suppressor mutations

Control of gene expression in bacteria. Operon concept-lactose, arabinose and tryptophan operons

Genetics of biosynthetic pathways

Transposons in prokaryotes and eukaryotes

Mutagenesis: mutagenic agents, mechanisms of mutagenesis

Expression of mutations- gene mutation

Transformation

Detection of DNA damage at molecular level, Ames test

BT 22 molecular biology

BT22,1: Genome organization and structure (15L)

Organization of viral, prokaryotic and eukaryotic genomes: Cot curves, repetitive and unique sequences, kinetics and sequence complexities, satellite DNA, DNA melting and buoyant density.

Organelle genomes

Rearrangement and amplification of DNA in the genome

BT22,2: DNA Replication DNA repair (15L)

DNA replication models, DNA polymerases - mode of action

DNA damage, DNA repair and recombination.

RNA polymerases and reverse transcriptase: structure and mechanism of action.

Enzymes involved in DNA modifications, methylases, demethylases, DNases, DNA gyrase, Topoisomerase

The concept of template surfaces

Transcriptions, post-transcriptional process and transport of RNA

Regulation of transcription, transcription factors

Organization structures and function of ribonucleoproteins

Protein synthesis: Genetic code, mechanism and regulation of protein synthesis

BT 22,4: MOLECULAR BASIS of development (14L)

Development, Molecular basis of development in animals and plants

Homeobox gene expression and Pattern formation in development

DNA methylation, gene expression, chromosomal inactivation and sex determination

Oncogenes, proto-oncogenes and etiology of cancer

BT 23a General immunology

BT 23,1: General Immunology - I (14L)

Introduction, History, Phylogeny

Immune system overview, innate and acquired immune system

Components of immune system

Structure and function of antibody

Inflammation, opsonization

Primary and secondary lymphoid organs

Complement

B cell, T cell ontogeny

Characteristics of antigen, T cell dependent and independent antigens

Hapten

Hypersensitivity

Primary and Secondary immune responses

Techniques in humoral immunology

BT 23,2 General Immunology - II (16L)

BCR and TCR structure, γ δ TCR

Generation of diversity

MHC I and II gene, polymorphism

Generation of immune response

T helper, T cytotoxic cells

MHC peptide interaction

Antigen presentation, secondary signaling

Immunological disorders

Lymphocyte traffic

Techniques in cellular immunology

Immune response to viral and bacterial lymphoitic infection

BT 23b SEMINARS

PRACTICALS

bt 24 molecular biology

BT 24,1 Molecular biology I

1. Isolation of chromatin: Determination of mononucleosomal size
2. Chromatin gel electrophoresis
3. Endonuclease digestion of nuclei
4. Analysis of DNA fragments by agarose electrophoresis

BT 24,2: Molecular biology II

1. Thermal melting of DNA
2. Isolation of nuclear DNA
3. Gel electrophoresis and detection of nuclear DNA
4. Restriction endonuclease digestions of nuclear DNA

BT 24,3 Molecular biology III

1. Isolation of mitochondrial DNA, agarose gel electrophoresis and detection of modifications
2. Restriction endonuclease digestion and separation of fragment by gel chromatography, density gradient centrifugation and base composition analysis of DNA

٣. Isolation plant genomic DNA, agarose gel electrophoresis and detection of plant DNA
٤. Restriction endonuclease digestions of plant genomic DNA

BT ٢٤,٤ Molecular biology IV

١. Isolation of bacterial DNA
٢. Agarose gel electrophoresis and detection of bacterial DNA
٣. Restriction endonuclease digestions of bacterial DNA
٤. Transformation

BT ٢٤,٥ Molecular biology V

١. Preparation of beads and column packing for cationic exchange chromatography
٢. To find out the capacity and nature of the cationic exchange resin
٣. Preparation of beads and column packing for anionic exchange chromatography
٤. To find out the capacity and nature of the anionic exchange resin

BT ٢٤,٦ Molecular biology VI

١. Gel filtration chromatography: Sepharose
٢. Gel filtration chromatography: Sephadex
٣. DEAE cellulose chromatography of DNA
٤. ٢-D gel electrophoresis of proteins and isoelectrofocusing

bt ٢٥ (a) General immunology

BT ٢٥,١ Immunology I

١. Immunodiffusion
٢. Rocket immunoelectrophoresis
٣. Immunoelectrophoresis
٤. Western blotting

BT ٢٥,٢: Immunology II

١. Interferon induction in cells - isolation and assay
٢. Development of monoclonal antibodies by hybridoma technology
٣. Production of polyclonal antibodies and testing-immunodiffusion, immunoelectrophoresis
٤. Crossed antigen-antibody electrophoresis

BT ٢٥,٣: Immunology III

١. Radioimmunoassay,
٢. Immunofluorescence,
٣. Agglutination, rosette-formation, complement fixation
٤. Antigen-induced T cell proliferation, Generation of cytotoxic T lymphocytes

bt ٢٥ (b) genetics

BT ٢٥,٤ genetics I

١. Cell Division: Mitosis and Meiosis.

٢. Permanent Slides: Polytene chromosomes, grass hopper spermatids and chromosomes
٣. Mutants of Drosophila, mono and dihybrid crosses in Drosophila - Mendel's laws of genetics Sex linkage in Drosophila
٤. Sex linked lethals in Drosophila

BT ٢٥,٥: genetics II

١. Dominant lethals in Drosophila
٢. Sister chromatid exchange in CHO cell line : Control and EMS treated
٣. Use of Drosophila as a model system in genetics: morphology, life history, mutants, culture, sexing pupae for setting up crosses etc.

٤. Study of autosomal gene inheritance, Study of sex linked gene inheritance

BT ٢٥,٦ genetics III

١. Estimating gene frequencies in human population, estimation of heterozygotes frequencies, Pedegree analysis, analysis of human karyotes, chromosomal aberrations
٢. Isolation/identification of auxotroph mutants in bacteria, Recombination in Bacteria
٣. Micronucleus test for detecting genotoxins, study of sister chromatid exchange for genotoxicity study.
٤. AME's test for screening genotoxins

SEMESTER III (THEORY AND PRACTICALS)

BT ٣١ tissue culture (Plant & Animal)

BT٣١,١: Introduction to Tissue Culture Techniques (١٥L)

Introduction to tissue culture: Definition, principle and significance of tissue culture.

Animal tissue culture.

Maintenance of sterility and use of antibiotics, Mycoplasma and viral contaminants

Various systems of tissue culture - their distinguishing features advantages and limitations

Culture medium: Logic of formulation (natural media, synthetic media, and sera)

Methodology: i. Primary culture: Behaviour of cells, properties, utility

ii Explant culture. iii. Suspension culture.

Development of plant tissue culture.

Totipotency of plant cells and its realization *in vitro*

Nutrient media: obligatory and optional constituents.

Incubation systems: static agitated culture systems

BT31,2: Animal Cell Organ Culture (15L)

Cell lines: Definition, development, maintenance and management and Cell adaptation.

Established cell lines: Their characteristic features and utility, Cross contamination hazards

Characteristics of cells in culture:

Contact inhibition, anchorage (in) dependence, cell-cell communication etc, Cell senescence

Cell and tissue response to tropic factors, Culturing of different cells.

Designing of an experiment in tissue culture and response assessment. Significance of various controls

Growth studies: Cell proliferation, cell cycle, mitosis in growing cells

Organ culture: Methods, behaviour of organ explant, and utility of organ culture

Organ transplants. Freeze storing of cells and transport of cultures.

Mass production of biologically important compound

Harvesting of products, purification and assays

Propagation of viruses (viral sensitivity of cell lines)

Cell cloning and cell synchronization

Separation of cell types: Various methods: advantages and limitations; Flow cytometry

Nuclear transplantation, Cell hybridization, Transfection studies

BT31,2: Plant Cell, Tissue and Organ Culture (15L)

Growth and differentiation of cultured cells and tissues

Cytodifferentiation, organogenesis and embryogenesis

In vitro culture: physical, chemical and genotypic factor

Culture systems: organ, callus, cell and protoplast cultures

Assessment of growth and development *in vitro*

Plant Growth Regulators: mode and mechanism of action

Secondary metabolism in cultured cells, increase of secondary metabolite production by suitable media supplements like elicitors, stress factors, precursor

Tissue culture of lower plants, algae, lichens and bryophytes

Genetic and epigenetic variation, spontaneous genetic variation, in vitro variation existing in cell populations or induced by culture conditions.

BT 31, 3: Applications of Tissue Culture (15L)

Commercial applications of animal tissue culture: Tissue culture as a screening system; Cytotoxicity and diagnostic test

Development and preparation of vaccines against infecting organisms

In vitro fertilization and dolly

Mutant cell lines: Significance in biomedical research, identification and isolation of mutants.

Applications of Genetic manipulations

Commercial applications of plant tissue culture:

Mass propagation,

Medicinally important compounds

Screening of cell lines for novel variations: disease resistant, stress tolerant

Transgenic plants

BT 32a Microbiology

BT 32, 1: General Microbiology (15L)

Distribution, classification and life cycles of bacteria, fungi, anaerobes, cyanobacteria protozoa and others.

Growth kinetics,

Cultivation, propagation and preservation

Handling pathogens

Sterilization

Antibiotics, drug resistance, MDR.

BT 32, 2: Applied microbiology and Diagnostics (15L)

Nutrients and energetics Biomass, Y (ATP) and maintenance energy.

Microbiology for public health: mycobacteria, enterobacteria, and protozoa

Anaerobes, soil bacteria, agrobacterium nitrogen fixation

Extremophiles

Industrially important microbes secondary metabolites, biotransformations, ethanol production

Microscopic identifications, immuno probe tests, PCR application in diagnostic microbiology

BT 32b Virology

BT 32,3: General Virology (15L)

Distribution, classification and modes of propagation: animal, plant and bacterial phages

Morphology and Ultrastructure

Viral replication: Nucleic acid and protein synthesis

DNA viruses: Herpes, pox, adenoviruses, SV40

RNA viruses: Measles, rabies, polio and influenza

Retroviruses: Structure, life cycles, transformations and viral genome infrastructure

Bacteriophages: Lambda phage, lytic cycle, lysogeny and transduction

Bacteriophages mu, T3, T4, M13

Plant viruses: tobacco mosaic virus

BT 32,4: Applied Virology and Diagnostics (15L)

Antivirals

Response to viral infections: slow and persistent infections, interferon

Cell transformations

Viral diagnostics – immuno diagnostics, molecular diagnostics

Viral vectors – gene delivery, viral vaccines

BT 33 genetic engineering

BT33,1: Basics of genetic engineering (15L)

General introduction and concept

DNA modifying enzymes and restriction enzymes for GE

Vectors in gene cloning

Transformation and Transfection

cDNA and genomic DNA cloning and characterization

DNA sequencing techniques

BT 33,3: Expression systems in genetic engineering (15L)

Various expression vectors in bacteria and eukaryotes

Induced expression

Chimeric constructs

Expression of industrially important products

BT 33,3: Applications of genetic engineering to medicine and agriculture (15L)

Concept

Genetic diseases

Detection and Diagnosis

Gene therapy

DNA marker technology in plants

DNA fingerprinting

Genetically engineered biotherapeutics and vaccines and their manufacturing

Transgenic plants

BT 33,3: Bioinformatics in gene and protein analysis, IPR and patents, biosafety regulations (15L)

Concept on data base in Protein and nucleic acids

Various programmes for sequence comparison and analysis

Human genome sequences

Molecular modeling and structure function relationship

Proteomics

General concept of patenting

International and Indian Scenario, WTO

Evolution of patenting system

Biosafety regulation and practices in genetic engineering research

Designing of manufacturing area

DCI requirements

PRACTICALS

bt 34 tissue culture (Animal & plant)

BT 34,1: Tissue culture techniques I

1. Acquaintance with tissue culture laboratory, Culture place: culture cubicals P1 to P4; Laminar flowsystem
2. Preparatory techniques: Washing of glassware, dry and steam sterilisation. Maintenance of aseptic conditions, Sterilisation techniques, Preparation of culture media, Media preparation: Filter sterilisation, Sterility tests, and media storage. Serum inactivation
3. Short term cultures. a. Primary culture of cells b. Organ culture
4. Staining of cell cultures and observations under microscope

BT 34,2: Tissue culture techniques II

1. Growth studies. Cell count, protein estimation, mitotic index
2. Development and maintenance of a cell line
3. Karyotyping
4. Virus propagation in cells, cytopathogenic response of cells to viruses

BT 34,3: Tissue culture techniques III

1. In vitro assay of drugs, predictive test for anticancer drugs
2. Staining and screening of cells /sera for mycoplasma, viruses
3. Cell cloning by single cell dilution method, Freeze storing and revival of cultured cells
4. Clonogenic assay, Cell-cell interaction: Co-culture of normal and mutant cells, cell cloning by single cell dilution method
5. Cell synchronization (determination of mitotic index and cell cycle time), LDH isozyme analysis of the given cell lines

BT 34,4: Tissue culture techniques IV

1. Purification of a product secreted by a functional cell line, Estimation of hormones secreted by a hormone - secreting cell line
2. Cell hybridization
3. Immunohistochemical staining (oncogene expression)
4. Transplantations: tumors, organs, cells

BT 34,5: Tissue culture techniques V

1. Introduction to plant tissue culture techniques: Surface sterilisation techniques, media preparation

2. Role of additives on various explant cultures
3. Effect of plant growth regulators on various explants for callus induction, cell suspension culture, growth analysis, cell plating efficiency
4. Organogenesis and Somatic embryogenesis

BT 34,6: Tissue culture techniques VI

1. Shoot tip and nodal sector culture

2. Anther culture
3. Embryo culture
4. Endosperm culture

bt 35 (a) microbiology & virology

BT 35,1 Microbiology I

1. Cleanliness, media preparation, sterilisation, culturing methods, dilution technique, and isolation of pure culture- techniques
2. Staining techniques in microbiology i) simple staining ii) negative staining iii) positive staining iv) spore staining v) capsule staining and identification.
3. Culture characteristics of microbes, identification of unknown bacteria by biochemical tests
4. Bacterial growth curve - serial dilution plating and turbidity measurement

BT 35,2 Microbiology II

1. Competent cell preparation , replica plating
2. Extracellular enzymatic activities of microbes, immobilization of *Saccharomyces cerevisiae* and alcohol
3. Standard qualitative analysis of water
4. Antibiotic sensitivity test, LD₅₀, Potency of drug/antibiotics and biotransformations

BT 35,3 Virology

1. Electron microscopic observations of ultrastructure of animal viruses
2. Propagation of viruses in animals/tissue culture/embryonated eggs and preparation of virus
3. Plaque/Focus formation assay of animal viruses and/or Animal cell transfection by viruses
4. Microtitration - Haemagglutination technique, Immunodiffusion, immunoelectrophoresis, radioimmunoassay and ELISA

bt 35 (b) genetic engineering

BT 35,4 GENETIC ENGINEERING I

1. Isolation of plasmid DNA- i) miniprep preparation ii) large scale isolation
2. *In vitro* DNA ligation, transformation of *E.coli*
3. Characterisation of transformants: DNA gel electrophoresis, Restriction map analysis
4. Southern blot analysis

BT 35,5 GENETIC ENGINEERING II

1. Isolation of cytoplasmic RNA
2. Electrophoresis of RNA on denaturing gels.

- 3. Separation of poly A⁺ RNA on oligo-dT column
- 4. Northern and dot blotting technique.
- 5. cDNA synthesis and cloning

BT 34,3: GENETIC ENGINEERING III

- 1. *In situ* detection of RNA in embryos/tissue
- 2. Sequencing and computer analysis
- 3. *In vitro* translation
- 4. PCR/ RFLP technique

SEMESTER IV (THEORY AND PRACTICALS)

bt 41 Molecular biophysics

BT 41,1: PROTEIN STRUCTURE AND MODELLING (15L)

Prediction of secondary structures of proteins and polypeptides

Molecular model building - using space filling CPK models and using computer graphics

Analysis of protein sequence

Study of sequence homology of proteins and generation of phylogenetic trees

BT 41,2: Conformation and Structure OF PROTEIN (15L)

Conformation of proteins-conformational energy calculations

Structure function relationship-conformation of active site

Interaction of water with proteins, interaction of substrate and drug with proteins

BT 41,3: Structural Biology OF PROTEIN (15L)

Crystal structure data, Protein Crystallography

Structure of fibrous proteins - collagen, silk, keratin etc. and fiber diffraction studies

BT 41,4: Solution Studies (15L)

Application of NMR spectroscopy to determine structure of proteins and nucleic acids

2D NMR. (COSY, NOSEY, SECSY techniques) Nuclear Overhauser effect and its application in biopolymer structure determination.

Application of fluorescence spectroscopy in biopolymer structure determination.

BT 42 Membrane biophysics and bioenergetics (optional)

BT 42,1 PHYSICAL BIOCHEMISTRY and THERMODYNAMICS (15L)

Classical thermodynamics: state functions, enthalpy, entropy, free energy, interconversion of energy, first second law.

Classical physics and physical chemistry in relation to pH, oxidation-reduction, elasticity diffusion, colligative properties, adsorption, activity vs. concentration, basics of electrochemistry.

Irreversible thermodynamics; onsagar matrix, coupling, open systems, equilibrium and far from equilibrium conditions

BT 42,2 MODELS OF BIOMEMBRANES AND ENERGY TRANSDUCTION

Membrane models; biological and physical models.

Energetics and transduction phenomena; biochemical models, chemiosmotic hypothesis of Mitchell

BT 42,2 MODELS IN energetics TRANSPORT AND growth (1.5L)

Energetics of transport: Diffusion, passive and active transport, physical and kinetic models.

Membranes and microbial growth; Linear and non-linear models

Molecular basis of enzyme catalysis, protein dynamics

BT 42,4 TECHNIQUES AND APPLICATIONS (1.5L)

Measurement techniques: polarography, manometry, ion-specific electrodes, difference and derivative spectroscopy, fluorescence spectroscopy, microscopy and fast kinetics.

BT 42 biochemical engineering

BT43,1: THEORY AND DESIGN OF BIOREACTIONS (1.5L)

Mathematical aspects of enzyme reactions and bio-reactors

Simulation of reaction kinetics and reactors

Construction and design of bioreactors

Scaling up of processes

BT43,2: BIOSEPARATIONS (1.5L)

Bio-separations: solid-liquid separation (filtration, centrifugation, membrane, flocculation), extraction, concentration (reverse osmosis, ultrafiltration), drying, instrumentation (GC/HPLC).

Basic Control theory

Immobilized enzymes

Energetics and irreversible thermodynamics

BT 43,3: TRANSPORT AND PROCESS CONTROL (1ΔL)

Transport phenomena in biochemical engineering: mass transfer, heat transfer, mixing, rheology

BT 43,4: MANAGEMENT PRACTICES (1ΔL)

Waste treatment

Costing and economics

BT 44 plant biotechnology

BT 44,1: Plant Tissue Culture in plant propagation (optional) (1ΔL)

Somaclonal variation: applications and limitations.

Exploitation for selecting superior phenotypes - disease resistant, stress tolerant, high secondary metabolite producing. Screening procedures.

Micropropagation - Seed versus soma, use of Micropropagation in multiplication of specific genotypes, rare and/or improved varieties, endangered species. Disease elimination.

Morphogenesis, regeneration of plantlets, multiplication of plantlets, rooting.

Hardening of micropropagated plants and their transfer to soil, Micropropagation methods for the following category of plants (one example for each category) (a) Floriculture (b) Horticulture (c) Medicinal and ornamental plants (d) Cereal, pulse, oilseed and fiber crops (e) Forest trees, fruit trees.

Problems in propagating trees namely systemic contaminants, phenolic leaching, seasonal variation in response, genotypic recalcitrance

BT 44,2: advances in Plant Biotechnology and Genetic MANIPULATIONS (optional) (1ΔL)

Commercial production of tissue cultured plants- (i) Technology transfer, equipment and procedures (ii) Aseptic techniques and control of contamination in a commercial laboratory, quarantine, pathological indexing, packaging, cost analysis, marketing

Somatic embryogenesis system and artificial seed production

Commercial production of secondary metabolites using cell cultures- Use of bioreactors, immobilized cells. Biotransformations. Applications and limitations

Cryopreservation and ex situ conservation of germplasm

Genetic improvement of plants through tissue culture- comparison with classical methods

- a. Transgenic plants, antisense RNAs, tissue specific sequences, elimination of plant viruses
- b. Homozygous plant production through anther, ovule, pollen cultures
- c. In vitro pollination and fertilization, embryo rescue endosperm culture and production of seedless plants
- d. Protoplast culture and its use in genetic improvement: (i) Somatic hybridization, cybrids: limitations (ii) Micromanipulation of genes using protoplasts

Genetic engineering in plant biotechnology

BT 4& immunotechnology

BT 4&,1: Molecular Immunology (1&L)

Cytokines

T cell education

Affinity maturation

Immunological Memory

Cell-cell interaction, signal transduction

Development of tolerance

Characteristics of T helper and TCTL and B cell peptide

Transplant immunology

Bone marrow chimera

Auto immunity molecular mimicry, Therapy

Monoclonal antibody

Techniques in molecular immunology

Network theory

BT 4&,2: Immunotechnology (1&L)

Animal models and transgenic animal and their use in immunology

Experimental immunology

Vaccine development

Stem cell technology

Molecular modeling and Bioinformatics

Chimeric antibodies, phage display, antibody engineering

Large scale manufacture of antibodies

Manufacturing of immuno diagnostics

Recombinant vaccines, combined vaccines, polyvalent vaccines

BT 44 biological macromolecules

BT 44.1: Synthesis and interaction of Biological Macromolecules (15L)

Synthesis of oligonucleotides

Synthesis of oligopeptides

Interaction of nucleic acids with drugs and metal ions

Structure and synthesis of polysaccharides: principles and applications.

BT 44.2 Macromolecule Structure (15L)

Physical probes for molecular properties: EM and TEM Microscopy in structure determination and biological macromolecules and complexes such as DNA, DNA-RNA hybrids, nucleoproteins, protein aggregates, viruses etc.

Separation techniques: analytical, ultracentrifuge.

PRACTICALS

BT 44 AS PER THEORY

BT 44.1 MOLECULAR BIOPHYSICS I

1. PC Modelling
2. TAMS (Teaching Aids for Molecular Structures)
3. Protein sequence homology: Fasta, Align, LAlign
4. Generation of phylogenetic tree: ClustalW

BT 44.2 MOLECULAR BIOPHYSICS II

1. Energy Optimisation techniques I: i) Golden section method ii) parabolic interpolation method iii) steepest descent
2. Energy Optimisation techniques II: i) conjugate gradient ii) Newton Raphson iii) genetic algorithm
3. Programming and use of DTMM
4. Use of Tinker for membrane proteins studies

BT 44.3 MOLECULAR BIOPHYSICS III

१. Molecular modelling
२. Use of Qbasic and Programming in C for structural analysis
३. Construction of long chain proteins I: i) conversion of internal co-ordinates of a molecule to cartesian co-ordinates
- ॴ. Construction of long chain proteins II: i) from cartesian co-ordinates to internal co-ordinates i) fourth atom fixation

BT ॣ१,ॣ MOLECULAR BIOPHYSICS IV

१. Simulation of spectroscopic data and analysis of spectra
२. Curve fitting and interpretation of real data
३. Enzyme kinetics, various models, mechanisms and simulation
- ॴ. Molecular models

BT ॣ१,। Membrane Biophysics and BIOENERGETICS I

१. Photosynthesis: palak/ pea leaves as source material: Isolation of chloroplasts and chlorophyll and carotene estimation
२. Intactness of chloroplasts and rate of oxygen evolution of uptake by Hansatech Oxygen Assembly
३. Washed thylakoid preparation from frozen chloroplasts and study chlorophyll protein complexes by PAGE
- ॴ. Leaf fluorescence measurement by Modulated fluorescence unit, Effect of DCMU

BT ॣ१,ॣ Membrane Biophysics and BIOENERGETICS II

१. Mitochondria from rat liver/raddish: i) Isolation of mitochondria and submitochondrial fraction and Measurement of P/O ratio
२. Assays of different complexes by Gilson Oxygraph / Hansatech Oxygen electrode assembly
३. Growth curve and respiration in micro-organisms : *E. coli* C^{१०}/K-१२ i) Preparation of medium and preinoculum ii) Growth curve by spectrophotometry
- ॴ. Respiration studies in *E. coli* by Gilson Oxygraph : Effect of glucose on respiration

BT ॣ१,१ Membrane Biophysics and BIOENERGETICS III

१. Liposomes preparation and osmometry
२. Liposomes/Artificial membranes/ protein : lipid mixture/BSA/Ovalbumin : i) Fluorescence anisotropy and polarisation measurement ii) Protein tryptophan fluorescence measurement
३. Erythrocyte : i) Erythrocyte preparation, haemoglobin content and osmotic fragility, Ionophore effect on erythrocytes
- ॴ. Detergent mediated lysis of erythrocytes

BT ॣ१,। Membrane Biophysics and BIOENERGETICS IV

१. Analysis of membrane proteins (PDB)
२. Interpretation of data analysis and its significance
३. Determination of surface charge density on biological membranes
- ॴ. Interpretation of calculated data and its significance

BT ॣ१,१ PLANT BIOTECHNOLOGY

१. Protoplast isolation, culture and fusion
२. Transformation by Agrobacterium-based vector systems and regeneration
३. *In vitro* secondary metabolite production

٤. Encapsulation of somatic embryos

BT ٢٧,١٠ Conformation of Biopolymers and Biological Macromolecules

١. Oligonucleotides: i) synthesis ii) characterisation and separation by HPLC and chromatography technique: DEMO
٢. Peptide synthesis: DEMO
٣. Fluorescence Spectroscopy –drug and nucleic acid interaction DEMO
٤. NMR spectroscopy: DEMO
٥. CD spectroscopy: DEMO
٦. Conformation of biopolymers I: i) Molecular modelling of peptide models ii) Construction of Ramachandran Plots iii) Calculations of helical parameters
٧. Conformation of biopolymers II: i) Energy calculations a) potential energy functions b) non-bonding energy (i) Lenard Jones Potential (ii) Buckingham Potential, c) electrostatic energy d) Torsion energy e) H- bonding energy f) solvent solute interaction
٨. Conformation of biopolymers III: Construction of energy maps of model peptides

BT ٢٧,١١ Biochemical engineering / Enzyme Technology

١. Simulations, Factorial design
٢. Fermentation- batch Fermentation-continuous
٣. Micro-filtration
٤. Ultrafiltration pH stat, dissolved oxygen
٥. Immobilisation of enzymes
٦. Sensors-measurement and characterisation Extraction methods

Bachelor Of Business Administration [BBA]

First Semester			Second Semester		
Course	Title	Credit	Course	Title	Credit
BB٠١	Marketing	٢	BB٠٧	Management Information System	٢
BB٠٢	Organisation & Behaviour	٢	BB٠٨	Legal Regulatory Framework	٢
BB٠٣	Organisation, Competition & Environment	٢	BB٠٩	Business Strategy	٢
BB٠٤	communication Skills In English Language	٢	BB١٠	Quantitative Techniques In Business	٢
BB٠٥	computer Fundamentals	٢	BB١١	Managing Financial Resources	٢
BB٠٦	Financial Accounting	٢	Total Credits		٣٢
Total Credits					
١٦					
Third Semester			Fourth Semester		

Course	Title	Credit	Course	Title	Credit
BB१२	Management Accountancy	५	BB११	Financial Reporting	२
BB१३	Financial System & Auditing	५	BB१४	Human Resource Management	२
BB१५	Introduction To Internet	५	BB१५	Taxation	५
BB१॥	Quality Management	२	BB२०	Managing Information	५
BB१५	Small Business Management	२	BB२१	Production & Operation Management	५
		Total Credits			Total Credits
		५४			५५

Fifth Semester			Sixth Semester		
Course	Title	Credit	Course	Title	Credit
BB२२	Capital & Money Market	५	BB२१	Cross-Culture Aspects Of Business	५
BB२३	Multinational & Their Roles	५	BB२४	Entrepreneurship Development	५
BB२५	Introduction To International Marketing	५	BB२५	Economic Reforms Process In India	५
BB२॥	E-Commerce	२	BB३०	Role Of International Financial Institutions	२
BB२५	Introduction To Technology Management	२	BB३१	Management Development	२
		Total Credits			Total Credits
		४०			३५

University and internal assessment will be completed at the Study Centre.

Third Semester			Fourth Semester		
Course	Title	Credit	Course	Title	Credit
MI13	Management Information System (MIS)	4	MI19	E-CRM & Supply Chain Management	4
MI14	E-Business & IT Law	4	MI20	International Business	4
MI15	Conflict Management & Negotiation Skills	2	MI21	Enterprise Resource Planning	4
MI16	Software Project Management	2	MI22	New Technologies	2
MI17	Website Management & Design	2	MI23	Project	2
MI18	Data Warehousing and Data Mining	2	Total Credits		64
Total Credits		48			

Master Of Business Administration [MBA]

First Semester			Second Semester		
Course	Title	Credit	Course	Title	Credit
MB01	Management process and Organization Behavior	4	MB08	Strategic Technology Management	4
MB02	Internet Application	2	MB09	Management of echnology transfer, absorption and IPR	2
MB03	Marketing Management	2	MB10	Business Process, Re-Engineering	2
MB04	Human Resource Management	2	MB11	Enterprise Resource Planning	2
MB05	Operation Management	2		E-Customer Relationship	
MB06	Financial Management	2	MB12	Management and Supply Chain Management	2
MB07	Management Information System	2	MB13	Conflict Management & Negotiation Skill	2
		16	MB14	History of Management: Case Study	2
		Total Credits			Total Credits

Lateral entry to the second Semester of MBA (First Level)

Eligibility:

1. Successful completion of BBA / BBM / equivalent from recognized University OR
2. Graduate in any discipline with 6 months management diploma from an institution and minimum 1 year managerial / supervisory experience in good organization. OR
3. Graduate in any discipline and min 3 year managerial / supervisory experience in reputed organization.

Additional fees: In addition to the normal fees, an additional lateral entry fee of Rs2500/- (including examination fees) is payable by the students opting for this Scheme.

Note: In this Lateral Entry Scheme, students have to

appear and pass the first semester examination. Book of first semester will be supplied by the University and internal assessment will be completed at the Study Centre.

Third Semester			Fourth Semester		
Course	Title	Credit	Course	Title	Credit
MB15	Infrastructure Management	2	MB20	MB20 Elective *	8
MB16	Fundamentals of Infrastructure Project Financing	4	MB21	Project	8
MB17	India Infrastructure Development, Policy planning	2	Total Credits		16
MB18	Project Management	4	Under elective, student can go for the following combinations:		
MB19	Decision Support Systems	4	<ul style="list-style-type: none"> Group 1: Finance: 4 Credits, Marketing: 4 Credits Group 2: System: 4 Credits, Marketing: 4 Credits Group 3: HRD: 4 Credits, Marketing: 4 Credits 		
		Total Credits	16		

Master Of Science In Information Technology [MScIT]

First Semester			Second Semester		
Course	Title	Credit	Course	Title	Credit
DT01	Basics of Information Technology	1	MT06	Object Oriented Programming	2
DT02	Window Based Application	3	MT07	Java Programming	4
DT03	Introduction to Database with Access	4	MT08	Oracle/Developer 2000	4
DT04	communication Skills In English Language	4	MT09	Visual Basics	4
DT05	Business Applications of IT	4	MT10	Project	2
		Total Credits			Total Credits
		16			22

Lateral entry to the Second Semester of MScIT (First Level)

Eligibility:

1. Successful completion of Graduation and six months computer course / Diploma in IT field from technical board OR

2. A 3 year Diploma from the State board of Technical Education after PUC/Higher Secondary and at least Two years experience in an IT related organization thereafter.

Additional fees: In addition to the normal fees, an additional lateral entry fee of Rs 2500/- (including examination fees) is payable by the students opting under this Scheme.

Note: In this Lateral Entry Scheme, students have to appear and pass the first semester examination. Books of first semester will be supplied by the University and internal assessment will be completed at the Study Centre.

Exemption: Candidates who have secured DIT from MAHE or SMU are not required to appear for First semester examination and need not pay lateral entry fees.

Third Semester			Fourth Semester		
Course	Title	Credit	Course	Title	Credit
MT11	Basic Electronics for Telecom	2	MT18	VC++	4
MT12	Principles of Network	2		Advanced	
MT13	Digital Telecom	2	MT19	Internet	4
		2		Programming	
MT14	Broad Band Communication		MT20	Client Server	4
MT15	Wireless Mobile Communication	2		Architecture	
MT16	Software Engineering	4	MT21	Project	4
MT17	Mathematics for Telecommunication	2			
				Total Credits	64

Total Credits **५८**

Lateral Entry to the Third Semester of MScIT (Second Level)

Eligibility:

१. Successful completion of BScIT / BCA / BSC (Computer Science) / BE / B Tech or equivalent OR
२. Graduation (any discipline) with PGDCA/PGDIT or equivalent from a recognized university / Successful completion of A level course from DOECC after Graduation OR
३. Graduation (any discipline) with २ years Diploma from CMC / ET&T / NIIT/APTECH/२ years Advanced Diploma in IT from Center for Electronic Design & Technology of India (CEDIT).

Additional fees: In addition to the normal fees, an additional lateral entry fee of Rs २५००/- (including examination fees) is payable by the students opting under this Scheme.

Note: In this Lateral Entry Scheme, students have to appear and pass the second semester examination. Books of second semester will be supplied by the University and internal assessment will be completed at the Study Centre.

Exemption: Candidates who have secured BIT from MAHE or BScIT from SMU are not required to appear for second semester examination and need not pay lateral entry fees.

Fifth Semester			Sixth Semester		
Course	Title	Credit	Course	Title	Credit
MT२२	Data Warehousing & Data Mining	५	MT२६	IT and Law	५
MT२३	E-Business	५		Advanced	
MT२५	Advanced Applications in IT in Compression Imaging	५	MT२७	Internet Programming	५
MT२५	Project	५	MT२८	Electives	५
			MT२९	Project	५
Total Credits		८०	Total Credits		९५

Master Of Science In Bio-Informatics [MScBI]

First Semester			Second Semester		
Course	Title	Credit	Course	Title	Credit
BI.1	Computer Basics	4		Computational	
BI.2	Linux	2	BI.6	method for Sequence Analysis	2
BI.3	Biological Systems and Bioinformatics	4	BI.7	Biological data banks and Analysis	4
BI.4	Database for Bio-Information & Computing	4	BI.8	Object Oriented Programming (OOPS)	2
BI.5	Statistics and Probability	2	BI.9	Perl for Bioinformatics	2
Total Credits		16		Introduction to Database system (Oracle 9i and Distributed Database)	2
			BI.10	Visual Basic	2
			BI.11	Project	2
			Total Credits		22

Lateral entry to the Second Semester of MScBI/PGDBI (First Level)

Eligibility:

1. Graduate in Microbiology or Biochemistry and six months diploma in Bio Informatics.

Additional fees: In addition to the normal fees, an additional lateral entry fee of Rs 2500/- (including

Note: In this Lateral Entry Scheme, students have to appear and pass the first semester examination. Books of first semester will be supplied by the University and internal assessment will be completed at the Study Centre.

Master Of Science In Computer Science [MScCS]

First Semester			Second Semester		
Course	Title	Credit	Course	Title	Credit
MC-1	Window Based Application	4	MC-6	Computational Techniques	2

MC०२	Internet	२
MC०३	Communication skills in English	२
MC०४	Mathematics and Statistics	४
MC०५	Discrete Mathematics and Digital system	४
Total Credits		१६

MC०७	Programming concepts and Object oriented programming	४
MC०८	Data and File structure	२
MC०९	Computer Organization and Architecture	२
MC१०	Information systems, Assemblers and Compilers	४
MC११	Operating system	२
Total Credits		३२

Lateral entry to the Second Semester of MCA (First Level)

Eligibility:

१. Successful completion of Graduation and six months computer course / Diploma in IT field from technical board **OR**

२. A ३ year Diploma from the State board of Technical Education after PUC/Higher Secondary and at least Two years experience in an IT related organization thereafter.

Additional fees: In addition to the normal fees, an additional lateral entry fee of Rs २५००/- (including examination fees) is payable by the students opting under this Scheme.

Note: In this Lateral Entry Scheme, students have to appear and pass the first semester examination. Books of first semester will be supplied by the University and internal assessment will be completed at the Study Centre.

Third Semester		
Course	Title	Credit
MC१२	Database Management and Oracle	४

MC13	Visual Basic	2
MC14	Computer Graphics	2
MC15	Computer Networks	2
MC16	Microprocessor Application	2
MC17	Algorithm & Algorithmic Graph Theory	4
Total Credits		18

Lateral Entry to Third semester of MCA (Second Level)

Eligibility: Graduation (any discipline) with PGDCA / PGDIT or equivalent from a recognized university / Successful completion of A level course from DOECC after Graduation. OR

Additional fees: In addition to the normal fees, an additional lateral entry fee of Rs 2500/- (including examination fees) is payable by the students opting under this Scheme.

Note: In this Lateral Entry Scheme, students have to appear and pass the second semester examination. Books of second semester will be supplied by the University and internal assessment will be completed at the Study Centre.

Bachelor of Computer Application [BCA]

First Semester			Second Semester		
Course	Title	Credit	Course	Title	Credit
BC01	Fundamentals of Computer Application	4	BC06	Computer Organization and Architecture	2
BC02	Mathematics	4	BC07	Data Base Management	2
BC03	Communication	4	BC08	Discrete	4

	Skills in English	
BC०५	Internet and Multimedia	२
BC०७	C Programming	२
	Total Credits	१५

	Mathematics	
BC०६	Object Oriented Programming (C++)	५
BC१०	Data & File Structure	५
	Total Credits	३२

Third Semester		
Course	Title	Credit
BC११	Linux	५
BC१२	Assemblers and Compilers	२
BC१३	Visual Basic .Net	२
BC१५	Oracle Ai and Distributed Database	५
BC१७	Accounting and Financial Management	५
	Total Credits	५४

Fourth Semester		
Course	Title	Credit
BC१५	Java Programming	५
BC१७	Web Site Management and Design	५
BC१८	Management Process & Organization Behavior	२
BC१९	Software Management and Quality Assurance	२
BC२०	VC++	५
	Total Credits	१५

Fifth Semester		
Course	Title	Credit
BC२१	Understanding PC Components and Preventive Maintenance	५
BC२२	Installing and Configuring Windows २०००	५
BC२३	Computational Numeric Analysis	२
BC२५	Operating System	२

Sixth Semester		
Course	Title	Credit
BC२५	Network Topology and Protocol	२
BC२७	Data Ware Housing and Data Mining	२
BC२८	Algorithm	५
BC२९	Artificial Intelligence	२
BC३०	Geographic Information Systems	२

BC२५	Markup Language and C# Programming	५	BC३१	Project	५
Total Credits		१०	Total Credits		१५

Master Of Commerce in Information Systems [MComIS]

First Semester			Second Semester		
Course	Title	Credit	Course	Title	Credit
MM०१	Management Process & Organization Behavior	५	MM०६	Database Management	५
MM०२	Economic Analysis (Production & Pricing)	५	MM०७	Financial Management	५
MM०३	Management Accounting	५	MM०८	Fundamentals of E-Business & C Programming	५
MM०४	Fundamentals of Computer Applications	५	MM०९	Economics of Business Growth	५
MM०५	Business Environment	५	MM१०	Visual Basic	५
Total Credits		१५	Total Credits		३५

Lateral entry to the Second Semester of MCom. I.S (First Level)

Eligibility: १. Graduate (any discipline) with atleast ३ years of experience in banking / Finance / Insurance / Accounting sector thereafter.

Additional fees: In addition to the normal fees, an additional lateral entry fee of Rs ५५००/- (including examination fees) is payable by the students opting under this Scheme.

Note: In this Lateral Entry Scheme, students have to appear and pass the first semester examination. Books of first semester will be supplied by the University and internal assessment will be completed at the Study Centre.

Third Semester		
Course	Title	Credit
MM11	Accounting Theory (New standards)	4
MM12	Secured E-Commerce transaction & Object Oriented Programming	4
MM13	Electronic Banking & Transactions	4
MM14	Business Policy	2
MM15	Company Law & New Regulatory Mechanics of Business	2
Total Credits		18

Fourth Semester		
Course	Title	Credit
MM16	International Business and Accounting	4
MM17	Information System Audits & Control	2
MM18	Business Data Communication	2
MM19	Elective * (Any Two)	8
Total Credits		16

Bachelor Of Commerce in Information Systems [BComIS]

First Semester			Second Semester		
Course	Title	Credit	Course	Title	Credit
BM०१	Financial Accounting	५	BM०६	Eco System & Micro Economics	५
BM०२	Modern Indian / Foreign Language	५	BM०७	Office Management & Secretarial Practice	५
BM०३	Mathematics and Statistics	५	BM०८	Programming in C & C++	५
BM०५	Business Organisation and Management	२	BM०९	Marketing Management	५
BM०५	Basic Computer Application	२	Total Credits		३२
Total Credits		१६			

Third Semester			Fourth Semester		
Course	Title	Credit	Course	Title	Credit
BM१०	Economics: Macro	५	BM१५	E-Commerce and Application Package	५
BM११	Business Law	५	BM१५	Audits & Business Taxation	५
BM१२	Database Management & Oracle	५	BM१६	Management & Cost Accounting	५
BM१३	Advanced Accounting	५	BM१७	Secured e-Transaction	२
Total Credits		५८	BM१८	Human Resources Management	२
			Total Credits		६५

Fifth Semester			Sixth Semester		
Course	Title	Credit	Course	Title	Credit
BM१९	Management Information System	२	BM२५	Small Business Management & Entrepreneurship	५
BM२०	Electronic Banking	२			

BM ²¹	Financial Management	4
BM ²²	Financial Services in India	4
BM ²³	Capital & Money Market	4
Total Credits		12

BM ²⁴	Visual Basic	4
BM ²⁵	CRM (Customer Relationship Management)	4
BM ²⁶	Insurance and Risk Management	4
Total Credits		12

Bachelor Of Science In Information Technology [BScIT]

First Semester			Second Semester		
Course	Title	Credit	Course	Title	Credit
DT ⁰¹	Basics Of information Technology	1	BT ⁰⁶	Computer Skills In English	4
DT ⁰²	Window Based Application	3	BT ⁰⁷	Basic Mathematics	4
DT ⁰³	Introduction To Database With Access	4	BT ⁰⁸	Object Oriented Programming	2
DT ⁰⁴	Business Applications Of IT	4	BT ⁰⁹	Java Programming	2
DT ⁰⁵	Internet/Multimedia	4	BT ¹⁰	Oracle/Developer 10g	4
Total Credits		16	Total Credits		16

Lateral Entry to the Second Semester of BScIT (First Level)

Eligibility:

1. Successful completion of 10+2 and six months computer course **OR** 2. A 3 year Diploma in IT field from a Technical board.

Additional fees: In addition to the normal fees, an additional lateral entry fee of Rs 2500/- (including examination fees) is payable by students opting for this Scheme.

Note: In this Lateral Entry Scheme, students have to appear and pass the first semester examination. Books of first semester will be supplied by the University and internal assessment will be completed

at the Study Centre.

Exemption: Candidates who have secured DIT from MAHE or SMU are not required to appear for the First semester examination and need not pay lateral entry fees.

Third Semester			Fourth Semester		
Course	Title	Credit	Course	Title	Credit
BT11	Computer Oriented Numeric Methods	4	BT16	Accounting Principles & Practice	4
BT12	Visual Basics	4	/CENTER>		
BT13	Object Oriented Analysis & Design	2	BT17	Communication Technology	2
BT14	Website Management & Design	4	BT18	VC++	4
BT15	Website Project	2	BT19	Software Engineering	4
		48	BT20	Project	2
		Total Credits			Total Credits
					64
Fifth Semester			Sixth Semester		
Course	Title	Credit	Course	Title	Credit
BT21	Data Warehousing & Mining	4	BT25	Strategic Use Of Information Technology	4
BT22	Oracle Ai & Distributed Database	4	BT26	Q/W Quality Assurance	4
BT23	Fundamentals Of e-Commerce	4	BT27	New Technologies	4
BT24	S/W Project Management	4	BT28	Project	4
		48			Total Credits
		Total Credits			16