STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600 086

M.Sc. DEGREE: BIOTECHNOLOGY

SYLLABUS
(Effective from the academic year 2019-2020)

BIOCHEMISTRY

CODE:19BY/PC/BC14 **CREDITS:4**
L T P:4 1 0
TOTAL TEACHING HOURS:65

OBJECTIVES OF THE COURSE

- To gain knowledge on the core principles and topics of Biochemistry
- To have a biochemical insight of various components of cells and their functions
- To enumerate the biochemical functions of water, buffer, enzymes and hormones and its role in metabolism of living matters
- To demonstrate an understanding of the principles, and practical experience of, a wide range of biochemical techniques
- To understand the scope of biochemistry for further education, research and employment

COURSE LEARNING OUTCOMES
On successful completion of the course, students will be able to

- demonstrate structured knowledge of fundamental biochemical principles, such as the structure/function of biomolecules, metabolic pathways, and the regulation of biological/biochemical processes
- explain biological mechanisms and underlying relationship in view of biochemical reactions
- design effective biochemical experiments and be able to apply the scientific method to the processes of experimentation
- critically analyze data, trouble-shoot and effectively communicate scientific reasoning and data analysis in both written and oral forums
- practice the ethics surrounding biochemical scientific research

Unit 1

Introduction to Biochemistry **(10 Hours)**

1.1 The Importance of Biochemistry in Understanding the Processes of the Body
1.2 Components of the Cell and Cell Fractionation techniques
1.3 Markers for Each Organelle
1.4 Relationship Between Cell Biology and Biochemistry

Unit 2

Chemical and Biological Foundation **(12 Hours)**

2.1 Water- Properties, Role of water
2.2 Maintenance of Body Fluids in Various Body Compartments and Related Disorders

2.3 pH- Acid Base Balance, Buffers
2.4 Maintenance of pH – Role of Hemoglobin, Respiratory Control, Role of Kidney, Acidosis, Alkalosis

Unit 3

Biomolecules (15 Hours)

3.1 Carbohydrates - Classification, Monosaccharides, Fischer Projection Formula, Hemiketal and Hemiacetal Formation, Furanoses, Pyranoses, Anomers, Epimers; Disaccharides-Sucrose, Lactose, Maltose; Polysaccharides - Cellulose, Chitin, Starch, Glycogen, Glycosaminoglycans, Proteoglycans
3.2 Proteins – Classification of Aminoacids, Peptide Bonds, Structural Hierarchy of Proteins
3.3 Lipids - Classification, Fatty Acids, Simple Lipids, Complex Lipids, Derived Lipids
3.4 Nucleic Acids - Purine and Pyrimidines, Nucleosides and Nucleotides, Structure of Nucleic Acids, Classification of DNA (A, B And ZDNA), Types of RNAs and their Biological Significance

Unit 4

Enzymes (13 Hours)

4.1 Enzyme Nomenclature, Classification, Cofactor, Active Site, Specificity and Factors Affecting Enzyme Action
4.2 Enzyme Regulation- Enzyme Inhibition (Competitive Inhibition, Uncompetitive Inhibition), Control of Enzyme Quantity, Altering the Catalytic Efficiency of the Enzyme
4.3 Enzymes in Clinical Diagnosis and Pharmaceutical Industries

Unit 5

Cellular Metabolism (15 Hours)

5.1 Concepts of Metabolism- Respiratory Chain and Oxidative Phosphorylation
5.2 Glycolysis, Gluconeogenesis, Pentose Phosphate Pathway, Metabolism of Glycogen, Citric Acid Cycle
5.3 Oxidation of Fatty Acids, Biosynthesis Fatty Acids and Triglycerides, Degradation of Amino Acids – Transamination, Oxidative Deamination and Urea Cycle
5.4 Synthesis and Catabolism – Purines and Pyrimidines

BOOKS FOR STUDY

Albert, L. Lehninger et al**.** *Biochemistry.* U.K: Worth, 2007.

Brown. T. A. *Biochemistry.* Scion Publishing Ltd, 2016.

Rodwell et al. *Harper's Illustrated Biochemistry*. McGraw-Hill Education, 2018.

Thomas. E. Creighton. *Proteins.* New Work: W. H. Freeman, 2005.

BOOKS FOR REFERENCE

Champe, Pamela C, Richard A. Harvey and Denise R. Ferrier. *Lippincott's Illustrated Reviews: Biochemistry.* India: J.P. Brothers, 2005.

Garrett, H. Reginald and Grisham, M. Charles. *Biochemistry.* U.S.A.: Thomson – Brooks/Cole, 2005.

Gerald Litwack. *Human Biochemistry*. First Edition. U.S.A. Academic Press, 2017.

Jeremy, M. Berg. *Biochemistry.* New York: W.H. Freeman, 2001.

J L Jain et al. *Fundamentals of Biochemistry*. Seventh Edition, S Chand, 2016.

Lubert, Stryer. *Biochemistr*y. New York: W.H. Freeman, 2005.

Namrata Chhabra, Sahil Chhabra. *A Case Oriented Approach Towards Biochemistry*. First edition. India: J.P. Brothers, 2013

Voet, D. and Voet, G. *Biochemistry.* New York: John Wiley, 2000.

JOURNALS

Journal of Biochemistry
Indian Journal of Clinical Biochemistry
Biochemistry

WEB RESOURCES

www.themedicalbiochemistrypage.org
www.biochemistry.org

PATTERN OF ASSESSMENT

Continuous Assessment Test: Total Marks: 50 Duration: 90 minutes
Section A - 3 x 2 = 6 Marks (All questions to be answered)
Section B - 3 x 8 = 24 Marks (All questions to be answered; Questions to be taken from all units and internal choices within the units to be given i.e. either/or)
Section C - 1 x 20 = 20 Marks (1 out of 2 to be answered; Questions to be taken from all units)

Other Components: Total Marks: 50
Assignment/open book test/seminar/group discussion

End-Semester Examination: Total Marks: 100 Duration: 3 hours
Section A—10 x 2 = 20 Marks (All questions to be answered, Questions to be of objective type: MCQ and Answer in few lines)
Section B—5 x 8 = 40 Marks (All questions to be answered; Questions to be taken from all units and internal choices within the units to be given i.e. either/or)
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M.Sc. DEGREE: BIOTECHNOLOGY

SYLLABUS
(Effective from the academic year 2019-2020)

MICROBIOLOGY

CODE: 19BY/PC/MI14 **CREDITS: 4**
L T P: 4 1 0
TOTAL TEACHING HOURS: 65

OBJECTIVES OF THE COURSE

- To understand growth and morphology of microbes
- To create an awareness on applied aspects of microbiology
- To provide insight on different aseptic culture techniques for practical knowledge
- To establish an overview of the recent advances in the field of microbiology

COURSE LEARNING OUTCOMES
On successful completion of the course, students will be able to

- establish knowledge on morphology of different microbes
- demonstrate the understanding on Microbial Diseases, their growth and control
- comprehend the current scenario of microbiology in industrial applications
- explicit learning on microscopy and culturing methods
- appreciate various applications of microbiology in various fields

Unit 1 **(15 Hour)**

Introduction to Microbiology

1.1 History of Microbiology- Scope, Evolution
1.2 Criteria for Classification - Taxometrics, Serological, Numerical Taxonomy; Chemotaxonomy; Phylogenetic Relationships - Cladogram, Dendrogram, Universal Phylogenetic Trees
1.3 Microscopy – Principles and Applications of Simple, Compound, Bright Field, Dark Field, Phase Contrast, Fluorescent and Electron Microscopy

Unit 2 **(12 Hour)**

Microbial Classification

2.1 Classification of Bacteria – Whittaker's Five Kingdom System, Characterization of Bacteria according to Bergey's Manual of Systematic Bacteriology
2.2 Classification of Fungi – General Properties – Reproduction
2.3 Classification of Viruses - General Properties – Multiplication - Reproduction
2.4 Classification of Algae – Micro and Macro Algae, Protozoa – Characteristics and Life cycle

Unit 3 **(12 Hours)**

Microbial Physiology

3.1 Microbial Nutrition, Types of Culture Media, Pure Culture Techniques, Preservation of Culture
3.2 Microbial Growth-Growth Curve, Measurement of Growth, Continuous and Batch

Culture Factors Influencing the Growth of Microorganisms - Temperature, pH, Osmotic pressure, Moisture, Radiations and Different Chemicals

3.3 Physical and Chemical Methods of Microbial Control

Unit 4 **(14 Hours)**

Microbial Diseases

4.1Medical Microbiology-Disease Transmission, Patterns and Spread of Infection

4.2Respiratory Tract Infection-Tuberculosis, Viral Influenza, Fungal Pneumonia and Aspergillosis

4.3 Gastrointestinal Infection-Dysentery, Gastroenteritis

4.4 Urinary Tract Infection – Leptospirosis, Adenovirus Type 2, Fungal Candidiasis

4.5 Sexually Transmitted Diseases – HIV, Syphilis, Herpes Simplex Virus

Unit 5 **(12 Hours)**

Food and Industrial Microbiology

5.1 Food Microbiology –Dairy Products – Fermented Foods – Baker's Yeast, Sauerkraut- Microbial Flora of Fresh Foods, Prebiotics and Probiotics

5.2 Industrial Microbiology – Industrially Important Microorganisms-in Fuel-Ethanol, Biofertilisers, Biopesticides, Pharmaceuticals- Production of Antibiotics – Streptomycin

5.3 Production of Organic Acids – Citric acid, Production of Enzymes - Amylase, Production of Amino acids–Glutamic Acid, Production of Vitamins–VitaminB12

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BOOKS FOR STUDY

Ananthanarayan, R and Jayaram Paniker C.K. *Textbook of Microbiology*. Chennai: Orient Longman, 1997.

Joanne Willey and Linda Sherwood and Christopher J. Woolverton Prescott's Microbiology 10th Edition 2017.

Krasner, R.I. *The Microbial challenge.* Canada: Jones and Bartlett, 2010.

Patel, A.H. *Industrial Microbiology***.** India: MacMillan, 1999.

Vasanthakumari. R. *Textbook of Microbiology***.** New Delhi: BI, 2007.

BOOKS FOR REFERENCE

Demain, Arnold L. and Davies, Julian E. *Manual of Industrial Microbiology and Biotechnology.* U.S.A.: ASM, 2010.

Dimmock, N.J., Easton, A.J.and Leppard. *Introduction to Modern Virology.* U.S.A.: Blackwell, 2007.

Glazer,A.N.,and Nikaido,H. *Microbial Biotechnology***.** U.K.: Cambridge, 2007.

Inglis, T. J. *Microbiology and Infection: A Clinical Core Text for Integrated Curricula with Self-Assessment.* U.S.A.: Elsevier Health Sciences, 2007.

Jawetz, Melnick, & Adelberg's Medical Microbiology, 27th Edition 2016

Michael T. Madigan, Kelly S. Bender, Daniel H. Buckley, W. Matthew Sattley, David A. Stahl Published by Pearson Brock *Biology of Microorganisms*, 15th Edition, 2018.

Pelczar, Michael, J (Jr.),Reid, Roger,D.Chan E.C.S.and H.Kreig**.** *Microbiology***.** New Delhi: Tata McGraw-Hill, 2001.

Tortora,G.G.J.,Funke,B.R.and Case,C.L. *Microbiology-An Introduction***.** U.S.A.: Benjamin-Cummings, 2009.

JOURNALS
Journal of Applied Microbiology
Journal of Industrial Microbiology

WEB RESOURCES
www.asm.org
www.ncbi.nlm.nih.gov/
www.sgm.org

PATTERN OF ASSESSMENT

Continuous Assessment Test: Total Marks: 50 Duration: 90 minutes

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M.Sc. DEGREE: BIOTECHNOLOGY

SYLLABUS
(Effective from the academic year 2019-2020)

MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY

CODE: 19BY/PC/MR14 **CREDITS: 4**
L T P: 4 1 0
TOTAL TEACHING HOURS: 65

OBJECTIVES OF THE COURSE

- **To provide knowledge in the areas of molecular biology, including genomics, transcriptional and post-transcriptional regulatory networks**
- **To gain knowledge of medicinal processes through the investigation of the underlying molecular mechanisms**
- **To prepare for further education and/or employment in teaching, basic research, or the health professions**
- **To provide a scientific and technical understanding on plasmids and vectors and its applications in recombinant DNA technology**
- **To conceive knowledge on gene cloning and molecular sequencing**

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- **exhibit a knowledge base in molecular biology and able to discuss biological process significantly on the aspects of molecular science**
- **demonstrate the understanding of common and advanced laboratory practices in molecular biology**
- **formulate and execute independently/collaboratively research projects using the techniques in molecular biology with the appropriate analysis of the results obtained**
- **perceived a detailed description of different types of Vectors and their cloning techniques**
- **scientific learning on different application of recombinant DNA Technology**

Unit 1

Cell Structure, Function and Genetic Material (10 Hours)

1.1 Structure, Organization and Function of Cells – Prokaryotes and Eukaryotes, Plasma Membrane – Passive and Active transport

1.2 Cytoskeleton – Microfilaments, Intermediate Filaments and Microtubules

1.3 Mechanisms of Cell Communication

1.4 DNA, RNA-Types, Organisation of Prokaryotic and Eukaryotic Genomes

Unit 2

Replication, Repair and Protein Synthesis (12 Hours)

2.1 DNA Replication - Prokaryotes and Eukaryotes
2.2 DNA Damage and Repair - Direct, Mismatch, Base- Excision, Nucleotide Excision
2.3 Protein Synthesis - Transcription and Translation – Prokaryotes and Eukaryotes

Unit 3
Gene Regulation (15 Hours)
3.1 Transcriptional Regulation in Prokaryotes – Regulation by Repressors and by Activators, Regulation by Attenuation, Translational Regulation in Bacteria
3.2 Transcriptional Regulation in Eukaryotes – Steroid Hormone Receptors, Homeotic Genes
3.3 Post Transcriptional Regulation-DNA Methylation and Histone Modification, Protein Processing, Folding, Sorting and Transport, Post Transcriptional Regulation
3.4 Genes Regulating Cell Cycle, Apoptosis- Regulators- Intrinsic and Extrinsic Pathways

Unit 4
Vectors and Gene Cloning (15 Hours)
4.1 Restriction Modification Systems - Types and Nomenclature and Restriction Enzymes TYPE I, II, III, Enzymes Used in Recombinant DNA Technology.
4.2 Plasmid Vectors and their Properties, Copy Number, Vectors- pBR 322, pUC, Bacteriophage Lambda (λ), M13 Vectors– its Construction and Derivatives,
4.3 Vector Construction Cosmids, Phasmids, Fosmids, Phagemids, Shuttle Vectors, Shotgun Cloning - Genomic Library and cDNA Library Construction- Marker Genes Recombinant Selection and Screening

Unit 5 (13 Hours)
Sequencing and Applications of rDNA Technology
5.1 DNA Sequencing and Polymerase Chain Reaction- its Principle, Types and Applications, Site Directed Mutagenesis, Blotting Techniques.
5.2 Molecular Markers and its Applications - RFLP, RAPD, AFLP, VNTR, STS, SSCP, SSR, CAPS, SCAR.
5.3 Applications of recombinant DNA Technology in Monoclonal Antibodies, Insulin, Growth Hormones, Vaccines , Gene Therapy

BOOKS FOR STUDY

Glick Bernard R. and Pasternak Jack J. *Molecular Biotechnology: Principles and Applications of Recombinant DNA*. U.S.A.: ASM Press, 2009.

Primrose, S. B. *Principles of Gene Manipulation: An Introduction to Genetic Engineering.* U.S.A.: Blackwell, 2009.

Weaver. *Molecular Biology*. India: Tata McGraw Hill. 2007.

Wolfe, Stephen L. *Molecular and Cellular Biology*. U.S.A.: Wadsworth, 1999.
Brown, Terence, A. *Gene Cloning and DNA Analysis: An Introduction.* U.S.A.: Blackwell, 2010.

BOOKS FOR REFERENCE

Albert, Bruce, et al. *Molecular Biology of the Cell*.U.S.A.: Garland, 2015
Cooper, G.M. and Hausman, R.E. *The Cell – A Molecular Approach*. U.S.A.: Sinauer Associates. 2018.

Dale, Jeremy W., Schantz Malcolm. *From Genes to Genomes: Concepts and Applications of DNA Technology*. U.S.A.: Wiley, 2007.

Green, Michael and Sambrook, Joseph. *Molecular Cloning: A Laboratory Manual.* U.S.A.: CSHL, 2012.

Lewin, Benjamin. *Genes XII*. U.S.A.: Jones and Bartlett, 2017.

Lodish et al. *Molecular and Cell Biology*. U.S.A.: Scientific American. 2016

JOURNALS
Journal of Molecular Cell Biology
Molecular Biology International
Journal of Cloning and Transgenesis

WEB RESOURCES
www.molbiolcell.org
www.biomedcentral.com/bmcmolbiol.
www.rpi.edu/dept/chem-emg/biotech-environ/.../rdna.html
www.web.mit.edu/hst.160/www/quiz/recombinant DNA andcloning.html

PATTERN OF ASSESSMENT

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End-Semester Examination: Total Marks: 100 Duration: 3 hours.

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Section B - 5 x 8 = 40 Marks (All questions to be answered; Questions to be taken from all units and internal choices within the units to be given i.e. either/or)
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M.Sc. DEGREE: BIOTECHNOLOGY

SYLLABUS
(Effective from the academic year 2019 - 2020)

BIOCHEMISTRY AND MICROBIOLOGY - PRACTICAL

CODE:19BY/PC/P112 **CREDITS: 2**
L T P: 0 0 3
TOTAL HOURS: 39

BIOCHEMISTRY

1. Preparation of Buffers (3 Hours)
2. Estimation of DNA by Diphenyl Amine Method (3 Hours)
3. Estimation of RNA by Orcinol Method (3 Hours)
4. Estimation of Carbohydrates – DNS Method (3 Hours)
5. Isolation and Estimation of Protein by Lowry and Bradford's Method (3 Hours)
6. Separation and Visualization of Proteins by SDS – PAGE (3 Hours)

MICROBIOLOGY

1. Pure Culture Techniques- Streak plate method, spread plate method (3 Hours)
2. Culturing of Bacteria and Bacterial Growth Curve (3 Hours)
3. Culturing of Fungi (3 Hours)
4. Staining - (3 Hours)
   Simple Staining, Fungal Staining, Differential Staining, Spore Staining
5. Biochemical Tests- (3 Hours)
   Carbohydrate Fermentation, TSI Agar Test, IMViC Test, Urease, Catalase Oxidase, Phenylalanine Deaminase Test, Amylase, Casein Hydrolysis, Gelatin Liquefaction, Coagulase test
6. Kirby- Bauer Antibiotic Sensitivity Test (3 Hours)
7. Motility by Hanging Drop Method (3 Hours)

PATTERN OF ASSESSMENT

Continuous Assessment Test:
Total Marks: 50 **Duration: 6 Hours**

BIOCHEMISTRY

1. Major experiment to be conducted (10 Marks)
   5 Marks for procedure and 5 Marks for conduct and result

2. Minor experiment (5 Marks)
   Marks allotted for principle and procedure

MICROBIOLOGY

3. Major experiment to be conducted (10 Marks)
   5 Marks for procedure and 5 Marks for conduct and result.

4. Minor experiment (5Marks)
   Marks allotted for principle and procedure

5. Five spotters each carrying 2 marks (10 Marks)

6. Record (5 Marks)

7. Viva voce (5 Marks)

End Semester Examination: Total Marks:50 Duration: 6 Hours

BIOCHEMISTRY

1. Major experiment to be conducted (10 Marks)
   5 Marks for procedure and 5 Marks for conduct and result

2. Minor experiment (5 Marks)
   Marks allotted for principle and procedure

MICROBIOLOGY

3. Major experiment to be conducted (10 Marks)
   5 Marks for procedure and 5 Marks for conduct and result

4. Minor experiment (5Marks)
   Marks allotted for principle and procedure

5. Five Spotters each carrying 2 marks (10 Marks)

6. Record (5 Marks)

7. Viva voce (5 Marks)

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M.Sc. DEGREE: BIOTECHNOLOGY

SYLLABUS
(Effective from the academic year 2019-2020)

MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY - PRACTICAL

CODE: 19BY/PC/P213 **CREDITS: 3**
L T P: 0 0 5
TOTAL HOURS: 65

MOLECULAR BIOLOGY

1. Isolation of Bacterial DNA (5 Hours)
2. PCR Amplification (5 Hours)
3. RFLP and RAPD Analysis (7 Hours)
4. Southern Hybridization (8 Hours)
5. Isolation of Total RNA (5 Hours)
6. Northern Blotting (5 Hours)

RECOMBINANT DNA TECHNOLOGY

1. Isolation of Plasmid DNA (5 Hours)
2. Restriction and Ligation (5 Hours)
3. Preparation of Competent cell (5 Hours)
4. Bacterial Transformation (10 Hours)
5. Identification of Recombinants – Antibiotic markers, Blue-White Screening (5 Hours)

PATTERN OF ASSESSMENT:

Continuous Assessment Test: **Total Marks: 50** **Duration: 6 hours**

MOLECULAR BIOLOGY

1. Major experiment to be conducted (10 Marks)
   5 Marks for procedure and 5 Marks for conduct and result

2. Minor experiment (5 Marks)
   Marks allotted for principle and procedure

RECOMBINANT DNA TECHNOLOGY

3. Major experiment to be conducted (10 Marks)
   5 Marks for procedure and 5 Marks for conduct and result.

4. Minor experiment (5Marks)
   Marks allotted for principle and procedure

5. 5 Spotters each carrying 2 marks (10 Marks)

6. Record (5 Marks)

7. Viva voce (5 Marks)

End-Semester Examination: Total Marks: 50 Duration: 6 hours

MOLECULAR BIOLOGY

1. Major experiment to be conducted (10 Marks)
   5 Marks for procedure and 5 Marks for conduct and result

2. Minor experiment (5 Marks)
   Marks allotted for principle and procedure

RECOMBINANT DNA TECHNOLOGY

3. Major experiment to be conducted (10 Marks)
   5 Marks for procedure and 5 Marks for conduct and result

4. Minor experiment (5Marks)
   Marks allotted for principle and procedure

5. 5 Spotters each carrying 2 marks (10 Marks)

6. Record (5 Marks)

7. Viva voce (5 Marks)

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M.Sc. DEGREE: BIOTECHNOLOGY

SYLLABUS
(Effective from the academic year 2019 - 2020)

ANIMAL AND PLANT BIOTECHNOLOGY

CODE: 19BY/PC/AP24
CREDITS: 4

L T P: 4
2 0 TOTAL TEACHING HOURS: 78

OBJECTIVES OF THE COURSE

- To understand the principles of animal cell culture and its application
- To understand the basics of transgenic animals, techniques, associated protocols and their applications
- To provide an insight into the techniques and applications of plant cell culture
- To understand concepts of transgenic plant technology
- To evaluate the risks and benefits of plant biotechnology

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- explain how the principles of biotechnology are being applied to address animal health issues
- describe the basics of maintenance of mammalian cell and generation of cell line using proper sterile techniques and optimum conditions for growth
- demonstrate the understanding of plant tissue culture and genetic engineering techniques and their identification using molecular marker assisted selections
- comprehensive training in the plant biotechnology and its application for increasing agricultural production, environment improvement, nutrition and health
- describe the current issues in transgenic plants
- execute research projects using the techniques in plant biotechnology with the appropriate analysis of the results obtained

Unit 1 (15 Hours)

Animal Cell Culture

1.1 Historical Background, Cell Culture Technology - Setting up a New Cell Culture Laboratory
1.2 Culture Vessels and Substrates, Media and Supplements- Serum Free Media
1.3 Primary Cell Culture and Passaging, Culturing of Animal Cells in Fluidized Bed Reactor (FBR)
1.4 Quantitation, Cytotoxicity Testing, Cryopreservation
1.5 Cell Bank Preparation and Characterization

Unit 2 **(20 Hours)**

Applications of Animal Biotechnology

2.1 Transgenic Animal Production-Retroviral Transfer, DNA Microinjection, Embryonic Stem Cell Mediated Gene Transfer, Gene Knock Down and RNA Interface

2.2 Transgenic Animal as Disease Models-Onco-Mouse, AIDS Mouse, Alzheimer's Mouse, Parkinson's Fly, Transgenic Animals as Biological Models-ANDi (Monkey), Doogie (Smart Mouse), Super Mouse, Youth Mouse, Influenza Resistance Mouse, Transgenic Animal as Xenotransplanters, Food Source (Super Fish, Super Pig)

2.3 Manipulation of Reproduction: Embryo Transfer Technology, *In vitro* Fertilization in Farm Animals

2.4 Biotechnology in Animal Production –Feed Additives, Probiotic, Prebiotics, Synbiotics

2.5 Common diseases in Cattle and Poultry-Anthrax, Foot and Mouth Disease, Mastitis, Avian Influenza, New Castle Disease, Common Zoonotic Diseases

Unit 3

Plant Tissue Culture **(15 Hours)**

3.1 Plant Tissue Culture - Principles and Methodology, Protoplast Technology and Somatic Embryogenesis

3.2 Somaclonal Variation, Synthetic Seeds, Screening of Secondary Metabolites

3.3 Production of Haploid Plants, Applications of Tissue Culture in Agriculture and Horticulture, Germplasm Conservation

Unit 4

Plant Genetic Transformation Techniques (15 Hours)

4.1 Selectable and Scoreable Markers, Reporter Genes and Promoters Used in Plant Vectors

4.2 Techniques for Plant Transformation – *Agrobacterium tumefaciens* – Mediated Gene Transfer, Direct Gene Transfer Methods

4.3 Chloroplast Transformation

Unit 5 **(13 Hours)**

Applications of Plant Genetic Engineering

5.1 GM Strategies for Insect Resistance – Environmental Impact of BT Crops; Herbicide Tolerance, Delay of Fruit Ripening

5.2 Transgenics for Abiotic Stress Tolerance – Drought, Cold and Salinity, Cytoplasmic Male Sterility

5.3 Plantibodies and Edible Vaccines

BOOKS FOR STUDY

Chawla, H.S. *Introduction to Plant Biotechnology***.** India: Oxford, 2009.

Freshney, Ian R. *Culture of Animal Cells: A Manual of Basic Technique***.** U.S.A.: Wiley-Liss, 2010.

Purohit, S.S. *Agricultural Biotechnology*. India: Agrobios, 2007.
Singh B, Gautam S.K, Chauhan M.S. *Text Book of Animal Biotechnology*. India.: Teri Press, 2015.

Slater, A., Scott, N and Fowler M. *Plant biotechnology.* U.S.A.: Oxford, 2003.

BOOKS FOR REFERENCE

Adrian Slater et al. *An Introduction to Genetic Engineering.* U.S.A.: Oxford, 2008.

Biswas. *Agricultural Biotechnology***.** New Delhi: Dominant, 2005.

Hammond, J. McGarvey, P and Yusibov V. *Plant Biotechnology***,** U.S.A.: Springer, 2000

Heiner Niemann, Christine Wrenzycki. Animal Biotechnology 1: Reproductive Biotechnologies. Springer, Switzerland, 2018.

Kishna, *G.K* et al. *Plant Biotechnology***.** India:New Vishal, 2016

Neal Stewart C. *Plant Biotechnology and Genetics.* U.S.A.: Wiley, 2008.

Pawan Kaur. *Advances in Animal Biotechnology and its Applications*. Springer, Singapore, 2018

Hammond, J. McGarvey, P and Yusibov V. *Plant Biotechnology***,** U.S.A.: Springer, 2000.

Singh**,** B.D. *Plant Biotechnology***.** India:Kalyani, 2015

JOURNALS

Journal of Animal Biotechnology
Journal of Animal science and Biotechnology
International Journal of animal Biotechnology
Journal of Plant Molecular Biology and Biotechnology
Plant Biotechnology Reports

WEB RESOURCES

www.jasbsci.com/
www.niab.org.in/
www.pb.ethz.ch/
www.nrcpb.org/
https://animalbiotech.ucdavis.edu/
https://www.nap.edu/read/10418/chapter/3
https://comparativegenomics.illinois.edu/.../Advances%20in%20animal%20biotechnol

PATTERN OF ASSESSMENT

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M.Sc. DEGREE: BIOTECHNOLOGY

SYLLABUS
(Effective from the academic year 2019-2020)

ANIMAL AND PLANT BIOTECHNOLOGY – PRACTICAL

CODE:19BY/PC/P324 **CREDITS:4**
L T P:0 0 6
TOTAL HOURS:78

ANIMAL BIOTECHNOLOGY

1. Preparation of Media and Development of Monolayer (10 Hours)
2. Subculturing / Passaging (5 Hours)
3. Quantitation and Cell Viability Test of Animals Cells by Hemocytometer (10 Hours)
4. MTT Assay (5 Hours)
5. Isolation of Genomic DNA from Animal Cells (6 Hours)

PLANT BIOTECHNOLOGY

1 Basic techniques in plant tissue culture (15 Hours)
- Preparation of Medium, Surface Sterilization
- Callus Induction, Organogenesis
- Embryo Culture
- Hardening

2 Protoplast Isolation by Enzymatic Method and Protoplast Fusion (6 Hours)

3 Production of Synthetic Seeds (5 Hours)

4 *Agrobacterium* culture, Reporter Gene (GUS) Assay (5 Hours)

5 Isolation of Plant Genomic DNA (6 Hours)

6 Isolation of Chloroplast (5 Hours)

PATTERN OF ASSESSMENT

Continuous Assessment Test: **Total Marks: 50** **Duration: 6 Hours**

Animal Biotechnology

1. Major experiment to be conducted (10 Marks)
   5 Marks for procedure and 5 Marks for conduct and result

2. Minor experiment (5 Marks)
   Marks allotted for principle and procedure

Plant Biotechnology

3. Major experiment to be conducted (10 Marks)
   5 Marks for procedure and 5 Marks for conduct and result

4. Minor experiment (5 Marks)
   Marks allotted for principle and procedure

5. 5 Spotters each carrying 2 marks (10 Marks)

6. Record (5 Marks)

7. Viva voce (5 Marks)

End-Semester Examination: Total Marks: 50 Duration: 6 hours

Animal Biotechnology

1. Major experiment to be conducted (10 Marks)
   5 Marks for procedure and 5 Marks for conduct and result

2. Minor experiment (5 Marks)
   Marks allotted for principle and procedure

Plant Biotechnology

3. Major experiment to be conducted (10 Marks)
   5 Marks for procedure and 5 Marks for conduct and result

4. Minor experiment (5 Marks)
   Marks allotted for principle and procedure

5. 5 Spotters each carrying 2 marks (10 Marks)

6. Record (5 Marks)

7. Viva voce (5 Marks)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600 086

M.Sc. DEGREE: BIOTECHNOLOGY

SYLLABUS

(Effective from the academic year 2019-2020)

RESEARCH METHODOLOGY

CODE: 19BY/PC/RM24 **CREDITS: 4**

L T P: 4 1 0

TOTAL TEACHING HOURS: 65

OBJECTIVES OF THE COURSE

- To develop a research orientation among the students and to acquaint them with fundamentals of research methods
- To identify the overall process of designing a research study
- To develop the technical art of writing research report and presentations
- To provide an understanding for quantitative reasoning using logical and statistical methods
- To acquire knowledge on applications of statistics in research

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- describe the concepts and research design
- demonstrate the ability to choose methods appropriate to research aims and objectives
- develop advanced critical thinking and skills in qualitative and quantitative data analysis
- demonstrate enhanced writing skills in preparing research grant proposals, scientific research/report and manuscript
- independently set hypothesis, analyze and interpret statistically

Unit 1 **(12 Hours)**

Principles of Research

1.1 Research Definition - Motivation and Objectives - Types of Research - Descriptive, Analytical, Applied, Fundamental, Quantitative, Qualitative, Conceptual and Empirical - Significance of Research - Methods *vs* Methodology

1.2 Research Formulation - Defining and Formulating the Research Problem - Selecting the Problem - Basic Principles of Research Design - Essential Steps in the Research Processes - Criteria for Good Research

1.3 Data Collection – Classification of Data- Primary Data, Secondary Data - Sampling - Sampling Methods

Unit 2 **(12 Hours)**

Research Communication and Proposal

2.1 Essentials of the Scientific Report- Abstract, Introduction, Review of Literature, Materials and Methods, Results, Discussion, Reference, Cross-Referencing, Proof Reading

2.2 Preparing Manuscripts, Oral and Poster Presentation - Writing a Thesis

2.3 Project Proposal Writing, Grant Application, Funding Agencies for Project, Plagiarism

Unit 3 **(15 Hours)**

Biostatistics

3.1 Introduction – Definition, Statistical Terms, Application of Biostatistics
3.2 Measures of Central Tendency - Mean (Weighted, Harmonic, Geometric Mean), Median, Mode
3.3 Measures of Dispersion - Range, Quartile Deviation, Mean Deviation, Standard Deviation
3.4 Co-Efficient of Variation, Co-Efficient of Quartile Deviation, Co-Efficient of Mean Deviation

Unit 4 **(13 Hours)**

Statistical Methods

4.1 Skewness, Kurtosis, Moments
4.2 Correlation - Simple, Rank and Karl Pearson's Correlation; Regression Analysis
4.3 Probability - Addition and Multiplication Theorem
4.4 Theoretical Distributions - Binomial, Poisson and Normal Distribution

Unit 5 **(13 Hours)**

Parametric and Nonparametric Statistics

5.1 Hypothesis Testing –Null Hypothesis, Alternate Hypothesis, Type I and II Errors
5.2 Chi-Square Test, Students T- Test- Paired and Unpaired
5.3 ANOVA- One Way Classification and Two Way Classification
5.4 Software Packages (SPSS) for Data Analysis

- Unit 3,4,5-Concepts and Simple Problems Only
  50% theory and 50% problems

BOOKS FOR STUDY

Gurumani, N. *Scientific thesis writing and Paper Presentation***,** Chennai: MJP, 2010.

Gurumani, N. *Research Methodology for Biological Sciences***.** Chennai: MJP, 2006.

Mariappan, P. *Biostatistics- An Introduction*. Chennai: Pearson, 2013.

Pranab Kumar Banerjee. *Introduction to Biostatistics.* India: S Chand, 2014.

BOOKS FOR REFERENCE

Antonismy. B, Prasanna S. Pemkumr, Solomon Christopher. *Principles and practice of Bioststistics*. Elsevier publication, 2017.

Gurumani, N. *An Introduction to Biostatistics***.** Chennai: MJP, 2005.

Kothari C.R, 2nd edition *Research methodology, Methods and techniques*. New Age International (P) Ltd, Publishers, New Delhi, (2004).

Raman, A. *A Handbook on Research Processes***.** Chennai: S. Viswanathan, 2003.

Sharma AK. *Text book of Biostatistics I*. Discovery Publishing house, India, 2005

Veera Bala Rastogi. *Biostatistics.* India: MedTech, 2015

JOURNALS

Journal of Mixed Methods Research
International Journal of Qualitative Methods
American Journal of Biostatistics
International Journal of Biostatistics
JP Journal of Biostatistics

WEB RESOURCES

www.nngroup./articles/which-ux-research-methods/
www.processresearchmethods.org.
www.statsoft.com/textbook/
biosun1.harvard.edu/
www.bettycjung.net/Statsites.htm
www.ucl.ac.uk/statistics/biostatistics

PATTERN OF ASSESSMENT

Continuous Assessment Test: Total Marks: 50 Duration: 90 minutes

Section A - 3 x 2 = 6 Marks (All questions to be answered)
Section B - 3 x 8 = 24 Marks (All questions to be answered; Questions to be taken from all units and internal choices within the units to be given i.e. either/or)
Section C - 1 x 20 = 20 Marks (1 out of 2 to be answered; Questions to be taken from all units)

Other Components: Total Marks: 50

Assignment/Open book test/Seminar/Group Discussion

End-Semester Examination: Total Marks: 100 Duration: 3 hours

Section A - 10 x 2 = 20 Marks (All questions to be answered, Questions to be of objective type: MCQ and Answer in few lines)
Section B - 5 x 8 = 40 Marks (All questions to be answered; Questions to be taken from all units and internal choices within the units to be given i.e. either/or)
Section C - 2 x 20 = 40 Marks (2 out of 4 to be answered; Questions to be taken from all units)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600 086

M.Sc. DEGREE: BIOTECHNOLOGY

SYLLABUS
(Effective from the academic year 2019 - 2020)

SUMMER INTERNSHIP

CODE:19BY/PN/SI32 **CREDITS:2**

OBJECTIVES OF THE COURSE

- To enable students to gain experiential learning in the field in Biotechnology
- The acquire hands – on training in Biotechnological techniques

The Summer Internship program is for a minimum period of three weeks. The students are expected to have regular attendance in their respective Institute and submit an assignment to the Department reporting the experiments they have observed/conducted. The students are expected to give a seminar presentation in the third semester of the work they have observed/conducted.

Guidelines for Evaluation

The maximum marks for the Summer Internship is 50 and is divided into the following:

a) Assignment	(20 Marks)
b) Seminar presentation	(15 Marks)
c) Attendance	(15 Marks)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600 086

M.Sc. DEGREE: BIOTECHNOLOGY

SYLLABUS
(Effective from the academic year 2019-2020)

BIOPROCESS AND FERMENTATION TECHNOLOGY

CODE:19BY/PC/BF34 **CREDITS:4**
L T P:4 1 0
TOTAL TEACHING HOURS:65

OBJECTIVES OF THE COURSE

- To provide the basics of bioreactors and its applications
- To develop bioengineering skills for the production of biochemical product using integrated biochemical processes
- To create an awareness on important industrial bio-products and the applications of enzymes in various fields

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- comprehensive understanding of design and types of bioreactors
- apprehend the concepts of downstream processing to retrieve the product
- demonstrate a wide range of scientific thinking fermentation technology and to produce economically important products
- perceive new methods and applications of microorganism and its product

Unit 1 **(13 Hours)**

Fundamentals of Bioprocess

1.1 Isolation, Screening, Strain Improvement and Maintenance of Industrially Important Microbes. Media Design and Inoculum Development, Media Optimization

1.2 Sterilization Methods – Medium Sterilization, Batch Sterilization, Continuous Sterilization, Filter Sterilization

1.3 Basic Configuration of Fermenter and Ancillaries, Control Systems in a Fermenter

1.4Types of Fermentation - Solid State, Submerged, Batch, Fed-Batch and Continuous, FeedBack Mechanism

Unit 2 **(15 Hours)**

Bioreactors

2.1 Types of Bioreactors – Stirred tank, Air lift, Packed Bed, Fluidized Bed, Photobioreactor, Membrane Bioreactor, Immobilized Cell Bioreactors

2.2 Extraction and Purification of Microbial Enzymes, Importance of Enzyme Purification, Extracellular and Intracellular Enzymes

2.3 Enzyme Fractionation by Precipitation (Using Temperature, Salt, Solvent, pH), Affinity Chromatography and Other Special Purification Methods, Enzyme Crystallization Techniques, Criteria of Purity of Enzymes

2.4 Enzyme Immobilization Methods- Immobilization of Microbial Enzymes – Principles and Applications

Unit 3

Downstream Processing **(15 Hours)**

3.1 Techniques Used in Bioproduct Analysis, Cell Distribution Methods for Intracellular Products, Removal of Insolubles, Biomass

3.2 Separation Techniques, Flocculation, Sedimentation, Centrifugation and Filtration- Solvent Extraction- Aqueous Two-Phase Separation

3.3Precipitation- Product Isolation and Purification Techniques - Chromatography (Ion-Exchange, Affinity, Gel Permeation Chromatography and Molecular Sieving)

3.4 Membrane Separation – Microfiltration - Ultrafiltration - Reverse Osmosis - Product Formulation and Finishing, Crystallization, Precipitation (Ammonium Sulfate, Solvent); Electrophoresis (Capillary); Dialysis, Drying and Lyophilization, Trouble Shooting in Product Recovery

Unit 4 **(12 Hours)**

Mass Transfer

4.1 Mass Transfer-Molecular Diffusion – Diffusion Theory – Film Theory

4.2 Types of Mass transfer-Liquid-solid- Liquid-Liquid, Gas – Liquid Mass Transfer Oxygen Transfer Rate and Coefficient

4.3 Microbial Growth Kinetics – Modes of Operation – Batch, Fed-Batch and Continuous

Unit 5 **(10 Hours)**

Microbial Products in Pharmaceutical, Food and Agricultural Industries

5.1 Production, Harvest, Recovery and Uses – Enzymes, Antibiotics, Vitamins, Aminoacids, Organic Solvents

5.2 Use of Microbes in Mineral Beneficiation and Oil Recovery. Production, Harvest, Recovery and Uses– Baker's Yeast, Milk Products, Edible Mushrooms

5.3 Single Cell Protein (Algae/Fungi), Beverages (Beer, Wine and Brandy). Formulation of Biofertilizer (*Rhizobium*, *Pseudomonas*) and Biopesticides (*Bacillus thruingiensis*).

BOOKS FOR STUDY

Doran, Pauline M. *Bioprocess Engineering Principles*. London: Academic, 1995.

Palmer, Trevor. *Enzymes : Biochemistry, Biotechnology and Clinical Chemistry***.** U.S.A.: Horwood, 2004.

Stanbury and Whitaker. *Principles of Fermentation Technology***.** U.S.A.: Pergamon, 1984.

BOOKS FOR REFERENCE

Asenjo, Juan A. *Bioreactor Systems Design*. India: CRC, 1995.

Bailey, J.E. and Ollis, D. *Biochemical Engineering Fundamentals*. New York: McGraw – Hill, 2002.

Bryce and Mansi. *Fermentation Microbiology & Biotechnology*. India: Kluwer Academic, 2011.

Bryce, A.L. Demain, A.R. Allman. *Fermentation microbiology and Biotechnology*. Second edition, edited by El-.Mansi, C.F.A. Taylor and Francis, 2007.

Butterworth. *Technological Applications of Biocatalysts*. U.S.A.: BIOTOL, 1995.
Coulson. *Chemical Engineering*. U.S.A.: Pergamon, 1984.

Schuler, Michael L. *Bioprocess Engineering*. U.S.A.: Prentice, 1992.

Shijie Liu. *Bioprocess Engineering, Kinetics, Sustainability, and Reactor Design.*U.K: Elsevier, 2016

Sivasubramanian V. *Bioprocess Engineering for a Green Environment*. India : CRC, 2018

Straathof, A.J. *Applied Biocatalysis*. New York: Tailor and Francis, 2000.

Wanng, D.I.C. and Cooney, C.L. *Fermentation and Enzyme Technology*. U.S.A.: John Wiley, 1994.

JOURNALS

Biotechnology and Bioprocess Engineering
Bioresources and Bioprocessing
Enzyme and Microbial technology
Enzyme Technology and Molecular Biology

WEB RESOURCES

www.bioprocessintl.com/
www.ibclifesciences.com/BPI/overview.xml
www.techenzyme.com/
www.abenzymes.com/
www.wildfermentation.com/
John Schollar and Benedikte Watmore, Practical Fermentation-a technical guide
web.mit.edu/professional/short.../fermentation_technology.html

PATTERN OF ASSESSMENT

Continuous Assessment Test: Total Marks: 50 Duration: 90 minutes

Section A - 3 x 2 = 6 Marks (All questions to be answered)
Section B - 3 x 8 = 24 Marks (All questions to be answered; Questions to be taken from all units and internal choices within the units to be given i.e. either/or)
Section C - 1 x 20 = 20 Marks (1 out of 2 to be answered; Questions to be taken from all units)

Other Components: Total Marks: 50

Assignment /Open book test/Seminar/Group Discussion

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STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600 086

M.Sc. DEGREE: BIOTECHNOLOGY

SYLLABUS
(Effective from the academic year 2019-2020)

ENVIRONMENTAL BIOTECHNOLOGY

CODE:19BY/PC/ET34 **CREDITS:4**
L T P:4 1 0
TOTAL TEACHING HOURS:65

OBJECTIVES OF THE COURSE

- To gain understanding of environment, about the ecosystem, bioremediation and its crisis
- To create an awareness of current technology employed in environmental sustainability
- To apprehend waste management technologies for different industries

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- conceive the fundamental issues of the environment and ecology
- comprehend on industrial pollution management and applications of recombinant DNA technology in environmental management
- explain different treatment methods for wastewater generated from municipal and industrial waste

Unit 1

Introduction to Environment **(13 Hours)**

1.1 The Environment- Physical Environment; Biotic Environment; Biotic and Abiotic Interactions. Habitat and Niche - Concept of Habitat and Niche; Niche Width and Overlap; Fundamental and Realized Niche; Resource Partitioning; Character Displacement

1.2 Community Ecology- Nature of Communities; Community Structure and Attributes; Levels of Species Diversity and Its Measurement; Edges and Ecotones

1.3 Population Ecology- Characteristics of a Population; Population Growth Curves; Population Regulation; Life History Strategies (R and K Selection)

1.4 Concept of Meta Population – Demes and Dispersal, Interdemic Extinctions, Age Structured Populations

Unit 2 **(14 Hours)**

Environmental Pollution and Management

2.1 Types of Pollution, Methods for the Measurement of Pollution, Air Pollution and its Control, Global Environmental Problems: Ozone Depletion, Greenhouse Effect and Acid Rain

2.2 Principles of Conservation and Application of Biotechnology, Remote Sensing and GIS (Principal and Applications in Ecological Mapping and Environmental Hazard Predictions), Ecological Modeling, Bioindicators and Biosensors for

Detection of Pollution

2.3 Sewage and Waste Water Treatments Systems: Primary, Secondary and Tertiary Treatments; Biological Treatments – Aerobic-Activated Sludge, Oxidation Ditches, Trickling Filter, Rotating Discs, Rotating Drums, Oxidation Ponds Anaerobic Digestion, Anaerobic Filters, Up Flow Anaerobic Sludge Blanket Reactors

Unit 3 **(13 Hours)**

Industrial Waste Management

3.1 Industrial Waste Management- Dairy, Paper and Pulp, Textile, Leather, Hospital and Pharmaceutical-Biomedical Wastes

3.2 E-waste- Radioactive and Nuclear Power Waste Management

3.3 Solid Waste: Sources and Management (Composting, Vermiculture and Methane Production)

Unit 4 **(13 Hours)**

Recombinant DNA Technology Application in Environment

4.1 Molecular Biology Tools for Environmental Management, rDNA Technology in Waste Treatment

4.2 Genetically Modified Organisms in Waste Management

4.3 Genetic Sensors, Metagenomics, Bioprospecting, Nanoscience in Environmental Management, Biosensors Development to Monitor Pollution

Unit 5 **(12 Hours)**

Biotechnological Applications in Environment

5.1 Bioremediation of Petroleum Hydrocarbons

5.2 Biodegradation of Xenobiotics - Types and Fate of Pesticides, Reasons for Persistence, Microbial Adaptation of Pesticides and Biodegradation of Pesticides

5.3 Microbes in Bioleaching Process- Metal Recovery by Leaching Process, Recovery of Petroleum, Bioelectricity through Microbial Fuel Cell

5.4 Phytoremediation - Rhizofiltration, Phytoextraction, Phytostimulation, Phytostabilization and Phytotransformation

BOOKS FOR STUDY

Bailey, J. E. and Ollis, D. F. *Biochemical Engineering Fundamentals*. New York: Mac Graw, 1986.

Chakrabarty K.D. Omen G.S. *Biotechnology And Biodegradation, Advances In Applied Biotechnology***.** London: Gulf, 1989.

Forster, C. F and Waste, D.A. J. *Environmental Biotechnology*. U.S.A.: Ellis Horwood, 1987.

Ismail, S.A., *The Earthworm Book.* India: Other India, 2005.

Lutgarde Raskin. *In-situ Bioremediation.* U.S.A.: Nayes, 1991.

Metcalf and Eddy. *Waste water Engineering Treatment, Disposal and Reuse***.** U.S.A.: Mc Graw, 1991.

Mohapatra P.K. *Textbook of Environmental Biotechnology***.** New Delhi: I.K. International, 2007.

Rana,S.V.S. *Environmental Biotechnology***.** New Delhi: Rastogi, 2010.

Thankur, I.S. *Environmental biotechnology – Basic concepts and applications***.** New Delhi: IK International, 2006.

BOOKS FOR REFERENCE

APHA. *Standard Method for Examination of Water and Waste water*. American Public Health, 1985.

Bhatia S.C. *Handbook of Environmental Biotechnology.,* India: Atlantic, 2008.

Daniel Vallero. *Environmental Biotechnology, A Biosystems Approach* Academic Press 2015.

Eugene Odum. *Fundamentals of Ecology*. India: Thomson, 2017.

Ismail S.A. *Vermitech (vermicompost and vermiwash).* India: Ajju's wormery, 1996.

Kaushik, Anubha and Kaushik, C.P. *Perspectives in Environmental Studies*. New Delhi: New Age, 2007.

Martin A.M. *Biological Degradation of Wastes*. New York: Elsevier, 1991.

Ram Chandra Advances in Biodegradation and Bioremediation of Industrial Waste CRC Press, 2015

Ritmann E .B. and Perry L. *Environmental Biotechnology: Principles and Applications.* U.S.A.: McGraw, 2001.

Sayler, Gray S. Robert Fox and James W. Blackburn. *Environmental Biotechnology for Waste Treatment*. New York: Plenum Press, 1991.

Sharma P.D. *Ecology and Environment.* India: Rastogi, 2017.

Smith. *Elements of Ecology*. India:Pearson, 2017

Stanier R.Y. Ingraham J.L. Wheelis M.L.Painter R.R. *General Microbiology*. U.S.A.: Mc Millan 1989.

Young Murray Moo. *Comprehensive Biotechnology.* U.S.A.: Elsever Sciences, 1985.

JOURNALS

Journal of petroleum and environmental Biotechnology
Microbial ecology and environmental Biotechnology

WEB RESOURCES

www.environmentalbiotech.com/
www.waterlooenvironmentalbiotechnology.com/
www.neeri.res.in/

PATTERN OF ASSESSMENT

Continuous Assessment Test: Total Marks: 50 Duration: 90 minutes

Section A - 3 x 2 = 6 Marks (All questions to be answered)

Section B - 3 x 8 = 24 Marks (All questions to be answered; Questions to be taken from all units and internal choices within the units to be given i.e. either/or)

Section C - 1 x 20 = 20 Marks (1 out of 2 to be answered; Questions to be taken from all units)

Other Components: Total Marks: 50

Assignment/Open book test/Seminar/Group Discussion

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Section A - 10 x 2 = 20 Marks (All questions to be answered, Questions to be of objective type: MCQ and Answer in few lines)

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STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600 086

M.Sc. DEGREE: BIOTECHNOLOGY

SYLLABUS

(Effective from the academic year 2019-2020)

IMMUNOTECHNOLOGY

CODE:19BY/PC/IM34 **CREDITS:4**

L T P:4 1 0

TOTAL TEACHING HOURS:65

OBJECTIVES OF THE COURSE

- To provide an understanding of the immune system and its components
- To gain knowledge on classical and clinical immunology
- To familiarize diagnostic immunology and immunotherapy

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- conceptualize how the innate and adaptive immune responses coordinate to fight invading pathogens
- describe the immune system in maintaining health and contributing to disease
- determine what immunomodulatory strategies can be used to enhance/ suppress immune responses such as might be required in hypersensitivity reactions, transplantations or autoimmune diseases
- apply the roles of immunology in protection against disease and autoimmune disorders to choices in their daily live
- identify diagnostic tools available in the field of Medical Science to combat diseases

Unit 1 **(13 Hours)**

Fundamental Concepts of Immune system

1.1 Immune Response - Humoral and Cell Mediated Immunity; Concepts of Innate and Adaptive Immunity
1.2 Hematopoiesis, Cells of the Immune System, Programmed Cell Death
1.3 Organs of the Immune System
1.4 B and T Cell- Maturation-Activation- Differentiation and Receptors

Unit 2 **(12 Hours)**

Mechanism of Immune Responses

2.1 Antigens- Structure, Properties and Types- Haptens, Adjuvants, Epitopes, Pattern Recognition Receptors, Receptors of Innate and Adaptive Immunity

2.2 Immunoglobulin - Structure, Properties and Types, Biological Activities, Monoclonal and Polyclonal Antibodies

2.3 Antibody Mediated Effector Function-Opsonization, ADCC, Antigenic determinants of Immunoglobulins, Immunoglobulin Super Family

2.4 Cytokines, Properties – Receptors - Antagonists - Cytokine Related Diseases

Unit 3 ***(12 Hours)***

Immunogenetics

3.1 Major Histocompatibility Complex/HLA Complex - General Organization

3.2 MHC Molecules, MHC Interactions- Peptide, Antigen Processing and Presenting Pathway

3.3 Complement System- Components- Activation, Function

3.4 Complement System - Biological Consequences, Regulation, Deficiencies

Unit 4 **(16 Hours)**

Immunopathology

4.1 Hypersensitivity Reactions - Type I, II, III, IV

4.2 Autoimmunity- Organ Specific - Systemic-Treatments of Autoimmune Diseases

4.3Transplantation Immunology- Basis of Graft Rejection -Immunosuppressive Therapy

4.4Tumor Immunology and Cancer Therapy, AIDS and Secondary Immunodeficiencies

4.5 Immune Response to Viral, Bacterial, Fungal and Parasitic Infection

Unit 5 **(12 Hours)**

Immuno Diagnosis and Therapy

5.1 Immuno Diagnosis: Cross Reactivity; Precipitation Reactions: SRID, ODD, Counter Current Immunoelectrophoresis and Rocket Immunoelectrophoresis

5.2 Agglutination Reactions; RIA, ELISA, Western Blotting, Immunoprecipitation, Immunofluroscence, Flow Cytometry, ANA (Antinuclear Antibody), FANA

5.3 CMI Technology-Lymphoproliferation Assay, Mixed Lymphocyte Reaction (MLR), Cell-Mediated Lympholysis (CML)

5.4 Vaccines and Immunization Procedure

BOOKS FOR STUDY

Fahim Halim Khan. *The Elements of Immunology*. India.: Pearson Education, 2009

Jean Punt, Sharon Stranford, Patricis Jones and Judith A. Owen. *Kuby Immunology*. 8th Edition, W. H. Freeman, 2018.

BOOKS FOR REFERENCE

Abbas, A.K., A.H.L. Lichtman and S.Pillai. *Cellular and Molecular Immunology*. 6th Edition. Philadelphia.: Saunders Elsevier Publications, 2010.

Abul K. Abbas & Andrew H. H. Lichtman & Shiv Pillai. *Basic Immunology*. 5th Edition, Elsevier, 2015

David Male, Jonathan Brostoff, David B. Roth, Ivan M. *Roitt. Immunology*. 8th edition, Elsevier, 2018.

Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt. *Roitt's Essential Immunology.* U.S.A.: Wiley-Blackwell, 2011.

Richard, C and S. Geoffrey. *Immunology-A Short Course*. USA, John, Wiley & Sons Ltd, 2015.

Seemi Garhat Bashir. *Text Book of Immunology*. New Delhi.: PHI Learning Pvt. Ltd, 2009.

Sunil K.M and Sai L. K. Textbook of Immunology Course. India, Jaypee Brothers Medical Publishes (P) Ltd, 2014.

JOURNALS

Infection and Immunity

European Journal of Immunology

Molecular Immunology

WEB RESOURCES

https://www.immunology.org/

https://www.immunology.org/public.../immunology.../immunology-resources-links

www.library.csusm.edu/course guides/biology

www.immunologylink.com

http://www.wiley.com/college/bio/karp12791/weblinks.html

PATTERN OF ASSESSMENT

Continuous Assessment Test: Total Marks: 50 Duration: 90minutes

Section A - 3 x 2 = 6 Marks (All questions to be answered)

Section B - 3 x 8 = 24 Marks (All questions to be answered; Questions to be taken from all units and internal choices within the units to be given i.e. either/or)

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STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600 086

M.Sc. DEGREE: BIOTECHNOLOGY
SYLLABUS
(Effective from the academic year 2019-2020)

IMMUNOTECHNOLOGY - PRACTICAL

CODE:19BY/PC/P432 **CREDITS: 2**
L T P:0 0 3
TOTAL HOURS:39

1. Differential Counting (4 Hours)
2. Isolation of Lymphocytes (4 Hours)
3. Agglutination Reactions: ABO Blood Grouping, Complement Fixation, Widal Test, ASO, Latex Agglutination Test (CRP), Haemagglutination, Rheumatoid Arthritis, Rapid Plasma Reagin, VDRL, Amboreceptor (24 Hours)
4. Precipitation Reactions- SRID, ODD (pattern), IEP, cIEP, Rocket Electrophoresis, Immuno Precipitation (12 Hours)
5. Antibody capture ELISA (4 Hours)
6. Western Blotting (4 Hours)

PATTERN OF ASSESSMENT

Continuous Assessment Test: Total Marks: 50 Duration: 6 hours

1. Major experiment to be conducted (20 Marks)
   12 Marks for principle, procedure and conduct. 8 Marks for result

2. Minor experiment to be conducted (10 Marks)
   5 Marks for principle and procedure, 5 marks for conduct and result

3. 5 Spotters each carrying 2 marks (10 Marks)

4. Viva voce (5 Marks)

5. Record (5 Marks)

End-Semester Examination: Total Marks: 50 Duration: 6 hours

1. Major experiment to be conducted (20 Marks)
   12 Marks for principle, procedure and conduct. 8 Marks for result

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   5 Marks for principle and procedure, 5 marks for conduct and result

3. 5 Spotters each carrying 2 marks (10 Marks)

4. Viva voce (5 Marks)

5. Record (5 Marks)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600 086

M.Sc. DEGREE : BIOTECHNOLOGY

SYLLABUS

(Effective from the academic year 2019-2020)

BIOPROCESS AND FERMENTATION TECHNOCLOGY AND ENVIRONMENTAL BIOTECHNOLOGY - PRACTICAL

CODE: 19BY/PC/P533 **CREDITS:3**

L T P:0 0 5

TOTAL HOURS:65

BIOPROCESS AND FERMENTATION TECHNOCLOGY

1. Effect of pH, Temperature on Enzyme Activity (10 Hours)
2. Enzyme Immobilization using Sodium Alginate (5 Hours)
3. Determination of Thermal Death Point of Bacterial Culture (5 Hours)
4. Production of Ethanol using *Saccharomyces cerevisiae* (5 Hours)
5. Sauerkraut Production (5 Hours)
6. Production of Wine (5 Hours)
7. Demonstration of Fermentor (5 Hours)

ENVIRONMENTAL BIOTECHNOLOGY

1. Estimation of Chlorides and Organic Carbon in Soil. (5 Hours)
2. Determination of Hardness, Acidity and Alkalinity of Water Sample (5 Hours)
3. Estimation of Phosphate and Nitrate in Water Sample (5 Hours)
4. Determination of Dissolved Oxygen and Biological Oxygen Demand of Water Sample (5 Hours)
5. Detection of Coliforms for Determination of the Purity of Potable Water (5 Hours)

PATTERN OF ASSESSMENT

Continuous Assessment Test: **Total Marks:50** **Duration: 6 Hours**

BIOPROCESS AND FERMENTATION TECHNOLOGY

1. Major experiment to be conducted (10 Marks)
   5 Marks for procedure and 5 Marks for conduct and result

2. Minor experiment (5 Marks)
   Marks allotted for principle and procedure

ENVIRONMENTAL BIOTECHNOLOGY

1. Major experiment to be conducted (10 Marks)

5 Marks for procedure and 5 Marks for conduct and result.

2. Minor experiment (5Marks)
   Marks allotted for principle and procedure

3. Five spotters each carrying 2 marks (10 Marks)

4. Record (5 Marks)

5. Viva voce (5 Marks)

End Semester Examination: Total Marks:50 Duration: 6 Hours

BIOPROCESS AND FERMENTATION TECHNOLOGY

1. Major experiment to be conducted (10 Marks)
   5 Marks for procedure and 5 Marks for conduct and result

2. Minor experiment (5 Marks)
   Marks allotted for principle and procedure

ENVIRONMENTAL BIOTECHNOLOGY

1. Major experiment to be conducted (10 Marks)
   5 Marks for procedure and 5 Marks for conduct and result

2. Minor experiment (5Marks)
   Marks allotted for principle and procedure

3. Five Spotters each carrying 2 marks (10 Marks)

4. Record (5 Marks)

5. Viva voce (5 Marks)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600 086

M.Sc. DEGREE: BIOTECHNOLOGY

SYLLABUS
(Effective from the academic year 2019-2020)

BIO-NANOTECHNOLOGY

CODE :19BY/PC/BN44 **CREDITS:4**
L T P:4 1 0
TOTAL TEACHING HOURS:65

OBJECTIVES OF THE COURSE

- To introduce the fundamentals of multidisciplinary nature of Bionanotechnology
- To have a better understanding of key design factors at the synthesis/fabrication methods of nanostructures
- To discuss on the possibility of current and future applications of nanostructured materials
- To acquire a discipline-based knowledge to create an impact in commercial products and technologies

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- review an overview of the state-of-the-art nanosynthesing processes and application of nano materials
- critically discuss various characterization methods of bionanotechnology
- elucidate emerging needs of bionanotechnology in different fields of life sciences
- assess the research directions in nanoscience and nanotechnology
- identify interdisciplinary research approaches in the field of bionanotechnology projects
- evaluate regulatory, ethical and economical problems of nanoscale domain

Unit 1 (12 Hours)

Introduction to Nanotechnology

1.1 Concept and Definitions of Nano-biotechnology & Historical Background
1.2 Fundamental Sciences and Broad Areas of Nano-biotechnology
1.3 Raw materials of Nanotechnology; Properties of Nanomaterials

Unit 2 (12 Hours)

Classes of Nanomaterials

2.1 Classification Based on Dimensionality - Quantum Dots, Wells and Wires
2.2 Carbon Based Nano Materials – Bucky Balls, Nanotubes, Graphene
2.3 Metal Based Nanomaterials - Nanogold, Nano Silver and Metal Oxides
2.4 Nanocomposites, Nanopolymers, Nanoglasses, Nano ceramics, Biological Nanomaterials

Unit 3 **(15 Hours)**

Fabrication of Nanomaterials

3.1 Nanoparticle Synthesis – Solvent Evaporation, Spontaneous Emulsification, Double Emulsion and Evaporation, Polymerization, Salting Out, Emulsions-Diffusion, Solvent Displacement, Production of Nanoparticles Using Supercritical Fluid Technology

3.2 Solid State Synthesis, Vapour Phase Synthesis; Solution Processing of Nanoparticles – Sol Gel, Solution Precipitation, Reverse Micelle Method

3.3 Molecular Self Assembly, Biosynthesis – Bacteria, Fungi, Yeast and Plant

3.4. Biogenic and Green Synthesis of Nanoparticles - Demonstration

Unit 4 **(15 Hours)**

Application of Nanotechnology

4.1 Food and Cosmetics Applications

4.2 Textiles, Paints and Catalysis

4.3 Bioremediation, Biochips – Analytical Devices, Biosensors

Unit 5 **(11 Hours)**

Nanotechnology in Diagnosis and Therapy

5.1 Nanomaterials in Bone Substitutes and Dentistry

5.2 Nanoparticles for Cancer Therapy

5.3 Nanopharmaceuticals – Nanosuspensions, Nano-encapsulation, Nanogels for Drug Therapy

BOOKS FOR STUDY

Arunava Goswami and Samrat Roy Choudhury. *Nanobiotechnology, Basic and Applied Aspects* Anthem Press, Delhi, India, 2017.

Pradeep T . *A Textbook of Nanoscience and Nanotechnology*. New Delhi.: Tata McGraw Hill Education.2012.

Siddhartha Shrivastava. *Introductory Nanobiotechnology*. Pune.: New Central Book Agency. 2013

BOOKS FOR REFERENCE

Bhupinder Singh, Rodney JY Ho, JagatR. Kanwar. *Emerging Trends in Nanobiomedicine*. US.: CRC Press. 2018.

Cato Laurencin T, Lakshmi S. Nair. *Nanotechnology and Tissue Engineering*: The Scaffold. U S. CRC press. 2012.

Chad A. Mirkin and Christof M. Niemeyer. *Nanobiotechnology II: More Concepts and Applications*, Wiley-VCH. 2007.

Deepak Chitkara, Anupama Mittal, Ram I. Mahato *Molecular Medicines for Cancer: Concepts and Applications of Nanotechnology*. US.: CRC Press. 2018.

Kurt E. Geckeler, Hiroyuki Nishide. *Nanotechnology- Advanced Nanomaterials.* Wiley VCH. 2010.

Murthy, B.S., Shankar, P., Baldev, R., Rath, B.B., and Murday, J. *Textbook of Nanoscience and Nanotechnology*. India.: IIM, Universities Press, 2012.

Pradeep T. *A Textbook of Nanoscience and Nanotechnology*. New Delhi.: Tata McGrawHill Education Pvt. Ltd, 2012.

Ravishankar Rai. V and Jamuna A. Bai. *Nanotechnology Applications in the Food Industry*. US.: CRC Press. 2018.

Shah M.A and Tokeer Ahmad. *Principles of Nanoscience and Nanotechnology*. UK.: Alpha Science International Ltd. 2010

Singh, Shubra, M.S., and Rao, Ramachandra. *Nanoscience and Nanotechnology: Fundamentals to Frontiers*. India.: Wiley Publishers, 2013.

Tuan Vo-Dinh. *Nanotechnology in Biology and Medicine: Methods, Devices and Applications***.** London: Taylor and Francis, 2007.

JOURNALS

Journal of Nanotechnology
International Journal of Nanotechnology

WEB RESOURCES

http://www.zyvex.com/nano
www.fda.gov/nanotechnology/
www.nature.com/nnano/

PATTERN OF ASSESSMENT

Continuous Assessment Test: **Total Marks: 50** **Duration: 90 minutes**

Section A - 3 x 2 = 6 Marks (All questions to be answered)

Section B - 3 x 8 = 24 Marks (All questions to be answered; Questions to be taken from all units and internal choices within the units to be given i.e. either/or)

Section C - 1 x 20 = 20 Marks (1 out of 2 to be answered; Questions to be taken from all units)

Other Components: **Total Marks: 50**

Assignment/Open book test/Seminar/Group Discussion

End-Semester Examination: **Total Marks: 100** **Duration: 3 hours**

Section A - 10 x 2 = 20 Marks (All questions to be answered, Questions to be of objective type: MCQ and Answer in few lines)

Section B - 5 x 8 = 40 Marks (All questions to be answered; Questions to be taken from all units and internal choices within the units to be given i.e. either/or)

Section C - 2 x 20 = 40 Marks (2 out of 4 to be answered; Questions to be taken from all units)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600 086

M.Sc. DEGREE: BIOTECHNOLOGY
SYLLABUS
(Effective from the academic year 2019-2020)

DISSERTATION

CODE:19BY/PC/DS49 **CREDITS:9**

GUIDELINES FOR DISSERTATION

Project should be done individually. Each student will choose a topic of her interest and the student will be assigned to a supervisor.

The project will require practical work with the submission of a project report. It should include wet lab work. The duration of the project work is between 3 and 6 months.

The project report should be submitted in the prescribed format containing a minimum of 50 pages. References should not be counted with the main pages. The report should be enhanced with photographs.

Each candidate has to give 3 periodical reviews to the internal guide on the scheduled dates prescribed by the department.

Each candidate can prepare 3 hard copies of the thesis. 1 copy for her and 2 copies must be submitted to the department. The project should be submitted on the scheduled date prescribed by the Department. The student should appear for Viva-voce before a panel comprising the External Examiner, the supervisor and the Head of the Department.

Guidelines for Evaluation

The maximum marks for the dissertation is 100 (50 marks for continuous assessment and 50 marks for end semester) and this is divided into 4 compartments.

a) Style format and neatness in presentation	(10 Marks)
b) Logic and reasoning	(25 Marks)
c) Methodology – analysis and interpretation	(50 Marks)
d) Viva	(15 Marks)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600 086

M.Sc. DEGREE: BIOTECHNOLOGY

SYLLABUS

(Effective from the academic year 2019-2020)

APPLICATIONS OF STEM CELL AND TISSUE ENGINEERING

CODE: 19BY/PC/ST44 **CREDITS:4**

L T P:4 2 0

TOTAL TEACHING HOURS: 78

OBJECTIVES OF THE COURSE

- To learn the concept of Stem cells & and their application in Engineering organs for replacement and Transplantation
- To offers updated fundamental knowledge, technological advancements and potential applications of stem cells and tissue engineering
- To provide an overview of fundamental concepts in Tissue Engineering
- To review the current scenario of tissue engineering applications in bioartificial organs development and transplantation

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- comprehend the basics of Stem cell biology, various sources of stem cells and their applications
- demonstrate how stem cells can be used to treat various disorders such as the neurodegenerative disorders, cardiovascular disorders and diabetes
- elucidate the fundamentals of Tissue Engineering including cells and scaffolds, various techniques associated and limitations
- apply Tissue Engineering principles to the solution of medical problems requiring the regeneration of tissues and the method for the fabrication of tissue engineered products

Unit 1 **(20 Hours)**

Introduction to Stem Cells

1.1 Stem Cells – History, Definition, Types
1.2 Stem Cell Banking
1.3 Stem Cell Niches
1.4 Role of International Society for Stem Cell Research (ISSCR)
1.5 Stem Cell Research Techniques - Demonstration

Unit 2 **(13Hours)**

Application of Stem Cells - I

2.1 Multiple Sclerosis, Muscular Degeneration

2.2 Diabetes

2.3 Heart disease

2.4 Parkinson's disease

Unit 3

Applications of Stem Cells - II **(14 Hours)**

3.1 Cancer Stem Cells

3.2 Spinal Cord Injury

3.3 Burns and Skin Ulcers

3.4 Orthopedic Applications

Unit 4 **(13 Hours)**

Tissue Engineering

4.1 Introduction, Time Line

4.2 Biodegradable Polymers

4.3 Growth Factors

4.3 Bioreactors

Unit 5 **(13 Hours)**

Applications of Tissue Engineering

5.1 Bioartificial Organs - Bioartificial Pancreas, Hepat Assist Liver Support System
5.2 Heamatopoietic System - Red Blood Cell Substitutes-Renal Replacement Devices
5.3 Artificial Womb
5.4 Breast Reconstruction

BOOKS FOR STUDY

Robert Lanza. *Essentials of Stem Cell Biology.* U.S.A.: Academic Press, 3d Edition, 2014.

Robert P. Lanaza, Robert Langer and Joseph Vacanti. *Principles of Tissue Engineering*. U.S.A.: Academic, 4th Edition, Elsevier Publications, 2013.

BOOKS FOR REFERENCE

Atala, Anthony, Robert Lanza, Tony Mikon, Robert Nerem. *Principles of Regenerative Medicine*. 3rd Edition, U.S.A. Elsevier publications, 2018.

Eliot Lander MD, Mark Berman MD. *The stem cell Revolution*. US.: Author House, 2015

Fong, Calvin A. *Stem Cell Research Developments***.** U.S.A.: Nova, 2007.

Greer, Erik V. *Neural Stem Cell Research***.** U.S.A.: Nova, 2006.

Lanza, Robert and Klimankaya, Irina. *Essential Stem cell Methods***.** U.S.A.: Academic, 2009.

JOURNALS

International Journal of Stem Cell

Journal of Tissue Engineering and Regenerative Medicine

Journal of Biomaterials and Tissue Engineering

WEB RESOURCES

stemcells.nih.gov/

www.nature.com/nature/stemcells/

www.cell.com/cell-stem-cell/

PATTERN OF ASSESSMENT

Continuous Assessment Test: **Total Marks: 50** **Duration: 90 minutes**

Section A - 3 x 2 = 6 Marks (All questions to be answered)

Section B - 3 x 8 = 24 Marks (All questions to be answered; Questions to be taken from all units and internal choices within the units to be given i.e. either/or)

Section C - 1 x 20 = 20 Marks (1 out of 2 to be answered; Questions to be taken from all units)

Other Components: **Total Marks: 50**

Assignment/Open book test/Seminar/Group Discussion/Research articles and review paper presentation

End-Semester Examination: **Total Marks: 100** **Duration: 3 hours**

Section A - 10 x 2 = 20 Marks (All questions to be answered, Questions to be of objective type: MCQ and Answer in few lines)

Section B - 5 x 8 = 40 Marks (All questions to be answered; Questions to be taken from all units and internal choices within the units to be given i.e. either/or)

Section C - 2 x 20 = 40 Marks (2 out of 4 to be answered; Questions to be taken from all units)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600 086

M.Sc. DEGREE: BIOTECHNOLOGY

SYLLABUS

(Effective from the academic year 2019-2020)

APPLICATIONS OF BIOTECHNOLOGY

CODE:19BY/PE/AB23 **CREDITS:3**

L T P:3 0 0

TOTAL TEACHING HOURS:39

OBJECTIVES OF THE COURSE

- To understand the basic of biotechnology
- To provide an insight on the trends of bio-techniques
- To familiarize the applications of Biotechnology in everyday life

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- understand the fundamentals of biotechnology
- discuss the use of by products
- demonstrate a knowledge of transgenic plants and animals
- explain the molecular diagnosis and treatment of diseases

Unit 1 **(10 Hours)**

Introduction to Biotechnology

1.1 Upstream and Downstream Fermentation Technology
1.2 Applications of Enzymes in the Food Industry - Bread, Wine
1.3 Antibiotic Production –Penicillin

Unit 2 **(5 Hours)**

Bioproducts

2.1 Biofertilizers and Vermicomposting
2.2 Mushroom – Types and Cultivation

Unit 3 **(5 Hours)**

Bioconversions

3.1 Biofuels
3.2 Ethanol Production and Biogas

Unit 4 **(10 Hours)**

Genetic Engineering

4.1 Introduction to Cloning, Production of Transgenic Animals (Mouse, Sheep, Cattle) 4.2 Transgenic Plants (Bt cotton, Edible Vaccines)

Unit 5 **(9 Hours)**

Applications

5.1 DNA Fingerprinting in Forensic Science
5.2 Cancer Therapy

BOOKS FOR STUDY

Chawla, H.S. *Introduction to Plant Biotechnology***.** India: Oxford, 2009.

Freshney, Ian R. *Culture of Animal Cells: A Manual of Basic Technique***.** U.S.A.: Wiley, 2010.

Ismail, S.A., *The Earthworm Book.* India: Other India, 2005

Ismail, S.A., Seshadri, C.V., Jeeji Bai, N., and Suriyakumar, C.R. *Composting through Earthworms.* India: M.C.R.C., 1994.

Palmer, Trevor. *Enzymes : Biochemistry, Biotechnology and Clinical Chemistry***.** U.S.A. : Horwood, 2004.

Patel, A.H. *Industrial Microbiology.* India: MacMillan, 1999.

Prescott and Dunn. *Industrial Microbiology***.** U.S.A.: AVI, 1987.

Purohit, S.S. *Agricultural Biotechnology***.** India: Agrobios, 2007.
Slater, A. Scott, N and Fowler, M. *Plant Biotechnology.* U.S.A.: Oxford, 2003.

BOOKS FOR REFERENCE

Demain, Arnold L., and Davies, Julian E. *Manual of Industrial Microbiology and Biotechnology***.** U.S.A.: ASM, 2010.

Glick, B.R., and Pasternak, J.J. *Molecular Biotechnology – Principles and Applications of Recombinant DNA.* New Delhi: Panima, 1994.

Kishna, *G.K. Plant Biotechnology***.** India:New Vishal, 2016

Purohit, S.S and Mathur S.K**.** *Biotechnology – Fundamentals and Applications.* India: Agrobios, 2000.

Satyanarayana, U. *Biotechnology***.** India: Allied, 2018

JOURNALS

Journal of Animal Science and Biotechnology
International Journal of Animal Biotechnology
Journal of Plant Molecular Biology and Biotechnology
Plant Biotechnology Reports

WEB RESOURCES

www.jasbsci.com/
www.niab.org.in/
www.pb.ethz.ch/
www.nrcpb.org/

PATTERN OF ASSESSMENT

Continuous Assessment Test: Total Marks: 50 Duration: 90 minutes
Section A - 3 x 2 = 6 Marks (All questions to be answered)
Section B - 3 x 8 = 24 Marks (All questions to be answered; Questions to be taken from all units and internal choices within the units to be given i.e. either/or)
Section C - 1 x 20 = 20 Marks (1 out of 2 to be answered; Questions to be taken from all units)

Other Components: Total Marks: 50
Assignment/Open book test/Seminar/Group Discussion

End-Semester Examination: Total Marks: 100 Duration: 3 hours
Section A - 10 x 2 = 20 Marks (All questions to be answered, Questions to be of objective type: MCQ and Answer in few lines)
Section B - 5 x 8 = 40 Marks (All questions to be answered; Questions to be taken from all units and internal choices within the units to be given i.e. either/or)
Section C - 2 x 20 = 40 Marks (2 out of 4 to be answered; Questions to be taken from all units)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600 086

M.Sc. DEGREE: BIOTECHNOLOGY

SYLLABUS

(Effective from the academic year 2019-2020)

HUMAN DISEASES AND MANAGEMENT

CODE:19BY/PE/HD23 **CREDITS:3**

L T P:3 0 0
TOTAL TEACHING HOURS:39

OBJECTIVES OF THE COURSE

- To understand of pathogenic spectrum of human.
- To gain knowledge on the underlying causes of human diseases
- To familiarize the disease prevention and diagnosis

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- demonstrate a basic understanding of the concepts and elements of disease
- elucidate the mechanisms, diagnosis and treatment of diseases
- describe the effects of drugs abuse on the human body
- discuss a balanced diet and the value of exercise to health
- evaluate scientific articles on health-related topics

Unit 1 **(5 Hours)**

Infectious Diseases of Bacteria and Viruses

1.1 Bacterial Diseases - Typhoid, Tuberculosis
1.2 Viral Diseases - Dengue, Chikungunya, AIDS

Unit 2 **(5 Hours)**

Infectious Diseases of Fungus and Parasites

2.1 Fungal Diseases – Dermatophytes, Candidiasis
2.2 Parasitic Diseases - Malaria, Amoebiasis

Unit 3 **(10 Hours)**

Pathology of Nerves, Heart and Lung

3.1 Nervous System -Alzheimer, Parkinson’s
3.2 Cardiovascular System – Atherosclerosis
3.3 Respiratory Tract- Bronchial Asthma, Pneumonia

Unit 4 **(9 Hours)**

Pathology of Gastro-Intestinal, Urinary Tract and Reproductive Organ

4.1 Gastro-Intestinal Tract -Peptic Ulcer, Jaundice, Hepatitis, Cirrhosis

4.2 Urinary Tract Infection

4.3 Reproductive System – Cancer of Breast, Uterus, Ovary, Cervical, Prostrate

Unit 5 **(10 Hours)**

Immunopathology

5.1 Allergy

5.2 Auto-immune disorders – Systemic Lupus Erythematosus, Type I Diabetes

BOOKS FOR STUDY

Carol D Tamparo. *Diseases of the Human Body.* 6th Edition, Philadelphia.: F A Davis Publishing. 2016.

Mark Zelman, Elaine Tompary, Jill Raymond, Paul Holdaway, Mary Lou E. Mulvihill. *Human Diseases: A Systemic Approach.* US.: Pearsons. 2015.

BOOKS FOR REFERENCE

Margaret Schell Frazier, RN, CMA, BS and Jeanette Drzymkowski, RN, BS. Essentials of Human Diseases and Conditions. 6th Edition. Philadelphia.: Saunders. 2016

Patton Kevin T. *The Human Body in Health & Disease*. Canada.: Elsevier. 2017

JOURNALS

Genes and Diseases

Journal of Infectious Diseases and Medicine

Infection, Disease & Health

Diseases

WEB RESOURCES

https://www.publichealth.org/resources/infectious-disease/

https://www.cdc.gov/diseasesconditions/index.html

https://healthfinder.gov/FindServices/SearchContext.aspx?topic=250&show=1

https://medicalsciences.med.unsw.edu.au/community/museum-human-disease/education

PATTERN OF ASSESSMENT

Continuous Assessment Test: **Total Marks: 50** **Duration: 90 minutes**

Section A – 10 x 1 = 10 Marks (All questions to be answered)

Section B – 2 x 10 = 20 Marks (2 out of 4 to be answered)

Section C – 1 x 20 = 20 Marks (1 out of 2 to be answered)

Other Components: **Total Marks: 50**

Assignment/Open book test/Case study/Seminars/Group Discussion

End-Semester Examination: **Total Marks: 100** **Duration: 3 hours**

Section A – 20 x 1 = 20 Marks (All questions to be answered)

Section B – 4 x 10 = 40 Marks (4 out of 7 to be answered)

Section C – 2 x 20 = 40 Marks (2 out of 4 to be answered)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600 086

M.Sc. DEGREE: BIOTECHNOLOGY

SYLLABUS
(Effective from the academic year 2019-2020)

HUMAN GENETICS

CODE:19BY/PE/HG23 **CREDITS: 3**
L T P: 3 0 0
TOTAL TEACHING HOURS:39

OBJECTIVES OF THE COURSE

- To get the insight on the principles of inheritance as formulated by Mendel
- To describe normal chromosome number, structure, and behavior in human cells
- To understand genome sequencing project

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- explore the fundamentals of human genetics
- identify family history, construct and interpret a pedigree
- brief chromosomal basis of inheritance and its alterations
- recognise the relationship between phenotype and genotype
- approach genetic counselor
- explain the molecular and biochemical basis, diagnosis and treatment of genetic disease

Unit 1 **(10 Hours)**

Basic Principles of Human Genetics

1.1 Fundamentals of Genetics
1.2 Law of Segregation, Law of Dominance, Law of Independent Assortment
1.3 Complete Dominance, Incomplete Dominance, Co-dominance, Multiple Alleles

Unit 2 **(5 Hours)**

Pedigree

2.1 Pedigrees- Gathering Family History- Pedigree Symbols-Construction of Pedigrees
2.2 Presentation of Molecular Genetic Data in Pedigrees, Genetic Counseling

Unit 3 **(10 Hours)**

Genetic Inheritance

3.1 Patterns of Genetic Inheritance –Autosomal Recessive Inheritance, Autosomal Dominance Inheritance
3.2 Sex-Linked Inheritance, Multifactorial Inheritance-Blood Grouping

Unit 4 **(9 Hours)**

Genetics in Medical Practice

4.1 Gene Therapy - Hemophilia

4.2 Stem Cells-Definition and Types- Cord Blood Banking

4.3 Pregnancy and Prenatal Diagnosis – Chorionic Villi Sampling – Ultrascopy - Amniocentesis

Unit 5 **(5 Hours)**

Genetics and Society

5.1 Eugenics-Positive and Negative Impact

5.2 Human Genome Project and its Significance

BOOKS FOR STUDY

Bruce R. Korf, Mira B. Irons. *Human Genetics and Genomics*. U.S.A.: Wiley-Blackwell, 2013.

Daniel L. Hartel and Elizabeth W. Johnes. *Essential Genetics - A Genomic Perspective*. U.S.A.: Jones and Bartleet, 2006.

Katira V. *Basics of Human Genetics*. India. Cbs Publishers and Distributors Pvt Ltd, 2017.

Michael R. Cumming. *Human Hereditary - Principles and Issues***.** U.S.A.: Cengag learning. 2010.

Trivedi Dipali J. *Kapur & Suri'S Basic Human Genetics*. India. Jaypee Brothers Medical Publishers. 2016.

BOOKS FOR REFERENCE

Gangane S.D. *Human Genetics*. U.S.A.: Elsevier, 2012.

Hong Weng Deng, Hui Shen, Yong-Jun Liu, Hai Hu. *Current Topics in Human Genetics.* U.K.: World Scientific, 2007.

Nussbaum RL, McInnes RR, Willard HF. Thompson & Thompson, *Genetics in Medicine.* U.S.A.: WB Saunders, 2004.

Ricki Lewis. *Human Genetics: Concepts and Applications***.** U.S.A.: Mc Graw, 2009.

Ricki Lewis. *Human Genetics: The Basics.* USA. Garland Science. 2016

Rimoin DL, Connor JM, Pyeritz RE, Korf, B. Emery and Rimoin's. *Principles and Practices of Medical Genetics.* U.S.A.: Churchill, 2002.

Russ Hodge. *Human Genetics: Race, Population and Disease*. U.S.A.: Infobase, 2010.
Turnpenny P and Ellard S. *Emery's Elements of Medical Genetics.* U.S.A.: Churchill, 2007.

JOURNALS

American Journal of Human Genetics

Indian Journal of Human Genetics

Annals of Human Genetics

WEB RESOURCES
https://www.genome.gov/
learn.genetics.utah.edu/

PATTERN OF ASSESSMENT

Continuous Assessment Test: Total Marks: 50 Duration: 90 minutes
Section A - 3 x 2 = 6 Marks (All questions to be answered)
Section B - 3 x 8 = 24 Marks (All questions to be answered; Questions to be taken from all units and internal choices within the units to be given i.e. either/or)
Section C - 1 x 20 = 20 Marks (1 out of 2 to be answered; Questions to be taken from all units)

Other Components: Total Marks: 50
Assignment/Open book test/Seminar/Group Discussion

End-Semester Examination: Total Marks: 100 Duration: 3 hours
Section A - 10 x 2 = 20 Marks (All questions to be answered, Questions to be of objective type: MCQ and Answer in few lines)
Section B - 5 x 8 = 40 Marks (All questions to be answered; Questions to be taken from all units and internal choices within the units to be given i.e. either/or)
Section C - 2 x 20 = 40 Marks (2 out of 4 to be answered; Questions to be taken from all units)