

**STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600 086**  
**M.Sc. DEGREE: BIOTECHNOLOGY**

**SYLLABUS**  
**(Effective from the academic year 2015 - 2016)**

**MARINE BIOTECHNOLOGY**

**CODE: 15BY/PE/MT14**

**CREDITS: 4**

**L T P: 4 0 0**

**TOTAL TEACHING HOURS: 52**

**OBJECTIVES OF THE COURSE**

- To enable student to have a clear understanding of the concepts of Marine Biology
- To have an additional dimension to the study Marine Biotechnology and its economic importance

**Unit 1**

**Introduction to Marine Biotechnology (10 hrs.)**

- 1.1 Basic Concepts – Composition of Seawater, Origin of Ocean Salts, Concepts of Chlorinity and its Significance, Salinity Measurements, Dissolved and Particulate Organic Matter – their Interaction with Marine Life, Eutrophication, Marine Sediments – Texture and Chemistry
- 1.2 Classification of Marine Environment – Marine, Brackish, Estuarine, Mangroves, Lagoons, Coral Reefs – their Physico-Chemical Features
- 1.3 Plankton and Nekton – Classification of Plankton, Methods of Collection, Preservation, Phytoplankton Blooms and Primary Production

**Unit 2**

**Diversity of Marine Environment (8 hrs.)**

- 2.1 Hydrothermal Vents-Vent Biodiversity, Hyperthermophilic and Barophilic Microorganisms and their Applications
- 2.2 Biotechnological Applications of Extremozymes from Extremophilic Organisms
- 2.3 Unculturable Bacteria, Occurrence, Characteristics and Exploitation

**Unit 3**

**Pollution and Biomaterial Interaction (10 hrs.)**

- 3.1 Marine Pollution-Major Pollutants-Heavy Metal, Pesticide, Oil, Thermal, Radioactive, Plastics, Litter and Microbial
- 3.2 Biological Indicators (Marine Microbes, Algae and Crustaceans) and Accumulators. Application of Protein Biomarkers, Biosensors and Biochips
- 3.3 Biodegradation of Natural and Synthetic Waste Materials, Bioremediation-Separation, Purification and Bio Removal of Pollutants
- 3.4 Biofouling, Biofilm Formation; Marine Fouling and Boring Organisms - their Biology, Adaptation; Factors Influencing the Settlement of Macrofoulers, Antifouling and Anti Boring Treatments, Corrosion Process and Control of Marine Structures

## Unit 4

### **Bioactive Marine Natural Product (12 hrs.)**

4. Collection and Identification of Marine Organism, Isolation, Screening and Identification of Pharmacological Bio Active Compounds, Commercial Development of Marine Natural Product
- 4.2 Biomedical Potential of Marine Products-Antiviral Substances, Antiparasitic Substances, Antitumor Substances, Anti-Inflammatory/Analgesic Compounds
- 4.3 Nutraceuticals- Development of Novel Foods and Food Ingredients, Low Calorie Sweeteners, Flavour Modifiers, Nutritional Enrichment - Food Supplements, Food Colouring Agents and Water Binding Agents
- 4.4 Biogenic Compounds from Marine Algae

## Unit 5

### **Applications of Marine Biotechnology (12 hrs.)**

- 5.1 Characteristics and Applications of GFP
- 5.2 Probiotics and their Importance in Aquaculture
- 5.3 Techniques for Identification of Bacterial and Viral Pathogen in Aquaculture
- 5.4 Gene Probes and their Applications in Disease Diagnosis
- 5.5 Chromosomal Manipulation of Commercially Important Marine Organisms, Transgenic Fishes with Growth Hormone (GH) and Antifreeze Genes, Transposon in Fishes
- 5.6 Vaccines for Aquaculture

## TEXT BOOKS

Kim, Sen-kwon. *Hand book of marine biotechnology*. U.S.A.: Springer, 2015.

David H Atlway. *Marine biotechnology-Vol I. pharmaceutical and bioactive natural products*. U.S.A.: Springer, 2000

Fingerman M. Nagabhushanam R and Thompson M. *Recent Advances in Marine Biotechnology*.U.K.: Oxford, 1998.

## BOOKS FOR REFERENCE

Bright Singh I. S. Somnath Pai S. Rosamma Philip and Mohan Das A. *Aquaculture Medicine*. Kochi: Paico, 2003.

David H. Attaway. Oskar R. and Zaborsky. *Marine Biotechnology volume 1: Pharmaceutical and Bioactive Natural Products*. U.S.A.: Springer, 1993.

Lee Y.K and Salminen S. *Handbook of probiotics and prebiotics*. U.S.A.: Wiley, 2009.

LeGal Y and Ulber R. *Advances in Biochemical Engineering/Biotechnology- Marine Biotechnology I & II*. U.S.A.: Springer, 2005.

## JOURNALS

Journal of marine Biotechnology

Journal of Marine Science: Research and Development

Advances and New perspectives in Marine Biotechnology

## **WEB RESOURCES**

[www.marinebiotech.eu](http://www.marinebiotech.eu)

[www.ecmb.org/](http://www.ecmb.org/)

## **PATTERN OF EVALUATION**

### **Continuous Assessment Test:**

**Total Marks: 50**

**Duration: 90 mins.**

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)

### **Third component:**

List of Evaluation modes:

Assignment

Open book test

Seminar

Group discussions

Debate

### **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 2015 - 2016)**

**PATENTING AND ENTREPRENEURSHIP**

**CODE: 15BY/PE/PN14**

**CREDITS : 4**

**L T P : 4 0 0**

**TOTAL TEACHING HOURS: 52**

**OBJECTIVES OF THE COURSE**

- To acquire a fundamental knowledge of the concepts of patenting
- To encourage and promote Entrepreneurship

**Unit 1**

**Intellectual Property Rights (10 hrs.)**

- 1.1 IPRs – Implications for India, WTO, WIPO, GATT, TRIPS
- 1.2 Patenting and the Procedures Involved in the Applications for Patents and Granting of Patent
- 1.3 Compulsory Licenses, Patent Search. Special Application of Patent Laws in Patenting of Living Organisms, Plant Breeders Rights, Legal Implications, Traditional Knowledge, Commercial Exploitation, Protection

**Unit 2**

**Ethical Issues in Plant and Animal Research (10 hrs.)**

- 2.1 Ethics: Regulations on Field Experiments and Release of GMO (Genetically Modified Organisms), International and Indian Regulatory Authority – BRAI, Labeling of GM (Genetically Modified) Foods
- 2.2 Impact of Gene Cloning, Legal, Social and Ethical Issues in Organ Transplantation

**Unit 3**

**Ethical Implications of Human Genome Project (8 hrs.)**

- 3.1 Ethical Implications of Human Genome Project – International Ethical and Legal Issues Connected to HGP
- 3.2 Human Fetal Sex Determination – Implications in India Genetic Study on Ethnic Races

**Unit 4**

**Entrepreneurship (12hrs.)**

- 4.1 Introduction, Concept and Theory, Entrepreneurial Traits and Motivation
- 4.2 Nature and Importance of Entrepreneurship in India, Promoting Entrepreneurship, Biotech Company Roadmap, Legal, Regulatory and Other Business Factors
- 4.3 Barriers in Entrepreneurship, Agreements, Valuation and Business Concerns

## Unit 5

### Entrepreneurship Strategies

(12 hrs.)

5.1 Funding of Biotech Business, MSME and Technology Incubator

5.2 Potential Entrepreneurship Activities in Biotechnology, Product Development, Marketing, Role of Knowledge centers and Research and Development (Knowledge Centers like Universities and Research Institutions, Role of Technology and Upgradation)

5.3 Biotech Parks, Biotechnology Industries in India and the Potential Job Opportunities

### TEXT BOOKS

Butler Gerard M. and Harris Antony. *Bioethics guide to Pharmaceutical Manufacturers*. U.K.: Medicines Control Agency, 2002.

Butler M. *Animal Cell Culture and Technology*. New Delhi: Bios International, 2000.

Damien Hine and John Kapeleris. *Innovations and Entrepreneurship –An international perspectives*. U.K.: Edward Elgar, 2006.

Jeffery M. Smith. *Seeds of Deception* U.S.A. : Chelsca Green, 2003.

Thomas Brenner and HolgerPatzelt. *Handbook of Bio-Entrepreneurship*. U.S.A.: Springer, 2008.

Verma and Agarwal. *Intellectual property Rights*. New Delhi: I. K. International, 1992.

### BOOKS FOR REFERENCE

Craig Shimasaki. *Biotechnology Entrepreneurship*. U.S.A.: Elsevier, 2014.

Sharma, P.D. and Agarwal P.K. *Patent Co-operation Treaty*, New Delhi: MJ, 2002.

### JOURNALS

World Patent Information

Bio-Entrepreneur

Journal of Commercial Biotechnology

Journal of the Patent and Trademark Office Society

### WEB RESOURCES

[www.ita.ucsf.edu/](http://www.ita.ucsf.edu/)

[www.nature.com/bioent/](http://www.nature.com/bioent/)

[www.epo.org/](http://www.epo.org/)

[www.ipindia.nic.in](http://www.ipindia.nic.in)

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Debate

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**Duration: 3 hours**

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**M.Sc. DEGREE: BIOTECHNOLOGY**

**SYLLABUS**  
**(Effective from the academic year 2015 - 2016)**

**RESEARCH METHODOLOGY AND BIOSTATISTICS**

**CODE: 15BY/PE/RB14**

**CREDITS : 4**

**L T P : 4 0 0**

**TOTAL TEACHING HOURS : 52**

**OBJECTIVES OF THE COURSE**

- To study the importance of research in basic and applied sciences
- To disseminate information on the collection, analysis and interpretation of biological data by using biostatistical tools

**Unit 1**

**Principles of Research (10 hrs.)**

- 1.1 Principles and Practice of Research- Literature Review, Action Plan and Pilot Study
- 1.2 Undertaking a Research Project- Data Collection
- 1.3 Classification and Presentation of Data

**Unit 2**

**Presentation of Project (10 hrs.)**

- 2.1 Preparing Manuscripts for Publication, Oral and Poster Presentation
- 2.2 Project Proposal Writing, Reference, Cross-Referencing, Proof Reading, Grant Application
- 2.3 Presentation of Project- Writing Reports, Organization of Manuscript, Writing a Thesis, Scientific Writing, Plagiarism
- 2.4 Presentation of the Results - Software Packages (SPSS) for Data Analysis
- 2.5 Funding Agencies for Project

**Unit 3**

**Biosafety and Bioethics (8hrs.)**

- 3.1 Biosafety – Cartagena Protocol, Different Levels of Biosafety
- 3.2 Containment Types, Facilities for Genetic Engineering Experiments
- 3.3 Good Laboratory Practices (GLP), Basic Laboratory and Maximum Containment Laboratory
- 3.4 Bioethics- Introduction, Intellectual Property Rights (IPR), Ethical Committee

**Unit 4**

**Biostatistics (12 hrs.)**

- 4.1 Applications in Biology-Collection-Classification –Tabulation and Diagrammatic Representation

- 4.2 Central Tendency – Measures of Dispersion
- 4.3 Correlation and Regression Analysis, ANOVA-Concepts and Simple Problems Only
- 4.4 Probability- Addition and Multiplication Theorem - Probability Distributions- Binomial, Poisson and Normal Distribution
- 4.5 Sampling Techniques- Concepts and Simple Problems Only

**Unit 5**

**Parametric and Nonparametric Statistics**

**(12 hrs.)**

- 5.1 Hypothesis Testing –Null Hypothesis
- 5.2 Chi-Square Test
- 5.3 Students T- Test, Z- Test-F- Test
- 5.4 Tukey's test - Concepts and Simple Problems Only

**TEXT BOOKS**

Bhuvaneshwari, S. *Introduction to Biosafety*. Chennai: Marina, 2008.

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**

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

Negi, S. *Biostatistics*. India : AITBS, 2002.

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

**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.com/articles/which-ux-research-methods/](http://www.nngroup.com/articles/which-ux-research-methods/)  
[www.processresearchmethods.org](http://www.processresearchmethods.org).  
[www.statsoft.com/textbook/](http://www.statsoft.com/textbook/)



biosun1.harvard.edu/  
www.bettycjung.net/Statsites.htm  
www.ucl.ac.uk/statistics/biostatistics

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**M.Sc. DEGREE: BIOTECHNOLOGY**

**SYLLABUS**  
**(Effective from the academic year 2015 - 2016)**

**BIO-NANOTECHNOLOGY**

**CODE :15BY/PE/BN14**

**CREDITS: 4**

**L T P: 4 0 0**

**TOTAL TEACHING HOURS : 52**

**OBJECTIVES OF THE COURSE**

- To enable student to have a clear understanding of Bionanotechnology
- To have an additional dimension to the study of Bionanotechnology and its use to human welfare

**Unit 1**

**Nanosystem**

**(10hrs.)**

- 1.1 Definition of a Nano System -Dimensionality and Size Dependent Phenomena, Quantum Dots, Nanowires and Nanotubes, 2D Films
- 1.2 Nano and Mesopores – Size Dependent Variation in Magnetic, Electronic Transport, Reactivity
- 1.3 Synthesis and Characterizations of Nanoscale Materials
- 1.4 Strategies for Nano architecture (Top Down and Bottom up Approaches)
- 1.5 Fabrication Technologies and Characterizations, Self-assembly Systems
- 1.6 Nanofluidics, Surfactants, Polymers, Emulsions and Colloids

**Unit 2**

**Nano Materials Preparation and Characterization**

**(11hrs.)**

- 2.1 Basic Concepts of Nanostructured Materials –Nucleation- Surface Nucleation Growth – Grain Size Distribution – Nano Particle Transport in Low Density Media – Vapour Nano Phase Thermodynamics – Coagulation of Nano Particles, Determination of Grain Size – Aggregate Formation – Mass Fractal Morphologies, Film Deposition Methods- Sol-Gel Processing
- 2.2 New Forms of Carbon – Types of Nanotubes – Formation, Characteristics and Applications of Nanotubes- Quantum Dots and Wires, Gold Nanoparticles. Nanopores
- 2.3 Nanoparticle Synthesis in Plants, Bacteria, and Yeast
- 2.4 Characterisation of Nano Particles- Scanning Electron Microscopy, Transmission Electron Microscopy, Scanning Probe Microscopy, Atomic Force Microscopy, FTIR, Scanning Tunneling Microscope, Nuclear Magnetic Resonance Spectroscopy

**Unit 3****Nanocarriers****(11hrs.)**

- 3.1 Nanoscale Devices for Drug Discovery -Application of Nano-biotechnology in Drug Delivery
- 3.2 Nanoparticle Flow, Implications for Drug Delivery – Polymeric Nanoparticles as Drug Carriers and Controlled Release Implant Devices
- 3.3 Micelles for Drug Delivery, Micro-array and Genome Chips
- 3.4 Genetic Vaccines, A Role for Liposomes, Polymer Micelles as Drug Carriers
- 3.5 Microemulsions as Drug Delivery Vehicles – Lipoproteins as Pharmaceutical Carriers, Solid Lipid Nanoparticles as Drug Carriers

**Unit 4****Nanocapsules****(10hrs.)**

- 4.1 Nanocapsules- Preparation and Characterization
- 4.2 Therapeutic Applications – Dendrimers, Cochleates, Aerosols, Magnetic Nanoparticles as Drug Carriers
- 4.3 Nanoparticulate Drug Delivery to the Reticuloendothelial System, Cardiovascular System, Lungs, Brain, Gastro-Intestinal Tract
- 4.4 Nanoparticles and Microparticles as Vaccines Adjuvants

**Unit 5****Nano-Medicine****(10hrs.)**

- 5.1 Bio-Pharmaceuticals – Implantable Materials – Implantable Devices –Surgical Aids – Diagnostic Tools – Genetic Testing
- 5.2 Nanoparticles Probe
- 5.3 Nanotechnology for Cancer Research and Therapy, siRNA, Tumor-Targeted Drug Delivery Systems
- 5.4 Nanotechnology for Imaging and Detection

**TEXT BOOKS**

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

Ratner, M. and Ratner, D. *Nanotechnology: A Gentle Introduction to the Next Big idea*. U.S.A.: Pearson, 2005.

Christef M. Niemeyer, C. A. Mirkin. *Nanobiotechnology: Concepts, Application and Properties*. New York: Wiley–VCH, 2004.

**BOOKS FOR REFERENCE**

Pradeep, T. *Nano*. New Delhi: Tata McGraw, 2006.

Jain, K.K. *Nanobiotechnology in Molecular Diagnostics: Current Techniques and Applications*. India: Horizon Biosciences, 2006.

Challa S.S.R and Kumar. *Biological pharmaceutical Nanomaterial*. Germany: Wiley, 2006.

Parag Diwan and Ashish Bharadwaj. *Nano Medicines*. U.S.A.: Pentagon, 2006.

Vladimir P. Torchilin. *Nanoparticulates as Drug Carriers*. U.S.A.: Imperial, 2006.

## **JOURNALS**

Journal of Nanotechnology

International Journal of Nanotechnology

## **WEB RESOURCES**

<http://www.zyvex.com/nano>

[www.fda.gov/nanotechnology/](http://www.fda.gov/nanotechnology/)

[www.nature.com/nnano/](http://www.nature.com/nnano/)

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Assignment

Seminar

Paper reviews

Quiz

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**M.Sc. DEGREE: BIOTECHNOLOGY**

**SYLLABUS**  
**(Effective from the academic year 2015- 2016)**

**ENVIRONMENTAL BIOTECHNOLOGY**

**CODE: 15BY/PE/ET14**

**CREDITS: 4**

**L T P : 4 0 0**

**TOTAL TEACHING HOURS: 52**

**OBJECTIVES OF THE COURSE**

- To gain better understanding of environment, its crisis and its remediation
- To create an awareness of current technology employed in environmental sustainability

**Unit 1**

**Introduction to Environment (10 hrs.)**

- 1.1 Microbial Flora of Soil, Ecological Adaptations, Interactions among Soil Microorganisms, Biogeochemical Role of Soil Microorganisms
- 1.2 Biodegradation, Microbiology of Degradation and its Mechanism, Bioaugmentation
- 1.3 Biosorption, Bioleaching, Bioremediation- Types of Bioremediation, Bioreactors for Bioremediation, Metabolic Pathways for Biodegradation for Specific Organic Pollutants

**Unit 2**

**Types of Pollution (12 hrs.)**

- 2.1 Pollution- Sources of Pollutants for Air, Water (ground water, marine), Noise, Land and its Characteristics- Pollution Control and Management- Environmental Monitoring and Sampling
- 2.2 Physical, Chemical and Biological Methods and Analysis- Air Pollution- Control and Treatment Strategies
- 2.3 Modes of Biological Treatment Methods for Wastewater- Aerobic Digestion, Anaerobic Digestion, Anoxic Digestion, the Activated Sludge Process
- 2.4 Design and Modeling of Activated Sludge Processes, Design of a Trickling Biological Filter, Design of Anaerobic Digester

**Unit 3**

**Industrial Waste Management (10 hrs.)**

- 3.1 Industrial Waste Management- Dairy, Paper and Pulp, Textile, Leather, Hospital and Pharmaceutical
- 3.2 E-waste- Radioactive and Nuclear Power Waste Management
- 3.3 Solid Waste Management

**Unit 4**

**Recombinant DNA Technology Application in Environment (10 hrs.)**

- 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, Phytoremediation for Heavy Metal Pollution, Biosensors Development to Monitor Pollution

## **Unit 5**

### **Environmental Sustainability (10hrs.)**

- 5.1 Alternate Source of Energy, Biomass as a Source of Energy, Biocomposting, Vermiculture, Biofertilizers, Organic farming, Biofuels
- 5.2 Biomineralization, Bioethanol and Biohydrogen, Bioelectricity through Microbial Fuel Cell
- 5.3 Energy Management and Safety

## **TEXT BOOKS**

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.: Naves, 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**

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

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.

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.: Elsevier Sciences, 1985.

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

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

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

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

## **JOURNALS**

Journal of petroleum and environmental Biotechnology

Microbial ecology and environmental Biotechnology

## **WEB RESOURCES**

[www.environmentalbiotech.com/](http://www.environmentalbiotech.com/)

[www.waterlooenvironmentalbiotechnology.com/](http://www.waterlooenvironmentalbiotechnology.com/)

[www.neeri.res.in/](http://www.neeri.res.in/)

## **PATTERN OF EVALUATION**

### **Continuous Assessment Test:**

**Total Marks: 50**

**Duration: 90 Mins.**

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### **Third Component:**

List of Evaluation modes:

Assignment

Open book test

Seminar

Group Discussion

Quiz

Working Models

### **End Semester Examination:**

**Total Marks: 100**

**Duration: 3 hours**

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**M.Sc. DEGREE: BIOTECHNOLOGY**

**SYLLABUS**

**(Effective from the academic year 2015 - 2016)**

**BIOPHYSICS AND BIOINSTRUMENTATION**

**CODE: 15BY/PE/BB14**

**CREDITS: 4**

**L T P: 4 0 0**

**TOTAL TEACHING HOURS: 52**

**OBJECTIVES OF THE COURSE**

- To emphasize the physical principles and theories underlying biological processes
- To acquire a fundamental knowledge of instruments and its applications

**Unit 1**

**Introduction to Molecular Biophysics (11 hrs.)**

- 1.1 Bioenergetic Principles- Concept of Energy- Thermodynamic Principles –Free Energy-Enthalpy-Entropy-Role of High Energy Phosphates- Energy Transduction
- 1.2 Structure, Conformation and Structural Polymorphism of Biomolecules-Proteins Carbohydrates and Nucleic Acids- Methods of Structural Elucidation of Biological Macromolecules- <sup>13</sup>C and <sup>1</sup>H NMR- X-ray Diffraction
- 1.3 Measurement of Transmittance and Absorbance – Beer's and Lamberts Law, Colorimetry, Spectrophotometry - UV Visible and Raman Spectroscopy, CD- ORD, Infrared, Fluorescence, ESR, Plasma Emission Spectroscopy, MALDI-TOF

**Unit 2**

**Protein Biology (10 hrs.)**

- 2.1 Ramachandran Plot, Protein Sequencing, Protein-Protein and Protein-Ligand Interactions-Protein Folding-Glycoprotein and Lipoprotein, Membrane Biophysics Structure and Dynamics of Biological Membranes, Signal Transduction Across Membranes, Nernst Equation
- 2.2 Membrane Potential-Biomechanics and Neurobiophysics, Macromolecular Interactions- Supramolecules

**Unit 3**

**Separation Techniques (9 hrs.)**

- 3.1 Centrifugation - Basic Principles of Sedimentation, Types of Rotors, Preparative and Analytical Ultracentrifugation
- 3.2 Chromatography - Definitions and General Principles, Gel Filtration, Affinity Chromatography, HPLC and FPLC, Ion-Exchange Chromatography, Supercritical Chromatography



**Unit 4****Radiation Biology (10 hrs.)**

- 4.1 Stable and Radio-isotopes, Measurement of Radioactivity in Biological Samples- Gas Ionization (GM counter), Scintillation Counter, Autoradiography and Dosimeter
- 4.2 Radiation Units, Safety Aspects in Handling Radioactive Isotope
- 4.3 Application of Radioactive Isotopes in Biological Studies

**Unit 5****Electrophoresis and Microscopy (12 hrs.)**

- 5.1 Electrophoresis - Basic Principles, Native- PAGE, SDS-PAGE, Isoelectric Focusing and 2 Dimensional Gels, Capillary Electrophoresis, Denaturing Agarose Gel Electrophoresis, Pulse-field Gel Electrophoresis, Mobility Shift Electrophoresis
- 5.2 Microscopy- Transmission and Scanning Electron Microscopy, Cryomicroscopy and Confocal Microscopy

**TEXT BOOKS**

Branden and Tooze. *Introduction to Protein Structure*. New York: Garland, 1999.

Creighton, Thomas. E. *Protein: Structure and Molecular Properties*. U.S.A: WH, 1996.

Skoog, D. A, Holler, J. F and Nieman, T. A. *Principles of Instrumental Analysis*. U.S.A.: Thomson, 2006.

Vasantha Pattabhi and Gautham N, *Biophysics* New Delhi: Narosa 2010.

Willard, H. H and Merrit, L. L. *Instrumental Methods of Analysis*. U.S.A.: Prentice Hall, 2005.

**BOOKS FOR REFERENCE**

Wilson, K and Walker, J. *Practical Biochemistry – Principles and Techniques*. U.S.A.: Cambridge, 2002.

Sambrook, J and Russell, D.W. *Molecular Cloning – A Laboratory Manual*. New York: ColdSpringHarbor, 2001.

Bozzola, John J. and Russel Lonnie D. *Electron Microscopy – Principles and Techniques for Biologist*. U.S.A.: Jones and Bartlett, 1992.

Herrit, Willard, Dean and Settle. *Instrumental Methods of Analysis*. U.S.A.: CBS, 1986.

Plummer, D.T. *An Introduction to Practical Biochemistry*. New Delhi: Tata McGraw – Hill, 1985.

Morris and Morris. *Separation Methods in Biochemistry*. London: Pitman, 1960.

## **JOURNALS**

Journal of Biophysics

International Journal of Biophysics

International Journal of Instrumentation

## **WEB RESOURCES**

[www.biophysics.org/](http://www.biophysics.org/)

[www.medbio.utoronto.ca/](http://www.medbio.utoronto.ca/)

[www.wiley.com](http://www.wiley.com).

[www.surface51.com](http://www.surface51.com)

## **PATTERN OF EVALUATION**

### **Continuous Assessment Test:**

**Total Marks: 50**

**Duration: 90 mins.**

Section A –  $10 \times 1 = 10$  Marks (All questions to be answered)

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

Section C –  $1 \times 20 = 20$  Marks (1 out of 2 to be answered)

### **Third component:**

List of Evaluation modes:

Assignment

Open book test

Quiz

Seminar

### **End Semester Examination:**

**Total Marks: 100**

**Duration: 3 hours**

Section A –  $20 \times 1 = 20$  Marks (All questions to be answered)

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

Section C –  $2 \times 20 = 40$  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 2015 - 2016)**

**APPLICATIONS OF BIOTECHNOLOGY**

**CODE: 15BY/PE/AB24**

**CREDITS: 4**

**L T P : 4 0 0**

**TOTAL TEACHING HOURS: 52**

**OBJECTIVES OF THE COURSE**

- To study various aspects of Biotechnology
- To understand the applications of Biotechnology in everyday life

**Unit 1**

**Fermentation Technology (10 hrs.)**

- 1.1 Fundamentals of Fermentation Technology- History of Fermentation Technology, Up Stream and Down Stream Processing
- 1.2 Applications of Enzymes in the Food Industry - Cheese, Bread, Wine, Beer and Meat
- 1.3 Enzyme and Antibiotic Production – Cellulase and Penicillin

**Unit 2**

**Bioactive Compounds and Bioproducts (11 hrs.)**

- 2.1 Biofertilizers and Vermicomposting
- 2.2 Importance of VAM Fungi, Mushroom Cultivation, Food Value of Edible Mushrooms
- 2.3 Biofuels- Ethanol Production and Biogas, Biodiesel, Petroplants and Algal Hydrocarbons

**Unit 3**

**Applications of Genetic Engineering (11 hrs.)**

- 3.1 Introduction to Cloning, Production of Transgenic Animals – Mouse, Fish, Poultry and other Mammals
- 3.2 Transgenic Plants for Crop Improvement- Herbicide and Insect Resistance Plantibodies and Edible Vaccines

**Unit 4**

**Applications of Plant Tissue Culture (10 hrs.)**

- 4.1 Tissue Culture-Overview, Synthetic Seeds
- 4.2 Applications in Agriculture (Herbal Products), Horticulture (Micropropagation), Floriculture (Ornamental Plants) and Pharmaceutical (Medical Compounds) Industry

## Unit 5

### Applications in Medicine

(10 hrs.)

- 5.1 DNA Fingerprinting in Forensic Science
- 5.2 Application of Vaccines
- 5.3 Application of Biosensors
- 5.4 Screening Tests for Genetic Diseases

### TEXT BOOKS

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.

Purohit, S.S. *Agricultural Biotechnology*. India: Agrobios, 2007.

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

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

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

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

### BOOKS FOR REFERENCE

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

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

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

### 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/](http://www.jasbsci.com/)

[www.niab.org.in/](http://www.niab.org.in/)

[www.pb.ethz.ch/](http://www.pb.ethz.ch/)

[www.nrcpb.org/](http://www.nrcpb.org/)

## **PATTERN OF EVALUATION**

### **Continuous Assessment Test:**

**Total Marks: 50**

**Duration: 90 mins.**

Section A –  $10 \times 1 = 10$  Marks (All questions to be answered)

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

Section C –  $1 \times 20 = 20$  Marks (1 out of 2 to be answered)

### **Third Component:**

List of Evaluation modes:

Assignment

Quiz

Seminar

Debate

### **End Semester Examination:**

**Total Marks: 100**

**Duration: 3 hours**

Section A –  $20 \times 1 = 20$  Marks (All questions to be answered)

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

Section C –  $2 \times 20 = 40$  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 2015 - 2016)**

**HUMAN GENETICS**

**CODE: 15BY/PE/HG34**

**CREDITS: 4**

**L T P: 4 0 0**

**TOTAL TEACHING HOURS: 52**

**OBJECTIVES OF THE COURSE**

- To create an awareness on hereditary diseases and transmission of genes through families and population
- To give an insight into the current trends in the field of genetics

**Unit 1**

**Basic Principles of Human Genetics (11 hrs.)**

- 1.1 Human Genetics – History
- 1.2 Pedigrees- Gathering Family History- Pedigree Symbols-Construction of Pedigrees- Presentation of Molecular Genetic Data in Pedigrees
- 1.3 Patterns of Genetic Inheritance –Autosomal Recessive Inheritance, Autosomal Dominance Inheritance, Sex-Linked Inheritance, Multifactorial Inheritance-Blood Grouping

**Unit 2**

**Cytogenetics (11 hrs.)**

- 2.1 Cell Cycle and Cell Division
- 2.2 Human Karyotype- Banding- Nomenclature of Banding
- 2.3 Pathology of Human Chromosomes, Nomenclature of Aberrant Karyotypes  
Structural and Numerical Chromosomal Aberration

**Unit 3**

**Genetics in Medical Practice (10 hrs.)**

- 3.1 Prenatal Diagnosis - Chorionic Villi Sampling - Foetoscopy, Ultrascopy - Amniocentesis
- 3.2 Postnatal Diagnosis- Peripheral Blood Leucocyte Culture, Sister Chromatid Exchange, Fragile Site, Mitotic Index
- 3.3 Genetic Counseling
- 3.4 Inborn Errors in Metabolism

**Unit 4**  
**Population Genetics** (10 hrs.)  
4.1 Population Genetics- Hardy-Weinberg Equilibrium-Natural Selection –Migration  
4.2 Inbreeding and its Impact in the Society  
4.3 Human Genome Project and its Significance

**Unit 5**  
**Gene Therapy and Cancer** (10 hrs.)  
5.1 Gene Therapy  
5.2 Cancer- Tumour Suppressor Gene-Oncogenes- Molecular Basis of Oncogenesis-  
Treatment for Cancer

### **TEXT BOOKS**

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.

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

### **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.

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/](http://learn.genetics.utah.edu/)

## **PATTERN OF EVALUATION**

### **Continuous Assessment Test:**

**Total Marks: 50**

**Duration: 90 mins.**

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)

### **Third Component:**

List of Evaluation modes:

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 2015 - 2016)**

**MOLECULAR ONCOLOGY**

**CODE: 15BY/PI/MO24**

**CREDITS : 4**

**OBJECTIVES OF THE COURSE**

- To introduce the basic concepts of Oncology
- To understand the recent developments in the field of Molecular Oncology

**Unit 1**

**Introduction**

- 1.1 Cell proliferation, Cell Cycle- Check Points, Genes Regulating the Cell Cycle
- 1.2 Differentiation, Apoptosis- Caspases, Senescence
- 1.3 Types of Cancer, Causes of Cancer- The Influence of Environment, Obesity, Estrogen
- 1.4 Oncogene and Tumour Suppressor Genes- Mutation, Genetic and Epigenetic Alteration, Multi –Step Carcinogenesis, Transformed Phenotype, Tumour Suppressor Genes

**Unit 2**

**Mechanisms**

- 2.1 Signal Transduction Pathway in Cancer- Receptor Tyrosine Kinase, RAS-MAP kinase, P13k-Akt Signaling, Classical and Alternative –NF-KB Pathway, JAK-STAT Pathway, FAK Src, Bax, Bcl-2
- 2.2 Metastasis, Primary Tumour, Micro Environment, Angiogenesis, Invasion, Epithelial Mesenchymal Transition, Extra Vacation, Tumour Establishment, Apoptosis, Tumour Dormancy

**Unit 3**

**Cancer Immunology**

- 3.1 Inflammation-Immuno Editing, Immuno Tolerance, Escape, Immuno Suppression, T-Regulatory Cells, Dysfunctional Dendritic Cells, Tumour Antigen, Adoptive T-Cell Immunotherapy, Novel, Combinatorial Therapy
- 3.2 Molecular Diagnosis and Prognosis- Biomarkers, PCR-Antigen, Chromosomal Translocation, Immuno Histochemistry, Oncogenomics, Oncoproteomics

## Unit 4

### ***In vitro* and *In vivo* Studies**

- 4.1 *In vitro* and *in vivo* Models for Cancer Research, Carcinogenesis
- 4.2 Cell Culture-Transgenic Mice, DNA Damage-Chemical Carcinogen, Metabolic Activation, Cytochrome 450, Solid Tumour, DNA Transfection, Gene Silencing, RNAi.

## Unit 5

### **Cancer Treatment**

- 5.1 Chemotherapy and Design of Antineoplastic Compounds - Medical Chemistry, Drug Design, Development, Bioinorganic Chemistry, Metal and Copper Compounds, Antineoplastics - Casiopeinas
- 5.2 Mechanism of Therapy- Multi – Drug Resistance, ABC Transporters, Tamoxifen, Antibody, EGFR Mutation
- 5.3 Future of Cancer Research- Epidemiological Studies, Pharmaco-Epidemiology, Cancer Prevention, Early Markers, Personalised Therapy, Clinical Trial, Mutation, Etiological Factors

## **BOOKS FOR REFERENCE**

Javier Camacho. *Molecular oncology: Principle and Recent Advances*. U.S.A.: Bentham science, 2012.

Bronchud M.H, Footy M.A., Giaccone G., Olopade O. and Workman P. *Principles of Molecular Oncology*. U.S.A.: Humana, 2004.

## **JOURNALS**

Journal of clinical oncology.  
Journal of oncology.

## **WEB RESOURCES**

[www.asco.org/](http://www.asco.org/)  
[www.esno.org/](http://www.esno.org/)

## **PATTERN OF EVALUATION**

### **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 2015 - 2016)**

**VIROLOGY**

**CODE: 15BY/PI/VR24**

**CREDITS : 4**

**OBJECTIVES OF THE COURSE**

- To provide an understanding on viruses and its molecular biology concepts
- To give an insight on human viral diseases

**Unit 1**

**Introduction to Viruses**

- 1.1 Definition of a Virus, Discovery, Virus Assay, Multiplication Cycle, Properties, Origin
- 1.2 Identification of Viruses Using Antibodies- Detection, Identification, Cloning of Virus Genome by PCR
- 1.3 Structure- Filamentous Viruses and Nucleoprotein, Structure of Isomeric, Enveloped, Tail- Head Morphology Viruses- Principles of Disassembly
- 1.4 Classification- Based on Disease, Host Organism, Virus Particle Morphology, Viral Nucleic acid (The Baltimore Scheme) and Taxonomy
- 1.5 Satellites, Virioids, Prions

**Unit 2**

**Virus Growth in Cells**

- 2.1 Virus Attachment and Entry into Cells- Nucleic Acid Synthesis-RNA Synthesis- Making Viral RNA
- 2.2 DNA-Genome Replication in DNA Virus-Transcription-Reverse Transcription
- 2.3 Transcription and RNA Processing-Processing Viral RNA-translation, Virion Assembly

**Unit 3**

**Virus Interaction with Host Organisms**

- 3.1 Virus Interaction- Viruses and Immune System
- 3.2 Interaction between Animal Viruses and Cells- Acutely Cytopathic Infection- Persistence, Latent, Transforming, Abortive, Null Infections
- 3.3 Animal Virus-Host Interaction- Classification-Acute, Subclinical, Persistent, Chronic, Latent Infection, Plant virus
- 3.4 Mechanism of Virus Latency- Interaction-Gene Expression
- 3.5 Transmission of Viruses- Horizontal, Vertical, Zoonoses
- 3.6 Vaccines and Antivirals- Peptide, Genetically Engineered Vaccines-Prophylaxis and Therapy with Antiviral Drugs

## Unit 4

### Viruses and Diseases

- 4.1 Viruses and Diseases- Human Viral Diseases-Human Viral Pathogens-Common Signs, Symptoms of Viral Infection-Gastrointestinal, Respiratory, Liver Infection, Systemic Spread
- 4.2 HIV and AIDS -Biology and Transmission, Course of Infection, Immunological Abnormalities, prevention and control
- 4.3 Carcinogenesis and Tumor Viruses- Polyomaviruses, Papillomaviruses, Adenoviruses, Retroviruses, Herpesviruses, Hepatitisviruses
- 4.4 Prion Diseases- Spectrum of Disease, Etiology, Pathogenesis, Bovine Spongiform Encephalopathy, Creutzfeldt-Jakob Disease

## Unit 5

### New Emerging Viruses

- 5.1 Evolution and Emergence- Viral Evolution
- 5.2 Emerging Viruses- Viruses and the Tree of Life, The Abundant and Diverse Viruses of the Seas
- 5.3 Chikungunya- An Exotic Virus on the Move-Lujo Virus, a New Hemorrhagic Fever Virus from Southern Africa
- 5.4 The Error-Prone ways of RNA synthesis
- 5.5 The Quasispecies Concept-Viral Quasispecies and Bottlenecks-the Number of Possible Viral Variants
- 5.6 The Trajectory of Evolution. Virulence - A Positive or Negative Trait for Evolution

## BOOKS FOR REFERENCE

Flint S.J, Enquist L.W, Racaniello V.R and Skalka A.M. *Principles of Virology*. U.S.A.: ASM, 2014.

Teri Shors. *Understanding Viruses*. U.S.A.: Jones and Bartlett, 2009.

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

## JOURNALS

Journal of Virology and Antiviral Research  
American Journal of Virology  
Journal of Virology

## WEB RESOURCES

[www.virology.net/](http://www.virology.net/)  
<https://www.coursera.org/course/virology>

## **PATTERN OF EVALUATION**

**End Semester Examination:**

**Total Marks: 100**

**Duration: 3 hours**

Section A –  $20 \times 1 = 20$  Marks (All questions to be answered)

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

Section C –  $2 \times 20 = 40$  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 2015 – 2016)**

**SOFT SKILLS**

**CODE : 15BY/PK/SS22**

**CREDITS : 2**

**L T P : 2 0 0**

**TOTAL TEACHING HOURS : 26**

**OBJECTIVES OF THE COURSE**

- To empower and create opportunities for self development
- To instill confidence and face challenges

**Unit 1 (6 hrs)**

**Behavioural Traits**

- 1.1 Self Awareness
- 1.2 Communication Skills – Verbal and Non Verbal
- 1.3 Leadership Qualities
- 1.4 Etiquette and mannerisms
- 1.5 Experiential Learning – Based on activities

**Unit 2 (5 hrs)**

**Team Work**

- 2.1 Interpersonal Skills
- 2.2 People Management
- 2.3 Creative Thinking
- 2.4 Critical Thinking
- 2.5 Experiential Learning – Based on activities

**Unit 3 (5 hrs)**

**Time Management**

- 3.1 Importance of time management
- 3.2 Planning and Prioritizing
- 3.3 Organizing skills
- 3.4 Action Plan
- 3.5 Experiential Learning – Based on activities

**Unit 4 (5 hrs)**

**Conflict Resolution**

- 4.1 Reasons for conflict
- 4.2 Consequences of conflict
- 4.3 Managing emotions
- 4.4 Methods of resolving conflicts
- 4.5 Experiential Learning – Based on activities

**Unit 5**

**(5 hrs)**

**Career Mapping**

- 5.1 Goal Setting and Decision Making
- 5.2 Career Planning
- 5.3 Resume Writing
- 5.4 Handling Interviews
- 5.5 Experiential Learning – Based on activities

Workshop on Societal Analysis

**BOOKS FOR REFERENCE**

Khera, Shiv, (2002), **You Can Win**, Macmillan India Ltd., Delhi.

Mishra, Rajiv K., (2004), **Personality Development : Transform Yourself**, Rupa and Co., New Delhi.

Newstrom, John W. and Scannell, Edward E., (1980), **Games Trainers Play: Experiential Learning**, Tata McGraw Hill, New Delhi.

**PATTERN OF EVALUATION (Totally Internal)**