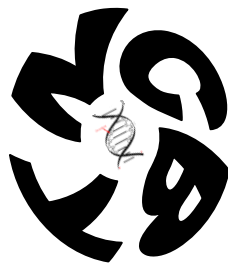


Department of Biotechnology



**The New College, Chennai
Autonomous**

Syllabus effective 2011- 12

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)

SUBJECT: MICROBIOLOGY

CODE: PB 101

CREDITS: 4

UNIT – I

History and scope of Microbiology. The morphology and fine structure of bacteria, virus, fungi and protozoa. The common nutrient requirements for bacteria. Culture media- Types of media. Growth curve, Isolation of pure culture. Spread plate, streak plate and pour plate. Principles of different staining techniques.

UNIT – II

Control of microorganisms by physical and chemical agents. Use of physical methods in control – heat, Filtration, radiation. Use of chemical agents-phenolics, alcohols, halogens, heavy metals, quaternary ammonium compounds, aldehydes and sterilizing gases.

UNIT – III

Antibiotics- general characteristics, Mode of action, classification, methods in antimicrobial susceptibility testing (Disk diffusion test, MIC, MBC). Mechanism of drug resistance. Bacterial diseases: Tuberculosis, Anthrax, cholera, Syphilis, and tetanus. Viral disease: Hepatitis, AIDS, rabies, poliomyelitis. Fungal disease: Superficial-dermatophytosis, systemic mycoses-candidiasis.

UNIT – IV

Medical Microbiology: Clinical specimens –collection, transport, handling. Identification of microorganisms from various specimens. Microscopic, biochemical and rapid methods of identification, immunologic techniques, molecular methods.

UNIT – V

Safety and quality control aspects in microbiology. Automation in microbiology, nosocomial infection. Method of microorganism preservation. Disposal of Infectious waste.

REFERENCES:

1. Pelczar MJ, Chan ECS, and King NR. 1993. *Microbiology- Concepts and Applications*. McGraw-Hill, Inc. NY.
2. Prescott LM, Haley JP, and Klecin DA, 2002. *Microbiology*. WCB Publishers, Sydney.
3. Shimeld LA, and Rodgers AT, 1999. *Essential of Diagnostic Microbiology*. Delmer Publishers.
4. Ingraham L, and Ingraham CA, 2000. *Introduction to Microbiology* 2nd edition. Thomson Asia Pte Ltd, Singapore.
5. Talaro KP, and Talaro A, 1999 *Foundation in Microbiology*, 3rd edition McGraw Hill
6. Cappuccino JG, Sharman N, 1999. *Microbiology - A laboratory manual* 4th edition, Wesley Longman
7. Lim D, 1998. *Microbiology* 2nd edition, McGraw-Hill.
8. Atlas RM, 1997. *Principles of Microbiology*. WCB Publishers.
9. Atlas RM, and Parks LC, 1997. *Handbook of Microbiology Media*, 2nd edition CRC Press.

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)

SUBJECT: BIOCHEMISTRY AND ENZYME TECHNOLOGY

CODE: PB 102

CREDITS: 4

UNIT – I

Introduction to Biochemistry. Water: role of water, maintenance of body water and pH, acidosis, alkalosis. Classification, structure, chemistry and properties of carbohydrates, proteins, lipids and nucleic acids.

UNIT – II

Principles of Bioenergetics, energy and laws of thermodynamics. The generation and role of ATP, biological oxidation, respiratory chain and oxidative phosphorylation, mitochondrial transport system and its inhibitors.

UNIT – III

Glucose metabolism, metabolism of glycogen, regulation of carbohydrate metabolism. Oxidation of fatty acid, biosynthesis of fatty acids, cholesterol and triglycerides. Regulation of lipid metabolism. Degradation of amino acids, transamination and oxidative deamination. Urea cycle.

UNIT – IV

Enzyme nomenclature and classification. General properties of enzymes and the factors that affect their activity. Enzyme kinetics (steady state), determination of K_m value using Lineweaver-Burke plot, Eadie-Hofstee plot and Hans-Woolf equation. Enzyme inhibitors, Allosteric regulation of enzymes.

UNIT – V

Enzyme specificity-Role of metal ions in enzyme catalysis (coenzymes, Isoenzymes and metalloenzymes), Mechanisms of enzyme action (lysozyme, chymotrypsin). Application of enzymes in medicine and other industries. Application of biosensors in industry, healthcare, therapeutics and environment.

REFERENCES

1. Stryer L, 1999. *Biochemistry*, 4th edn. W.H. Freeman and Company, New York.
2. Harper's Biochemistry, 1998. 24th edn. Prentice Hall, Singapore.
3. Jain JL, 1999. *Fundamentals of Biochemistry* 4th edn. Chand Company, New Delhi.
4. Lehninger A, 2000. *Biochemistry* 5th edn. Worth Publishing, New York.
5. Voet D, Voet JG, 2004. *Biochemistry*, John Wiley & Sons, NJ, USA
6. Palmer T, 1985. *Understanding Enzymes* 4th edn. Prentice Hall, London.
7. Wisemann A, Harward E, 2000. *Hand Book of Enzyme Biotechnology*.
8. Shanmugam A, 1997. *Fundamentals of Biochemistry*.

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)

SUBJECT: GENETICS AND MOLECULAR BIOLOGY

CODE: PB 103

CREDITS: 4

UNIT – I

Basic Genetics: Brief history, Mendel's Law and experiments, Epistasis, Complementary genes, Sex chromosomes and sex linked inheritance. DNA damage and repair: Mechanism of repair, photoactivation and types of repair mechanisms. Parasexual processes in bacteria: transformation, transduction and conjugation.

UNIT – II

Nucleic acids: Synthesis of macromolecules, DNA structure, replication, D-Loop and rolling circle mode of replication. Elucidation of genetic code, Wobble base pairing, Suppression of nonsense, missense and frame shift mutations. Site - Directed Mutagenesis. Cell Cycle and Cell cycle regulation: Genes regulating cell cycle. Signaling – signal transduction.

UNIT – III

Transposable genetic elements: Discovery, early experiments of McClintock in Maize. Complex transposons (ex: Tn10, Tn5, Tn9, and Tn3). Mechanism of Transposition in prokaryotes, transposable elements in eukaryotes.

UNIT – IV

Regulation of Gene Expression: positive and negative regulation, attenuation. Operon models: *lac*, *ara*, *trp* and *gal* operons. Mechanisms of recombination: breakage and reunion of DNA molecules, chiasmata, recombination models, Holliday model, enzymatic mechanism of recombination.

UNIT – V

Transcription: DNA-RNA hybrid complex, major classes of RNA, RNA synthesis and processing, Differences between eukaryotic and prokaryotic transcription. Post-transcriptional alteration. RNA interference. Translation: Steps in Protein synthesis, Protein targeting, post-translational modification.

REFERENCES:

1. Griffith AJF, Miller JH, Suzuki DT, Lewontin RC, Gelbart WM, 2000. *An introduction to Genetic Analysis*, 7th edn. W H Freeman, New York.
2. Gardener, 1991. *Principles of Genetics*, Simmons and Snustad.
3. Maloy S, Cronan JR, Frifelder D, 1994 *Microbial genetics*, Jones and Barlett Publications, London
4. Frifelder D, 1987. *Molecular Biology*, Narosa Publishing House, New Delhi.
5. Weaver J, 1995. *Basic Genetics* 2nd edn. Mc Graw Hill, NY.
6. Janardhanan S, and Vincent S, 2007. *Practical Biotechnology*. Universities Press Pvt Ltd, Hyderabad
7. Elrod S, and Stansfield W, 2002. *Genetics* (4th edn). Tata McGraw Hill, India.

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)

SUBJECT: RESEARCH METHODOLOGY AND BIostatISTICS

CODE: PB 104

CREDITS: 3

UNIT I:

Literature collection- different sources of biological online databases, Determining sample design, data collection, analysis and hypothesis testing, interpretation, writing reviews, articles in journals, construction of thesis; Manuscript and proof reading, power point presentation.

UNIT II:

Colorimetry, Spectrophotometry and Centrifugation techniques:

General principles- Visible and UV Spectrophotometry. Beer-Lambert's law- Spectrofluorimetry and Flame Spectrophotometry. Centrifugation - principles and applications of ultracentrifugation, differential centrifugation, and density gradient centrifugation.

UNIT III: Microscopy Microtomy and Chromatographic techniques:

Types of microscopes – principles and application of phase, fluorescence and electron microscopes. Tissue processing-microtomes-rotary and ultra microtomes-section cutting-processing-histological staining-Haematoxylin, Eosin, Mallory's Triple- Histochemistry-BPB, PAS, Sudan Black. Paper chromatography, Thin layer, Column chromatography, Gas Liquid (GLC) and HPLC.

UNIT IV: Electrophoresis and electrochemical techniques:

Electrophoresis- General principles- Gel electrophoresis- SDS Polyacrylamide gel electrophoresis, Blotting Techniques, Immuno electrophoresis - Isoelectrofocussing. pH and its measurements, Ion selective electrodes (ISE), Redox potential and potentiometric titration- oxygen electrode and its application.

UNIT V: Biostatistics:

Mean, median, mode, variance, standard deviation, t-test, ANOVA, Chi-Square Test – Correlation and Regression. Binomial Poisson and Normal distribution.

REFERENCES:

1. Cambell. ID and Dwek RA, 1986. *Biological spectroscopy*. Benjamin Cummins and company.
2. Williard and Merrit, 1996. *Instrumental Methods of Analysis* John Wiley & sons.
3. Skoog D.A, 1985. *Principles of instrumental analysis* .Holf - Saunders.
4. Sewell PA and Clarke B, 1991. *Chromatographic separations*. John Wiley and Sons.
5. Gupta SP, *Statistical Methods*. Sultan Chand Publications, New Delhi
6. Kapoor VK and Gupta SC. *Fundamentals of Mathematical Statistics*. Sultan Chand Publications, New Delhi

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)
SUBJECT: PRACTICAL I

CODE: PBP 11

CREDITS: 4

Microbiology

1. Laboratory safety and sterilization techniques.
2. Preparation of culture media – Nutrient broth and nutrient agar.
3. Isolation of pure culture from a spread plate and Streak plate preparation.
4. Gram Staining – Bacterial Identification.
5. Isolation and identification of pathogenic organism from urine sample.
6. Kirby-Bauer method of antibiotic susceptibility testing bacteria.
7. Serial dilution –Agar plate procedure to quantitative viable cells.
8. The bacterial growth curve to determine the generation time and bacteria.
9. Identification of fungi by LPCB staining.
10. Detection of penicillinase enzyme production in bacteria by Iodometric method.
11. Identification of protozoa by Leishman staining.

Biochemistry and Enzyme Technology

1. Paper Chromatography, TLC, Gel filtration.
2. Estimation of protein (Lowry/Bradford) and carbohydrates (Anthrone).
3. Native and SDS-PAGE
4. Estimation of total lipids and lipase enzyme activity.
5. Assay and activity of given crude enzyme from plant, animal and microbial samples.
6. Effect of Substrate and time on enzyme activity.
7. Effect of pH and Temperature on enzyme activity.
8. Immobilization of enzymes.

Genetics and Molecular Biology

1. Isolation of DNA
2. Southern Blotting
3. Isolation of RNA
4. Northern Blotting.
5. Western Blotting
6. Agarose Gel Electrophoresis & molecular size determination of a given nucleic acid sample.
7. Micronuclei and chromosomal aberrations from root meristem.

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)

SUBJECT: QUALITY CONTROL AND ASSURANCE

CODE: PB 105

CREDITS: 3

UNIT - I (Introduction to Quality Control)

History – Definition of Quality (QC, QA and QI), Quality in Manufacturing and Service system – Philosophy of Quality Management (Deming, Jurang, Croshy and others).
Management and Control of Quality.

UNIT - II (Laboratory Quality Control)

Writing QC Manual, Biosafety manual, SOPs, Equipment maintenance, Log books etc. –
Sampling procedures – Data validation and Interpretation – Reporting – Document and
Sample Retention – Corrective action.

UNIT – III (Statistical Quality Control)

Descriptive statistics – Confidence intervals & Tests of the means – Probability and
Computational Methods.

UNIT – IV (Quality Systems)

Introduction to ISO family – ISO – 9001; ISO – 17025; Regulatory bodies of ISO; Good
Laboratory Practices (GLP).

UNITS – V (Quality Auditing)

Audit – Definition and Fundamentals – Preparation – Performance – Reporting – Closure –
Post script. Internal System Audit – Procedure – Auditing check list.

REFERENCES:

1. Juran, J.M and Godfrey, A. B. 1998. Juran's Quality Handbook. Vth ed. McGraw Hill, New York.
2. Evans, J.R and Lindsay, W.M. 1996. The Management and Control of Quality. IIIrd Ed. West Publishing Company. New York. 767 pp.
3. Srinivasan, J. 2000. Managing Quality with Quality systems. JS Associates, HiTech Printers, Chennai. 227 pp.
4. Montgomery, D.C. 2001. *Introduction to Statistical Quality Control*. IVth Ed. John Wiley & Sons, Inc. USA. 796 pp.
5. Arter, D.R. 1994. Quality Audits for Improved Performance, IInd Ed. ASQC Quality Press, Milwaukee, 119 pp.
6. Russell, J.P and Regel, T. 1996. After the Quality Audit – Closing te loop on the Audit Process. ASQC Quality Press, Milwaukee, 230 pp.
7. MINITAB Statistical Software, 2000. Release 13. Minitab Inc. US.

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)

SUBJECT: Soft Skills for career Prospects I
Skill based elective I

CODE: PS

CREDITS: 2

1. Basics of communication on : Some definitions, the process of communication, elements of communication, barriers to communication; interpersonal skills, body language.
2. Introduction to Soft Skills: Defining Soft Skills; Work Ethics, Self-confidence, Courtesy and Interpersonal Skills, Team Work, Negotiation Skills, Self-discipline, Conformity, Positive Attitude, Honesty and dependability, Assertiveness, leadership qualities, Self Management, Responding to Feedback, Adaptability and Creativity.
3. Greetings at the workplace: Greetings and asking after, introducing oneself and others.
4. Goals and Goal-setting : Definition of a goal, purpose of goal setting, why set goal, goals and objective pyramids.
5. Putting oneself on paper : Preparing curriculum vitae, resume, covering letters.

REFERENCES

1. Hariharan. S, Sundarajan. N, Shanmugapriya. S.P., 2010, *Soft Skills*, MJP Publishers, Chennai.
2. Bhatia. R.C., 2010, *Personality Development*, Ane Books Pvt. Ltd, New Delhi.
3. *Soft Skills For Career Prospects* compiled by Department of English, The New College.

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)

SUBJECT: GENETIC ENGINEERING AND CLONING VECTORS

CODE: PB 206

CREDITS: 4

UNIT I

Introduction to Genetic Engineering, Fundamental Steps in Recombinant DNA Technology, Isolation and purification of DNA, DNA Manipulative enzymes :Restriction enzymes, Ligase, Polymerases and DNA modifying enzymes.

UNIT II

Vectors: Plasmid Biology, pBR322 and its derivatives, gene markers, phage vectors, cosmids, YAC, phasmids, shuttle and expression vectors. Cloning promoters and terminators.

UNIT III

Construction of Genomic and cDNA Libraries. Identification of Recombinant DNA: Colony and plaque hybridization, Chromosome walking.

UNIT IV

Techniques employed in genetic engineering – DNA sequencing, Polymerase chain reaction, types and Modifications Electrophoresis of DNA – Pulsed Field Gel Electrophoresis. Antisense RNA technology, Transformation techniques.

UNIT V

Application of genetic Engineering in medicine, industry, genetically engineered microorganisms, plant and animals. Merits and demerits - Impact on biodiversity and environment.

REFERENCES:

1. Winnacker EL, 1987. *From genes to clones, Introduction to Gene technology*. VCH Publications, Germany
2. Old RW, and Primrose SB, 1999. *Principles of gene manipulation, An introduction to genetic Engineering*.
3. Brown TA, 1995. *Gene Cloning, An Introduction*. Chapman & Hall, London
4. Watson J, Gilman M, Jan-Witkowski, Zoller M, 1992. *Recombinant DNA*, 2nd edn. Scientific American Books, USA.
5. Glick BR, and Pasternak JJ, 1998, *Principles and Applications of Recombinant DNA*, 2nd edn. ASM Press, Washington DC.

THE NEW COLLEGE AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)

SUBJECT: FOOD AND BIOPROCESS TECHNOLOGY

CODE: PB 207

CREDITS: 4

Unit: 1

Introduction and scope of Bioprocess Technology, Fundamentals: -Media formulation- Inoculum development - Strain improvement, Thermal Death Kinetics, Sterilization: Batch, Continuous and Filtration. Scale up, Theory of mixing, Gas - liquid mass transfer, Gas holds up.

Unit: 2

Bioreactors in Biotechnology: Bubble column, Enzyme reactor, Fluidized bed reactor, Plug flow reactor, Plant and animal cell bioreactors. Fermentation Process: Batch, Fed and Continuous.

Unit: 3

Microbial growth Kinetics: Monod Growth Kinetics, other forms of growth kinetics, Product formation kinetics, Growth curve, Rheological properties - Newtonian and Non-Newtonian behaviours. Measurement of microbial growth - Direct and Indirect.

Unit: 4

Products and Processes: Marine microbial products, insecticides, industrially important bio-products; Health care- Antibiotics (penicillin), anticancer agents, Steroids, vitamins; Food and Beverage :Brewing Technology, Fermented dairy products, amino acids, SCP. Biochemicals: Alcohol, Organic acids, Enzymes. Techniques in Downstream Processing.

Unit: 5

Food and Microorganisms: Spoilage of different kinds of food - meat, fish, cereals, fruits, vegetables. Preservation - low temperature -high temperature - food additives – drying - radiation. Fortification and enrichment of food. Food borne illness – bacterial - non bacterial - poisonings, Food sanitation, control and inspection – food and health.

REFERENCES:

1. Stanbury PF and Whittaker A, 1984, *Principles of fermentation technology*, Pergamon Press
2. Bailey JE and Ollis, 1986. *Biochemical engineering fundamentals*, McGraw Hill,
3. Schragg AH, 1999, *Bioreactors in Biotechnology*. Ellis Horwood Ltd,
4. Cassida LE Jr, 1997, *Industrial Microbiology*. New Age International Publication Ltd.
5. Coulson JM, 2004. *Chemical engineering*, Pergamon press
6. Moo-young M, 1985 *Comprehensive Biotechnology* Vol 2,3,4. Pergamon Press
7. Frazier WC, 1997. *Food microbiology*. Tata McGraw Hill, India

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014

M.Sc., DEGREE: BIOTECHNOLOGY

(Syllabus effective from the academic year 2011 - 2012)

SUBJECT: IMMUNOLOGY AND IMMUNOTECHNOLOGY

CODE: PB 208

CREDITS: 4

Unit I

Basics of Immunology: Introduction to Immunology – Innate and Adaptive Immunity, Humoral and Cell Mediated Immunity. An overview of Immune system – Molecules of Immune System – Antibodies, Complements, Cytokines, Interferons. Cells of Immune system, Organs of Immune System.

Unit II

Immune Responses: Antigens – T Dependent and T Independent antigens, Antigen processing and presentations, B and T cell Receptors. Antibodies, Polyclonal and Monoclonal Antibodies.

Immune Response to viral, Bacterial, Parasitic Infections and Cancer cells. MHC's, Hypersensitivity, Transplantation Immunology, Auto Immune and Immunodeficiency diseases.

Unit III

Isolation and characterization of T cell subsets, B cells and Macrophages. Mitogen and Antigen induced Lympho Proliferation Assay: Cell Mediated lympholysis, mixed lymphocyte reaction, Production of Antibodies, Purification of Antibodies, Quantification of Immunoglobulins by RID, EID, Nephelometry and ELISA.

Unit IV

Isolation, purification and characterization of antigens from pathogens and other biological molecules by biophysical, chemical and affinity separation method. Assessment of Immune complexes within tissues. Immunodiagnosis of infectious disease and Antigen – Antibody interactions, In-vitro agglutination, Complement fixation, Flow Cytometry (FACS), Immunoblotting (Western Blotting), Immunofluorescence, Radio Immuno Assay and Sero typing

Unit V

Purification of Mononuclear cells from peripheral blood. HLA typing. Hybridoma techniques and Monoclonal Antibodies production. Vaccine Technology and application of Biotechnology in Vaccine production.

REFERENCES:

1. Ramasamy P, & Hanna REB, 2002. *Immunity and Inflammation*, University of Madras Publications, Pearl Press Ltd.,
2. Parslow TG, Stites DP, Terr AL, 2001, *Medical Immunology*, 10th edn McGraw Hill Publication.
3. Zola H, 2000. *Monoclonal Antibodies*. Bios Scientific Publishers Ltd.,
4. Goldsby RA, Kindi TJ, & Osborne BA, Kuby 2000 *Immunology*, Freeman and company
5. Roitt L, 1996. *Immunology* BlackWell Scientific Publishers Ltd.,
6. *Current Protocol in Immunology, III volumes*, 1994. Wiley publications,.
7. Weir DM, 1992. *Immunological Techniques III volumes*, Black Well Scientific Publishers Ltd.,

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)

**SUBJECT: ETHICAL, LEGAL, SOCIAL AND INTELLECTUAL ISSUES
IN BIOTECHNOLOGY (ELSI)**

CODE: PB 209

CREDITS: 3

UNIT – I

Definition of IPR, patents, product patent writing, record keeping trade secrets, Copyright ©, choice of Intellectual property protection, IPR and Plant genomic Resources (PGR), GATT and TRIP, ISR – PCT, Geographic indicators and protection of plant varieties (HPOV).

UNIT – II

International conventions, International cooperation, obligations with patent applications of patenting, current issues. UN, WWF, WHO, IUCN, Carbon credits.

UNIT - III

Patents for higher plants and higher animals, patenting transgenic organisms and isolated genes. Human genome project - Patenting of genes and DNA sequences. Plant Breeders' Rights and Farmers' Rights, International gene Fund.

UNIT – IV

Social and genetic discrimination: insurance and employment, human cloning, sex determination, foeticide. Animals in experimentation – cell lines – CPCSEA.

UNIT – V

Ethical issues in somatic and germ line, gene therapy, clinical trials, the right to information, ethical committee function. Biosafety containment facilities, biohazards, Genetically Modified Organisms (GMOs), Living Modified Organisms (LMOs)

REFERENCES:

1. Emery, *Medical Genetics*.
2. Baker DL, *Genetic Counselling*, Wiley-Liss Publications.
3. Hill WE (ed). 2002. *Genetic Engineering - A primer*, Taylor & Francis.
4. Harper P, 1997. *Genetics, Society and Clinical Practice*. Bio-Scientific publishers Ltd, UK.
5. Clarke (ed), *Culture, Kinship and Genes*. Macmillan, London.

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)
SUBJECT: PRACTICAL II

CODE: PBP22

CREDITS: 4

Genetic Engineering and Cloning Vectors

1. Bacterial culture and antibiotic selection-Preparation of competent cells.
2. Isolation of plasmids and screening.
3. Isolation of DNA.
4. Restriction fragment Length Polymorphism (RFLP).
5. Gene expression in *E. coli* and analysis of gene(Demonstration)
6. Polymerase Chain Reaction (PCR).
7. Molecular cloning of a potential Gene in a bacterial culture(Demonstration)

Food and Bioprocess Technology

1. Isolation of industrially important micro-organisms for microbial processes.
2. Determine Thermal Death Point (TDP) and Thermal Death Time (TDT) of a given micro-organism.
3. Production of Penicillin.
4. Plot Growth curve, Specific growth rate and Substrate degradation profile.
5. Compute Biomass/Growth yield of a given micro-organism.
6. Microbial production of citric acid and alkaline protease.
7. Screening of micro-organism (bacterial/fungal) from a spoiled food source.
8. Microbial Load Estimation(Fish/fruits/vegetables)

Immunology and Immunotechnology

1. Cell counting by Hemocytometry –Whole Blood - RBC, WBC
2. Differential cell count of WBC.
3. T & B lymphocytes differentiation
4. Separation of mononuclear cells by Ficoll – Hypaque
5. Con-A induced proliferation of thymocytes (MTT method)
6. Immunoglobulin preparation
7. Lymphoid organs and their microscopic organization
8. Immunization, collection of serum
9. Double diffusion, Radial Immunodiffusion and Immuno-electrophoresis
10. ELISA, Hapten conjugation and quantitation.

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)

SUBJECT: APPLIED BIOTECHNOLOGY

CODE: PB 210

CREDITS: 3

UNIT - I (VERMITECH)

Definition – Earthworms – Ecological strategies, basic traits and life cycle – Application of earthworms in Waste management, Vermiculture, Vermicastings, Vermicompost – Liquid fertilizers – Vermiwash – Characteristics of Vermicompost and Vermiwash – Applications.

UNIT - II (Mushroom cultivation)

History – Introduction to fungi – basic characters – classification – Methodology of Oyster mushroom (*Pleurotus* sp) cultivation – Spawn production – mass cultivation of mushrooms – diseases of mushroom – control measures.

UNIT – III (Foliar sprays and Pest repellants)

Foliar sprays – Panchagavya - Vermiwash – Farmers EM- Effective Microorganisms preparations and applications – Pest repellents: NCBT 01, NCBT 02, NCBT 03 – botanical extracts – preferred combinations

UNIT – IV (Production of Microbial fertilizers)

Mass production of Microbial fertilizers – *Azospirillum*, *Azetobacter*, *Trichoderma*, Mycorrhiza, Sea weeds, etc.,

UNIT – V (Healthy Practices)

Micro-enterprises – Self Help Groups – Economics of cultivation – Organic farming – Endemic vs exotics; Diversity Vs GMOs - Sustainability

REFERENCES:

1. Ismail, S.A., 2005. *The Earthworm Book*. Other India Press, Goa, India.
2. Vijaya Ramesh K, 2005. *Environmental Microbiology*. MJP Publishers, Chennai, India

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)

SUBJECT: Soft Skills for career Prospects II
Skill based elective II

CODE: PS 201

CREDITS: 2

1. Oral Communication: Confidence building exercises, interviewing and questioning, guessing games, choosing and justifying, exercising the inauguration, telling a story, role play.
2. Giving and receiving feedback: What is critical feedback, responding to critical feedback.
3. Time management: Introduction, steps towards effective time management / Positive attitude: Willingness to learn, assertiveness, positive thinking.
4. Presentation skills: Facing interviews, oral presentation, business presentations, technology enabled presentation, group discussion skills, and public speaking skills.
5. Work ethics: Introduction, values to be upheld in workplace, honesty, integrity, punctuality, self-respect, respect for others, dealing with superiors/subordinates.

REFERENCES:

1. Hariharan. S, Sundarajan. N, Shanmugapriya. S.P., 2010, *Soft Skills*, MJP Publishers, Chennai.
2. Bhatia. R.C., 2010, *Personality Development*, Ane Books Pvt. Ltd, New Delhi.
3. *Soft Skills For Career Prospects* compiled by Department of English, The New College.

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)

SUBJECT: PLANT BIOTECHNOLOGY

CODE: PB 311

CREDITS: 4

UNIT - I

Plant genome organization – organization of chloroplast genome, nuclear encoded and chloroplast encoded genes for chloroplast proteins. Organization of mitochondrial genome – encoded genes for mitochondrial proteins.

UNIT - II

Techniques for plant transformation – *Agrobacterium* – mediated gene transfer and direct gene transfer methods

UNIT - III

Transgenic plants and applications: antibodies, foreign protein in plants, edible vaccines – modification of plant nutritional content: amino acids, lipids and vitamins – molecular farming: carbohydrates and proteins – engineering herbicides and insect resistant crops.

UNIT - IV

Maize transposable elements – organization and function, transposable elements in transgenic plants. Signal transduction – types: protein kinases and G-proteins; transport routes – regulation of gene expression – plant hormones – use of heat shock promoters to control gene expression in plants.

UNITS - V

Plant tissue culture – principles and methodology – cell culture and protoplast culture – haploid production– Somatic Hybridization – germplasm storage – application of tissue culture in agriculture and horticulture.

REFERENCES:

1. Biswas, 2005, *Agricultural Biotechnology*. Dominant, New Delhi.
2. Glick, BR., and Pasternak, JJ., 1994. *Molecular Biotechnology*, ASM Press, Washington.
3. Ignacimuthu, 1996. *Applied Plant Biotechnology*. Tata McGraw Hill.
4. Larz, H, and Wenzel G, (ed) 2004. *Molecular Marker Systems in Plant Breeding and Crop Improvement*. Oxford University Press.
5. Reynolds, PHS., 1999. *Inducible gene expressions in plants*. CABI Publ, UK
6. Slater A, Scott N, and Fowler M, 2003. *Plant Biotechnology*. Oxford Univ Press
7. Purohit SS, 2003. *Agricultural Biotechnology*. Agrobios, India
8. Jha TB, and Ghosh B, 2006. *Plant Tissue Culture*. Universities Press Pvt Ltd, Hyderabad.

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)

SUBJECT: ANIMAL CELL BIOTECHNOLOGY

CODE: PB 312

CREDITS: 4

UNIT – 1

History of animal biotechnology - basic requirements for cell culture laboratory, sources and collection of explant tissues, nutrient medium, and maintenance of aseptic condition in cell culture laboratory. Basic principles of biotechnology as applicable to animal science- Artificial insemination, pregnancy diagnosis, In vitro-fertilization and Embryo transfer technology, Cryopreservation.

UNIT - 2

Animal health - animal diseases and diagnosis. Prophylaxis-vaccines-oral and other vaccines in animal diseases. Transgenic animals (mice, sheep and cows). Enzymes in animal feed. Manipulation of rumen microbes.

UNIT – 3

DNA fingerprinting and characterization of animal cell. Cell evaluation protocols: Cell counting and viability measurements. Monitoring animal cells growth and productivity- Measurement of cell death in culture- hollow film technology.

UNIT – 4

Culturing animal cells in fluidized bed reactors. Hematopoietic cells for cellular and gene therapy: Basic assay techniques- Expansion protocols- cyto-toxicity testing using cell lines. Control of proteolysis in cell culture: use of inhibitors and engineered cell lines.

UNIT – 5

Introduction to Clinical Trials: Different types and phases of clinical trials. Benefits and risks of participating in a clinical trial, clinical trials inclusion/exclusion criteria. Basic statistics for clinical trials, Protocol development, Trial designs, Data management, Reporting and reviewing clinical trials.

REFERENCES:

1. Ignacimuthu 1996. *Basic Biotechnology*, Tata McGraw Hill. India
2. Trevan 2001 *Biotechnology*, Tata McGraw Hill, India
3. Kreuzer H, & Massey A, 2001. *Recombinant DNA and Biotechnology: A guide for teachers*, 2nd edn. ASM Press, Washington,.
4. Walker JM, & Gingold EM, 1999. *Molecular Biology and Biotechnology*, 3rd edn. Panima Publishing Corporation.
5. Jenkins N (ed), 1999. *Animal Cell Biotechnology, Methods and protocols*. Humana Press, New Jersey.
6. Watson JD, Gilman M, Witkowsky J, and Zoller M, 1992. *Recombinant DNA* 2nd edn. Scientific American Books, NY.

7. Puhler A (ed),1993.*Genetic Engineering of Animals*.VCH Publishers, Weinheim, FRG.
8. Murray ET, 1991 *Gene Transfer and expression protocols – Methods in Molecular Biology* Vol. 7 Humana Press.
9. Watson JD, Hopkins NH, Roberts JW, Steitz JA, and Weiner AM, 1987. *Molecular Biology of gene*, Cummings, 4th edn. Vol. 1 & 2.

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)

SUBJECT: GENOMICS AND PROTEOMICS

CODE: PB 313

CREDITS: 4

UNIT I

Defining genomes, transcriptomes and proteomes - the organization and structure of the genomes - Organism specific Genomic databases - finding genes in large genomes - gene family databases - Analysis and annotation of sequence.

UNIT II

Sequencing methods and strategies - chain termination DNA sequencing - Prediction of splice sites, introns and exons, codon usage bias- database and analysis, Serial analysis of gene expression - Repetitive elements – genome wide repeats - Promoter elements - GC% in genomes.

UNIT III

Proteomes, Protein families and databases - Regular expressions, finger prints, profiles and PSSM's - Post translational modification prediction - glycosylation, phosphorylation, proteolytic cleavage, signal peptides.

UNIT IV

Proteomics and protein identification, 2D gel databases, structure prediction and analysis. Structure based databases - SCOP, CATH domain structure databases - Structure comparison and alignments - Structural bioinformatics in drug discovery - Intermolecular interactions-protein-protein interactions. Prediction of protein - protein interactions from evolutionary information. Biological pathways, protein interactions maps

UNIT V

Human genome project - Computational approaches in comparative genomics – an aid to gene mapping- in the study of human disease genes. Computer analysis of gene function. Homology – evolution, homology analysis – gene function. Microarrays: principles and applications.

REFERENCES:

1. Brown TA, 2002. *Genomes*. 2nd edn, Wiley-Liss Publications.
2. Lesk A, 2005. *Database annotation in molecular biology*, 2nd edn, John Wiley Publication.
3. Krane DE, Raymer ML, *Fundamental concepts of Bioinformatics*, 2nd edn.
4. Higgs PF, and Attwood TK. 2005. *Bioinformatics and Molecular Evolution*. Blackwell Publishing.
5. Bourne PE, 2003. *Structural Bioinformatics*, Wiley–Liss Publications.

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)

SUBJECT: PRACTICAL III

CODE: PBP33

CREDITS: 4

Plant Biotechnology

1. Basic Techniques in plant tissue culture – preparation of medium – callus induction, organogenesis and meristem culture.
2. Chloroplast and mitochondrial DNA isolation
3. Protoplast isolation and fusion by enzymatic method
4. Agrobacterium culture, selection of transformants, reporter gene (GUS).

Animal Cell Biotechnology

1. Preparation of tissue culture medium and membrane filtration
2. Preparation of single cell suspension from spleen and thymus
3. Cell counting and cell viability
4. Macrophage monolayer from PEC and measurement of phagocytic activity
5. Trypsinization of monolayer and subculturing
6. Cryopreservation and thawing
7. Measurement of doubling time
8. Role of serum in cell culture

Bioinformatics

1. Database; primary, secondary & composite.
2. BLAST and FASTA analysis for determination of functions of hypothetical and unknown proteins in the human genome.
3. Identification of functional domains in nucleotide binding proteins using a domain analysis server like SMART
4. Determination of structurally similar proteins (PDB protein structure similarity search)
5. Conformation of secondary structure of proteins from their PDB entry (Illustration with Acetylcholine esterase from humans)
6. Ligand protein interactions and docking for Acetylcholine esterase with its native ligands from PDB.

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)

SUBJECT: BIOINFORMATICS

CODE: PB 314

CREDITS: 3

UNIT – I

Databases in Bioinformatics: Primary biological databases and their applications: Protein nucleotide sequence and structure databases, NCBI, EMBL, SWISSPROT and PDB. Introduction to secondary biological databases like pubmed, OMIM, CATH, SCOP, PFAM and SMART. PSSM .

UNIT – II

Genomics and Bioinformatics : Genome and proteome basic concepts and definition, CpG islands in nucleotide sequences ,Types of interactions in bases, sugars and their geometry, Hydrogen and vanderwaals interactions stabilizing the structure of proteins and nucleic acids, EST's, SNP's with relevance to Sickle cell anemia (SNP),sugar ring puckering and base stacking interactions in nucleic acids. Phylogenetic analysis and evolutionary significance.

UNIT – III

Informatics: data collection and interpretation. Collecting and storing data: Interpreting data: Mapping database. Sequence databases: Nucleic acids and proteins. Sequence analysis, Database searching and BLAST and FASTA, BLOSUM.

UNIT – IV

Applications of Bioinformatics to Computational Drug design : Lead Vs Drug Similarities and differences, Lead identification and optimization with target specificity, Physiochemical properties governing the binding of ligand to target, introduction to docking, ADME properties and their importance in drug design, Structure activity analysis for disease specific leads,

UNIT – V

Genome to drugs: Structural genomic a perspective. Bioinformatics as a business perspective, IPR issues in Bioinformatics Discoveries, Patent rights and copyright.

REFERENCES:

1. Branden c, and Tooze J, 1999. *Protein structure*. Garland Publishers Inc., USA
2. An introduction to analysis of proteins and genes by Andreas D Baxevanis and Francis Oulette
3. Bergeron B, 2004. *Bioinformatics computing*. Pearson Education Inc., Singapore
4. Campbell, AM, and Heyer, LJ, 2004. *Discovering genomics, proteomics and bioinformatics*. Pearson Education Inc., Singapore
5. Atwood TK. *Introduction to bioinformatics*

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)

SUBJECT: BIOTECHNOLOGY AND MANAGEMENT

CODE: PB 315

CREDITS: 3

Unit 1:

Management defined – functions and scope – need for planning, types and steps in planning – organization – organizational hierarchy – departmentation – authority relationship – line functional and staff basics of delegation –

Unit 2:

Span of control – need for coordination – motivational theories – staffing functions – concepts of control.

Unit 3:

Functional areas of management - production and materials management – production process – basic inventory models – quality control concepts – Total Quality Management.

Unit 4:

Human Resource Management – human resource planning – HR policies and work culture – marketing management philosophies, e-marketing.

Unit 5:

System concept – the meaning and role of MIS – the entrepreneur – definition - skills – new product, ideas, and evaluation – project analysis for start up company with project report.

REFERENCES:

Kanna, O.P., Industrial Engineering and Management, Dhanpat Rai Publication.

Guest faculty from NCIM

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)

SUBJECT: ENVIRONMENTAL BIOTECHNOLOGY

CODE: PB 416

CREDITS: 4

Unit I:

Environmental Monitoring: Major pollutants of the soil, air, water and their impact – Physical, Chemical and Biological parameters of environmental pollutants. Environmental Impact Assessments – Regulatory bodies – environmental issues – laws and bio-restoration.

Unit II:

Waste water management: Characteristics of waste waters, biological and biochemical methods of waste water treatment – operational units – designing – modelling. STPs & ETPs – Sludge process – digestion – end use – waste management. Bioreactors – types and designs. DEWATS and Root Zone Treatment of waste water.

Unit III:

Treatment of Industrial wastes: Leather tannery waste – dairy, paper and pulp, sugar and distillery – colour dyes – hydrocarbon. Use of microbes for bioremediation – biodegradation of contaminants – co-culture – immobilization – recycling and reuse. Biomagnification and biotransformation of waste in environment.

Unit IV:

Use of Industrial wastes: Production of biogas – source – prerequisite for setting up of biogas plants – solid waste management – hazardous and non-hazardous waste – source segregation of waste – waste disposal – recycling – reuse.

Unit V:

Sanitary landfills – bioleaching - leachate and its problems- biosurfactants-biopolymers-biofilms- regulations- safety measures – Disaster Management – Tsunami, Nuclear Explosions.

REFERENCES:

1. Rittmann BE, and McCarty, PE, 2001. *Environmental Biotechnology: Principles and Applications*. McGraw Hill Publications
2. Ahmed N, Qureshi, FM, and Khan OY. 2004. *Industrial and Environmental Biotechnology*. Horizon Scientific Press, UK
3. Vijaya Ramesh K, 2005. *Environmental Microbiology*. MJP Publishers, Chennai, India

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2007 - 2008)

SUBJECT: PROJECT WORK

CODE: PBPR41

CREDITS: 4

Guidelines for Project Dissertation:

1. Project should be done individually. Each student shall be assigned a supervisor. Each student shall choose a topic of his interest and pursue the project.
2. The project will require practical work with submission of a project report. The project report should be submitted in the prescribed format containing a minimum of 50 pages. References will not be counted with the main pages. The report shall include photographs, graphs and drawings.
3. Each Student will have to present the project in Power Point during at the time of the commencement, during the course and on completion of the project.
4. The project should be submitted on the scheduled date as prescribed by the Department. The student should appear for the viva-voce before a panel comprising of the external examiner, the supervisor and the Head of the Department.

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)
SUBJECT: PRACTICAL IV

CODE: PBP44

CREDITS: 4

Environmental Biotechnology

1. Detection of microbes in sewage waters
2. Determination of pH, dissolved oxygen, salinity and nitrite in water samples
3. Determination of BOD and COD in sewage water samples
4. Determination of TDS and TSS in sewage water waters
5. Degradation of industrial effluents by microbes (co-culture and immobilisation) – demonstration only
6. Vermiculture – identification of selected species
7. Vermicompost production and application
8. Vermiwash – setting up of unit , collection, standardisation and application
9. Preparation of organic foliar sprays (Panchagavya and Gunapaselam)
10. Concepts of soil biotechnology in organic farming including field visits

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011 - 2012)

SUBJECT: HERBAL SCIENCE

CODE: PB 418

CREDITS: 2

Unit I:

Historical background – Scope of Medicinal plants. Traditional medicines and herbs – various forms of herbal preparations.

Unit II:

Pharmacognosy – Identification of herbs - Taxonomic evidences of herbal plants – Exomorphic characters – Endomorphic characters – Anatomical, Cytological and Palynological evidences in identification of Medicinal herbs.

Unit III:

Extraction methods - Detection methods of Alkaloids, Glycosides, Tannins, Volatile oils and gums and other phytochemicals in extracts by colour tests and TLC.

Unit IV:

Conventional methods (Reproductive and Vegetative) of cultivation of Medicinal herbs. Standardization of cultivation protocols of five selected Medicinal herbs. Collection, Stabilization, Drying and Preservation of crude drugs.

Unit V:

Enhancement of Phytoconstituents – Scale up: Enhancement of product formation by elicitation, permeabilization of plant cells for product release. Tissue culture in isolation of phytochemicals.

REFERENCES:

1. Phytochemical methods, J. B. Harborne.
2. Pharmacognosy of crude drugs, M.A. Iyengar.
3. Phytochemistry and Pharmacology of some Indian medicinal plants, E. Sukumar, Vivekananda Kendra Patrika, 1987.

THE NEW COLLEGE (AUTONOMOUS), CHENNAI 600014
M.Sc., DEGREE: BIOTECHNOLOGY
(Syllabus effective from the academic year 2011-2012)

SUBJECT: PREPARATION FOR PROJECTS

CODE: PS 403

CREDITS: 4

Unit I:

Introduction of the project - Motivation Sentence - Summarising the problem - Specific Aims - Summarising the solution – Description of the format of rest of proposal (sections, etc.).

Unit II:

Motivation - history of the problem - Background and Significance - Why is the problem interesting - When and why does the problem occur - Is the problem already solved - What is relevant now - Are there any similar systems or solutions to the one you propose - brief explanation.

Unit III:

Project Summary - What in general will this project achieve? – Preliminary Studies/Progress Report - Significance – social relevance – justification - estimated timeline of project deliverables and important dates.

Unit IV:

Project Details- software, hardware, or tools to be used - Design and Methods - Implementation Issues and Challenges - using or extending current tools/systems for the problem - What makes your project unique – Deliverables - What will the project produce? - Conclusion

Unit V:

Budget – Recurring and non-recurring expenses – Claims with justifications – Contingencies – Over head expenses – travel costs and regulations – Funding Agencies – Human resource. – Conclusions, References, Presentation of projects.

REFERENCES:

<http://documents.rec.org/publications/ProposalWriting.pdf>
<http://www.nwp.org/cs/public/print/books/teachingnewwriting>
<http://www.learnerassociates.net/proposal/hintsone.pdf>
http://dbtindia.nic.in/proforma/proforma_x.pdf
<http://www.serc-dst.org/generalinfo1.html>
<http://www.tanscst.org/>