

SYLLABUS

Post Graduate Diploma in Applied Microbiology - Cell and Molecular Biology

(Semester I-II)

Choice Based Credit System (CBCS)

Effective from June 2014

Department of Biochemistry

Saurashtra University

Rajkot



Re-Accredited **Grade B** by NAAC

(CGPA 2.93)

POSTGRADUATE DIPLOMA IN APPLIED MICROBIOLOGY

- CELL AND MOLECULAR BIOLOGY

<u>Course</u>	<u>Name of Paper</u>	<u>Hours / Week</u>	<u>Credits</u>
SEMESTER 1			
Core Subjects			
CCMB-101	Advanced Cell Biology	04	04
CCMB-102	Molecular Biology And Methodologies	04	04
CCMB-103	Developmental Biology	04	04
Interdisciplinary Subject			
ICMB-101	Analytical Techniques	04	04
Practicals and Class presentations			
CCMB-104	Class presentations	02	02
CCMB-105	Practicals	12	06
SEMESTER 2			
Elective Subjects (any one out of two)		04	04
ECMB-101	Animal Cell Tissue Culture		
ECMB-102	Bioinformatics & Biostatistics: Concepts And Application		
CCMB-106	Dissertation Research Thesis Work	26	12
Total Credits			40

Examination Marks Distribution

Subject	External Marks		Internal Marks		Total Marks	
	Max	Min	Max	Min	Max	Min
All Theory Papers (Core, Interdisciplinary & Elective)	070	028	030	012	100	040
Practicals	150	060	-	-	150	060
Seminar	050	020	-	-	050	020
Dissertation	300	120	-	-	300	120

SEMESTER-I

CCMB-101 ADVANCED CELL BIOLOGY

UNIT 1: Cells, Cell Organelles & Membrane Biochemistry

Evolution and Introduction of Cell Types including Cellular Specialization and Differentiation, Differences in Plant and Animal Cells, Eukaryotic Cell Organelle's Structure, Functions and Biochemistry, Structure and Biochemical Aspects of Specialized Plant Cell Organelles, Cell Plate, Primary and Secondary Cell Walls, Plasmodesmata, Importance of Vacuoles, Chemical Composition and function of Biomembranes, Model of Lipid Membranes, Differences between Biomembranes and Artificial Phospholipids Membranes, Models of Plasma membranes and techniques to study fluidity

UNIT 2: Tissue Organization and Cytoskeleton:

Cell Differentiation, Organogenesis, Morphological, Functional and Biochemical Maturation of Tissues, Cytoskeleton: Microtubules Polymerization, Dynamic, and Functions, Microtubules in Cell Division, Role of Cytoskeleton Filaments in Cancer

UNIT 3: Cell Cycle

Phases of Cell Cycle, Functional Importance of each Phase, Molecular Events during Cell Cycle, Check Points, Cyclins and Protein kinases, MPF (maturation promoting factor), Regulation of Cell Cycle. Apoptotic Pathway and Cell Death.

UNIT 4: Signaling Pathway

Signal transduction, G proteins, cyclic nucleotide and kinase signaling, phospholipid and Ca⁺⁺ signaling, growth factor and cytokine signaling, MAP kinase cascades, signaling via regulated proteolysis

CCMB-102 MOLECULAR BIOLOGY AND METHODOLOGIES

Unit-1: Basic genetics

Mendelian principles: Dominance, segregation, independent assortment, deviation from Mendelian inheritance. Concept of gene: Allele, multiple alleles, pseudoallele, complementation tests, Extensions of Mendelian principles, Codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters.

Unit-2: Advanced genetics

Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants. Extra chromosomal inheritance: Inheritance of mitochondrial and chloroplast genes, maternal inheritance. Microbial genetics: Methods of genetic transfers – transformation, conjugation, transduction and sex-duction, Lambda Genetics mapping genes by interrupted mating, fine structure analysis of genes. Human genetics, Mutation, Structural and numerical alterations of chromosomes, Recombination.

Unit-3: Molecular dogma

DNA replication, repair and recombination, RNA synthesis and processing, Protein synthesis and processing, Control of gene expression at transcription and translation level

Unit-4: Methods in Molecular biology

Cloning, Cloning vectors, Selection and expression of suitable vectors, cDNA libraries and Genomic libraries, DNA sequencing, Site directed mutagenesis, Hybridization techniques, PCR techniques, Molecular markers, Transgenic animals and Plants, Applications of recombinant technology

CCMB-103 DEVELOPMENTAL BIOLOGY

Unit-1 Introduction and overview of animal development

Developmental control of gene expression, Cell signaling, Determining cell fate and cell commitment, Fertilization and cleavage, Gastrulation and Neurulation

Unit-2 Examples of induction and cell fate determination

Early inductive events in Xenopus: Axis formation, Early inductive events in Xenopus: the Nieuwkoop center and the Organizer, Early inductive events in Xenopus, continued (neural fate), Examples of determination of cell fate in the nervous system: the cerebral cortex, Examples of determination of cell fate in the nervous system: the retina, Consequences of molecular evolution

Unit-3 Developmental Genetics

Introduction to developmental genetics: approaches and techniques, introduction to *C. elegans*, Developmental genetics in practice: studying events controlled by maternal transcripts as well as later signaling events using *C. elegans*, Developmental genetics in practice continued: using epistasis and mosaic analysis to determine how genes products interact, Developmental genetics in practice: studying early events in *Drosophila* development, *Drosophila* axis formation and embryonic patterning, *Drosophila* segmentation and segment identity (Hox genes), Developmental genetics in practice: Mouse transgenics: techniques and applications

Unit-4 Patterning: genes, environment and plasticity

Organizing the limb, Pattern formation in the nervous system: Axon guidance, Neuronal plasticity, Sex determination, Dosage compensation, Epigenetics: Imprinting, Stem cells and medical applications for humans

ICMB - 101: ANALYTICAL TECHNIQUES

UNIT 1: Microscopy and Autoradiography

Theories of Tissue Fixation and Staining Techniques. Principles of Transmission and Scanning Electron Microscopy. Principles of Phase Contrast and Fluorescence Microscopy. Principle and Applications of Autoradiography

UNIT 2: Spectroscopy

Basic Principles of Spectroscopy, UV, IR, Raman, ESR, ORD. CD and Structure of Proteins using NMR and ESR. Neutron and X-Ray Diffraction for Elucidation of 3D Structure. Molecular Modelling, Mass Spectrometry

UNIT 3: Chromatographic Techniques

Basic Principle and types of Chromatography. Gas Chromatography, GC-MS, LC – MS / MS. Ion Exchange Chromatography, Gel permeation, Affinity and Reverse Phase Chromatography. HPLC and FPLC

UNIT 4: Centrifugation and Electrophoretic Techniques

Principle and Applications of Centrifugation Techniques. Basic Principles of Electrophoresis, Agarose Gel, Native and SDS-PAGE. Isoelectric Focusing, 2D-PAGE and their uses in Protein Research. Fractionation and Blotting Techniques

CMB-104 Class presentations

CMB-105 Practicals

SEMESTER – II

ECMB-101: ANIMAL CELL TISSUE CULTURE

UNIT 1: Introduction

History, Biology of cell culture, Laboratory design and layout, equipments, aseptic condition, safety, bioethics and validation

UNIT 2: Media

Culture vessels, substrates, defined media supplements, serum free media, media preparation and sterilization

UNIT 3: Various Cell Culture

Primary culture, subculture and cell lines, cloning and selection, cell separation, characterization, differentiation, transformation and immortalization

UNIT 4: Techniques and Media

Contamination, cryopreservation, quantification, cytotoxicity, special cell type culture, culture of tumor cells, organotypic culture, scale up and specialized techniques

ECMB-102: BIOINFORMATICS & BIOSTATISTICS: CONCEPTS AND APPLICATION

UNIT 1: Basics of Bioinformatics

Introduction to Bioinformatics: Definition and History of Bioinformatics, Internet and Bioinformatics, Introduction to Data Mining, Applications of Data Mining to Bioinformatics Problems and Applications of Bioinformatics

UNIT 2: Biocomputing and Softwares in Bioinformatics

Introduction to String Matching Algorithms, Database Search Techniques, Sequence Comparison and Alignment Techniques, Use of Biochemical Scoring Matrices, Introduction to Graph Matching Algorithms, Automated Genome Comparison and its Implication, Automated Gene Prediction, Automated Identification of Bacterial Operons and Pathways Bioinformatics Softwares: Clustal V, Clustal W, RasMol, Oligo, Molscript, Treeview, Alscript, Genetic Analysis Software, Phylip

UNIT 3: Biological Databases & Protein Engineering

Nucleic acid sequence databases: GenBank, EMBL, DDBJ, Protein sequence databases: SWISS-PROT, TrEMBL, PIR_PSD, Genome Databases at NCBI, EBI, TIGR, SANGER, PDB, NDB, CCSD, Prosite, PRODOM, Pfam, PRINTS, CATH, SCOP, DSSP, FSSP, DALI, Site directed mutagenesis, Role of Bioinformatics in Protein Engineering.

UNIT 4: Statistical Tests in Biology

Mean, Median, Mode, Student's t Test, Meaning of Significance and Significance Levels Analysis of Variance. Analysis of Covariance, Regression and Correlation Analysis, Chi square test, Confidence limits

CCMB-106: Dissertation Thesis work / Research Project Work include thesis work and viva voce examination

**Department of Biochemistry
Saurashtra University
Rajkot**

**Post Graduate Diploma in Applied Microbiology - Cell and Molecular Biology
(Semester I & II) Examination**

General Rules

O.1 PGDAMCMB:

A candidate for Post Graduate Diploma in Applied Microbiology - Cell and Molecular Biology must possess the B.Sc. degree in science of this university or any other university recognized by the university grants commission, new delhi (graduates in Biochemistry, Biotechnology, Bioinformatics, Botany, Microbiology, Zoology and any life sciences & have passed the post graduate diploma in clinical research after keeping terms as laid down, that is two semesters and have completed the courses as laid down in the relevant regulation.

Entrance test will be conducted and the admission will be offered on the basis of merit list prepared combining 50 % of the entrance test and 50 % of the final year % of the relevant graduate degree.

Enlistment as post graduate diploma student is essential, within one month of the admission to the course. In the registration, candidate must specify the subjects & the paper of study for post graduate diploma in cell and molecular biology.

O.2 PGDAMCMB:

Post Graduate Diploma in Applied Microbiology - Cell and Molecular Biology semester I and II examinations will be held at the end of each semester and internal examination and its remedial examination will be held during the middle in each semester.

O.3 PGDAMCMB:

Candidates for Post Graduate Diploma in Applied Microbiology - Cell and Molecular Biology (semester - I and II) examination shall be examined after they have satisfactorily completed the prescribed courses of study & have kept the term in an institution recognized for the purpose under the recognized post graduate diploma teachers in prescribed subjects.

O.4 PGDAMCMB:

The passing standard in theory and practicals will be 40% in each head of passing. The final class will be awarded as under:

The candidate securing greater than or equal to 70% aggregate marks obtained in all semesters together (Sem. I-II) will be awarded a distinction class.

Department of Biochemistry
Saurashtra University
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The candidate securing below 70% but less than equal to 60% aggregate marks obtained in all semesters together (Sem. I-II) will be awarded first class.

The candidate securing the aggregate percentage from 48 to less than 60% aggregate marks obtained in all semesters together (Sem. I-II) will be awarded a second class.

Regular records / test of theories, shall be maintained for each student & 30% of the total marks for each subject in theory shall be allotted for these records/tests and min. 75 % of attendance is mandatory.

O.5 PGDAMCMB:

The syllabus laid down for various paper of Post Graduate Diploma in Applied Microbiology - Cell and Molecular Biology (semester-I and II) examination is attached separately at the end of the rules.

O.6 PGDAMCMB:

No class shall be awarded to the successful candidate at the Post Graduate Diploma in Applied Microbiology - Cell and Molecular Biology (semester-I) examination.

O.7 PGDAMCMB:

It is essential to attend seminar / conferences / training and visit industry in the relevant areas.