# Master of Science (Biotechnology)

***Programme Code: MSB***

***Duration – 2 Years Full Time***

**Programme Structure**
**And**
**Curriculum & Scheme of Examination**
**With**
**Choice Based Credit System (CBCS)**
**2020-22 Batch**

AMITY UNIVERSITY
RAJASTHAN

# PREAMBLE

Amity University aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic programme with necessary skills to enable them to excel in their careers.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

| Components | Codes | Weightage (%) |
|---|---|---|
| Case Discussion/ Presentation/ Analysis | C | 05 - 10 |
| Home Assignment | H | 05 - 10 |
| Project | P | 05 - 10 |
| Seminar | S | 05 - 10 |
| Viva | V | 05 - 10 |
| Quiz | Q | 05 - 10 |
| Class Test | CT | 10 - 15 |
| Attendance | A | 05 |
| End Semester Examination | EE | 70 |

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

May, 2020

# PROGRAMME OVERVIEW

Biotechnology in the present scenario is helping by showing advancement in diagnosis of a disease by helping us to move forward from primitive Symptomatic Treatment to modern Molecular Treatment along with rapid organization and analysis of biological data possible (Bioinformatics), Marine and aquatic applications of Biotechnology used to improve cleanup of toxic spills, improve yields of fisheries (Blue Biotechnology), Agricultural use of Biotechnology, heading towards the production of crops in not only good quantity but also with good quality (Green Biotechnology), Medicine including designing of organisms to produce antibiotics and the engineering of genetic cures through genomic manipulation (Red Biotechnology), Exemplified by the designing of an organism to produce useful chemicals, use of enzymes as industrial catalysts (White Biotechnology).

In view of above Amity University Rajasthan running Bachelors, Master and Ph.D biotechnology programs to fulfill the demand of various biopharmaceutical and biotechnological industries. All these programs course curriculum and structure have been designed in consultation with various pharmaceutical, biotechnological and dairy industry experts to meet the demand and supply of technical qualified personals. The course curriculum covering the major part of advanced biotechnological process, bioprocess and downstream technology, enzyme technology, separation technology, immunology, virology, genetics, molecular modeling drug design, biopharmaceuticals, pharmaceutical biotechnology, and bioinformatics in relation to the industry requirements.

The MSc. programme in Biotechnology seeks to provide education and training, empower students with technical skill-set, create capacities and build career opportunities in four key domains of biotechnology namely:

- Research and Development (Academic & Research Institutions and Industrial Sectors)
- Biotechnology Industries, Breweries, Pharmaceutical & Food Industries
- Forensic, Diagnostics Centers and Regulatory agencies
- Data handlings, Coding and Clinical research

This is achieved through a combination of interdisciplinary curricula as well as intensive laboratory work. Through its unique pedagogical methods, the academic programme allows transferability of acquired skills in domains unrelated to biotech sectors. Students are expected to have both specialized knowledge and practical experience for addressing contemporary problems in both academic and industrial setting.

**Program Learning Outcomes (PLO):**

The objective of the programme is to highlight the role played by biotechnology in modern society and its relevance to sustainable development. It seeks to provide the following:

| | | |
|---|---|---|
| **PLO-I** | **:** | Apply the theoretical and empirical methods of Biotechnology to questions at the frontier of knowledge for a successful career in Biotechnology and allied industries. |
| **PLO-II** | **:** | Explain, debate and demonstrate to lay audiences the application of Biotechnology to solve the problems of society. |
| **PLO-III** | **:** | Build teams that work collaboratively and make progress efficiently towards solutions for real world projects. |
| **PLO-IV** | **:** | Evaluate and explain the potential impacts, including risks of large scale engineering projects from Biotechnology and thereby produce recommendations for sustainable development. |

## Credit Summary Sheet

| M. Sc. Biotechnology | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Semester** | **CC** | **DE** | **VA** | **OE** | **NTCC** | **Anandam** | **Total** |
| **1** | **17** | 3 | 4 | - | - | 2 | 26 |
| **2** | **18** | 3 | 4 | 3 | - | 2 | 30 |
| **3** | **18** | 3 | 4 | 3 | - | 2 | 30 |
| **4** | **-** | **-** | **-** | **-** | 30 | - | 30 |
| **Total** | **53** | 09 | 12 | 06 | **30** | **6** | **116** |

**Note:- CC - Core Course, VA - Value Added Course, OE - Open Elective, DE - Domain Elective**

| List of Open Electives from M.Sc Biotechnology | | | | | | |
|---|---|---|---|---|---|---|
| **From M.Sc Biotech** | | | | | | |
| **Course Code** | **Course Title** | **Category** | **Lectures (L) Hours Per Week** | **Tutorial (T) Hours Per Week** | **Practical (P) Hours Per Week** | **Credits** |
| MSB231 | Medical Biotechnology | CC | 3 | - | - | 3 |
| MSB 304 | Recombinant DNA Technology | CC | 3 | - | - | 3 |

| M. Sc. Biotechnology: **I Semester** | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Category** | **Lectures (L) Hours Per Week** | **Tutorial (T) Hours Per Week** | **Practical (P) Hours Per Week** | **Credits** |
| MSB101 | Biochemistry & Metabolic Regulation | CC | 3 | - | - | 3 |
| MSB102 | Advanced Microbiology | CC | 3 | 1 | - | 4 |
| MSB103 | Bioinformatics | CC | 3 | - | - | 3 |
| MSB104 | Cell & Molecular Biology | CC | 3 | - | - | 3 |
| MSB121 | Biochemistry & Metabolic Regulation Lab | CC | - | - | 2 | 1 |
| MSB122 | Advanced Microbiology Lab | CC | - | - | 2 | 1 |
| MSB123 | Bioinformatics Lab | CC | - | - | 2 | 1 |
| MSB124 | Cell & Molecular Biology Lab | CC | - | - | 2 | 1 |
| AND001 | ANANDAM-I | NTCC | - | - | - | 2 |
| DE Electives: Student has to select 1 course from the list of following DE electives | | | | | | |
| MSB130 | Instrumentation in Biotechnology | DE | 3 | - | - | 3 |
| MSB131 | IPR & Drug Regulatory Affairs | DE | | | | |
| MSB132 | Industrial Safety & Hazards | DE | | | | |
| BCS111 | Communicational Skills – I | VA | 1 | - | - | 1 |
| BSS111 | Behavioural Science I (Self Development and Interpersonal Skills) | VA | 1 | - | - | 1 |
| FLT111<br>FLG111<br>FLS111<br>FLC111 | Foreign Language – I<br>French<br>German<br>Spanish<br>Chinese | VA | 2 | - | - | 2 |
| NCC001 | Good Laboratory Practices | NCC | - | - | - | - |
| | **TOTAL** | | | | | **26** |

**Note:** Common details for ANANDAM course given at the end of syllabus.

| M. Sc. Biotechnology: **II Semester** | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Category** | **Lectures (L) Hours Per Week** | **Tutorial (T) Hours Per Week** | **Practical (P) Hours Per Week** | **Credits** |
| MSB201 | Advanced Plant Biotechnology | CC | 3 | - | - | 3 |
| MSB202 | Advanced Animal Biotechnology | CC | 3 | - | - | 3 |
| MSB203 | Advanced Structural Biology | CC | 3 | - | - | 3 |
| MSB204 | Advance Biostatistics for Biologists | CC | 3 | - | - | 3 |
| MSB205 | Research Methodology and Scientific Writing | CC | 3 | - | - | 3 |
| MSB221 | Advanced Plant Biotechnology Lab | CC | - | - | 2 | 1 |
| MSB222 | Advanced Animal Biotechnology Lab | CC | - | - | 2 | 1 |
| MSB223 | Advanced Structural Biology Lab | CC | - | - | 2 | 1 |
| AND002 | ANANDAM-II | NTCC | - | - | - | 2 |
| DE Electives: Student has to select 1 course from the list of following DE electives | | | | | | |
| MSB230 | Environment Biotechnology | DE | 3 | - | - | 3 |
| MSB231 | Medical Biotechnology | DE | | | | |
| MSB232 | Pharmaceutical Technology & Biotechnology | DE | | | | |
| OE | Open Elective II | OE | 3 | - | - | 3 |
| BCS211 | Communicational Skills – II | VA | 1 | - | - | 1 |
| BSS211 | Behavioural Science – II (Behavioral Communication and Relationship Management) | VA | 1 | - | - | 1 |
| FLT211<br>FLG211<br>FLS211<br>FLC211 | Foreign Language – II<br>French<br>German<br>Spanish<br>Chinese | VA | 2 | - | - | 2 |
| | **TOTAL** | | | | | **30** |

| M. Sc. Biotechnology: **III Semester** | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Category** | **Lectures (L) Hours Per Week** | **Tutorial (T) Hours Per Week** | **Practical (P) Hours Per Week** | **Credits** |
| MSB301 | **Bioprocess and Industrial Biotechnology** | CC | 3 | - | - | 3 |
| MSB302 | Molecular Genetics and Developmental Biology | CC | 3 | - | - | 3 |
| MSB303 | Enzyme Technology & Immunology | CC | 3 | - | - | 3 |
| MSB304 | Recombinant DNA Technology | CC | 3 | - | - | 3 |
| MSB305 | Genomics & Proteomics | CC | 2 | - | - | 2 |
| MSB321 | **Bioprocess and Industrial Biotechnology Lab** | CC | - | - | 2 | 1 |
| MSB323 | Enzyme Technology & Immunology Lab | CC | - | - | 2 | 1 |
| MSB324 | Recombinant DNA Technology Lab | CC | - | - | 2 | 1 |
| MSB325 | Genomics & Proteomics Lab | CC | - | - | 2 | 1 |
| AND003 | ANANDAM-III | NTCC | - | - | - | 2 |
| DE Electives: Student has to select 1 course from the list of following DE electives | | | | | | |
| MSB330 | Advanced Food Technology | DE | 3 | - | - | 3 |
| MSB331 | Tissue Engineering | DE | | | | |
| MSB332 | Drug Discovery & Development | DE | | | | |
| OE | Open Elective III | OE | 3 | - | - | 3 |
| BCS311 | Communicational Skills - III | VA | 1 | - | - | 1 |
| BSS311 | Behavioral Science III (Leading Through Teams) | VA | 1 | - | - | 1 |
| FLT311<br>FLG311<br>FLS311<br>FLC311 | Foreign Language - III<br>French<br>German<br>Spanish<br>Chinese | VA | 2 | - | - | 2 |
| | **TOTAL** | | | | | **30** |

| M. Sc. Biotechnology: **IV Semester** | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Category** | **Lectures (L) Hours Per Week** | **Tutorial (T) Hours Per Week** | **Practical (P) Hours Per Week** | **Credits** |
| MSB460 | Major Project /Dissertation | NTCC | - | - | - | 30 |
| | **TOTAL** | | | | **-** | **30** |

# BIOCHEMISTRY AND METABOLIC REGULATION

**Course Code: MSB101** **Credit Unit:03**

**Theory**

**Course Objective:**

The objectives of the Metabolic Biochemistry course are to provide a comprehensive understanding of human metabolism in areas of enzymology and protein structure and function; energy releasing and energy consuming metabolic processes; the regulation of synthesis and breakdown of sugars, lipids, nucleic acids, and amino acids which is necessary for further work in the biochemical/biomedical and biotechnology areas.

**Course Contents:**

**Module I**

Structure of Biomolecules, Metabolism of Carbohydrates, Lipids, Proteins, Amino acids and Nucleic acids.

**Module II**

Photosynthesis in Microorganisms; Role of chlorophylls, carotenoids and phycobilins; Calvin cycle; Chemolithotrophy; hydrogen- iron-nitrite-oxidizing bacteria; nitrate and sulfate reduction; methanogenesis and acetogenesis; Bacterial fermentations.

**Module III: Modes of Regulation**

Different levels of regulation - protein synthesis/degradation, allosteric regulation, reversible covalent modification, proteolytic processing, Requirements for ATP in synthesis and degradation cycle, Reversibility of the different methods of regulation, Consequences of misregulation

**Module IV: Regulation of metabolic pathways**

Glycolysis/glycogenolysis, Phosphogluconate/Citric Acid Cycle, Oxidative Phosphorylation, Fatty acid oxidation, Fatty Acid Biosynthesis, Amino Acid Oxidation.

**Module V:**

Regulation of Metabolism for the production of Primary and Secondary Metabolites with case studies.

**Examination Scheme:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Text & References:**

***Text:***


- Lehninger, A. (2013). Principles of Biochemistry, 6th Ed., Nelson and Cox.
- Mathews, Van Holde & (2012).Ahern Biochemistry. 4th Edition.


***References:***


- Smith, E. L., Hill, R. L. Lehman, I. R. Lefkowitz, R. J. Handler, P. & White, A. (1983). Biochemistry 7th Ed. McGraw-Hill Book Company.
- Berg, J. M., Tymoczco, J. L. & Stryer, L. (1990). Biochemistry, 3rd Ed., W.H. Freeman and Company.
- Voet, D. V. & Voet, J. G. (2010). Biochemistry, 4th Ed. Wiley
- Conn, E. E. & Stumph, P. K. (1987).Outlines of Biochemistry, John Wiley & Sons.

# ADVANCED MICROBIOLOGY

**Course Code: MSB102** **Credit Unit:3L+1T**

**Theory**

**Course Objective:**

An introduction to microorganisms, their morphology, reproduction, cultivation, metabolism, genetics, ecology of microorganisms and their relationships to health and environment

**Course Contents:**

**Module I**

Introduction (bacteria, fungi, algae, protozoa and viruses), Contribution of Scientists, Koch's Postulates, methods in Microbiology -Principles of microbial nutrition, Culture media, Theory and practice of sterilization, pure culture techniques, Enrichment culture techniques and Microbial lab techniques.

**Module II**

Prokaryotic structure and function - Microbial nutrition and growth - Arithmatic and Geomatric Growth expression, mathematical expression of growth, growth curve, measurement of growth and growth yields, synchronous growth, continuous culture, Diauxic growth, culture collection and maintenance of cultures.

**Module III**

Microbial evolution, systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, characteristics of primary domains, taxonomy, nomenclature and Bergey's manual, ribosomal RNA sequencing, microbial regulation of gene expression (attenuation and negative regulation with e.g. *trp* and *lac* operon), transfer of genetic material: plasmids, transposons, transduction, transformation and conjugation .

**Module IV**

Host-parasite relationship -Normal micro flora of skin, oral cavity, gastrointestinal tract; entry of pathogens into the host, types of toxins (Exo, endo, entro) and their mode of actions, Plant -Microbe Interactions, Microbial pathogenesis -Disease reservoirs; Epidemiological terminologies; Infectious disease transmission

**Module V**

Chemotherapy/antibiotics -Antimicrobial agents, sulfa drugs, antibiotics -penicillin and cephalosporins, broad spectrum antibiotics, antibiotics from prokaryotes. antifungal antibiotics; mode of action, resistance to antibiotics

**Examination Scheme:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Text & References:**

***Text:***

- Pelczar, M.J., Chan, E.C.S. & Kreig, N.R. (2001). Microbiology 6th Ed. Tata McGraw Hill.
- Prescott, L.M. (2014). Microbiology, 9th Ed. McGraw by Hill Higher Education.

***References:***

- Stanier, R.Y., Ingraham, J.L., Wheelis M.L. & Painter, P.R. (2005). General Microbiology, 5th Ed. McMillan,
- Atlas, R.M. (1997). Principles of Microbiology 2nd Ed. WMT Brown Publishers.
- VanDemark, P.J. & Batzing, B.L. Menlo Park (1987). The microbes: an introduction to their nature and importance, Benjamin/Cummings Publishing Co.
- Tortora, G. J., Funke, B. R. and Case, C.L. (1994).Microbiology 5th Ed. Benzamin Cummings Inc. California.

# BIOINFORMATICS

**Course Code: MSB103** **Credit Unit:03**

**Theory**

**Course Objective:**

The course depicts the fundamental concepts and methods in Bioinformatics, a field at the junction of Biology and Computing. The course covers the principles and methods used to search and compare DNA, RNA and proteins, cast as biological "sequences". It also includes three dimensional data of protein structure and the associated problems are structure prediction (secondary and tertiary), analysis of protein structures for clues regarding function, and structural alignment. It serves a gateway course for all science students.

**Course Contents:**

**Module I: Basics of Bioinformatics**

Introduction to Bioinformatics; Computers in Biology to understand Biological System; Basic commands of Windows, Unix and Linux operating systems; Concept of open resources in Bioinformatics.

**Module II**

**Biological databases -**

Database concepts; Introduction to Data types and source; Protein Sequence and Structural Databases; Nucleic acid databases; Genome databases; Specialized Databases; Protein databases- UniProt, Protein Data Bank. Clinically relevant drug-drug interactions databases; Information retrieval from Biological databases: Entrez system, TCGA data bases, Bioportal.

**Module III**

**Sequence Analysis**

Biological background for sequence analysis; Sequence alignment: Global, Local, Pairwise and Multiple sequence analysis; Algorithm for alignments; Database Searching; Tools for Sequence alignment.

**Module IV**

**Introduction to Modeling and Visualization tools**

Introduction to RASMOL, PyMoL SWISS-PDB Viewer.

**Module V**

**Insilico Structure prediction of protein and docking**

Protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification; Structure databases– PDB and MMDB, visualizing structural information, Docking of Molecules, structure prediction in proteins, prediction of buried residues in proteins, RNA secondary structure – minimum free-energy structures.

**Examination Scheme:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Text & References:**

***Text:***


- Sensen, C.W. (2002). Essentials of Genomics and Bioinformatics, John Wiley and Sons.
- Mount, D.W. (2004). Bioinformatics: Sequence and Genome Analysis. 2nd Ed., Cold Spring Harbor Laboratory Press.
- Baxevanis, A.D. and Ouellette, B.F.F (2009). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Wiley – Interscience


***References:***


- Gusfield, D. (1997). Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, Cambridge University Press
- Heijne, G. Von and Heijne, G. Von (1987). Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by Academic Press.
- Pevzner, P.A. (2000). Computational Molecular Biology: An Algorithmic Approach by MIT Press
- Doolittle, R.F., Abelson, J.N, & Simon, M.I. (1996). Computer Methods for Macromolecular Sequence Analysis, Academic press
- Waterman, M. (1995). Introduction to Computational Biology: Maps, Sequences and Genomes, 1st Ed, Chapman and Hall.

# CELL AND MOLECULAR BIOLOGY

**Course Code: MSB104** **Credit Unit:03**

**Theory**

**Course Objective:**

The object of the present course is to develop basic knowledge and skills in cell and molecular biology and to understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of recent techniques. This course will help students to get an understanding of cell function at the molecular level including the fundamentals of DNA They will become aware of the complexity and harmony of the cell. Applications of cellular and molecular biology in Biotechnology will also be presented.

**Course Contents:**

**Module I**

Protein targeting - Chemical and physical properties of cell membranes and their major components, significance of these properties to membrane structure, integral and peripheral membrane proteins, biosynthesis of membrane and secreted proteins; targeting of proteins to membranes.

**Module II**

Membrane transport/Cell Cycle - Mechanisms for transport of small molecules across the membrane, including simple diffusion, facilitative diffusion, primary and secondary active transport, action of ionophores. Cell cycle and the events associated with each stage, control of the cell cycle and the proteins involved; know the role of the cyclins and cyclin-dependent kinases, cell cycle checkpoints, methods for synchronizing the cell cycle in cell populations.

**Module III**

Intracellular Signaling I - define growth, growth factor, growth factor receptor, mitogen, receptor, effector, second messenger, action of hormones and other biologically active agents that act via receptors in the nucleus and/or cytoplasm. Intracellular Signaling II - the intracellular signaling cascades triggered by hormone binding to these receptor, G proteins signalling, the action of Ca 2+ and diacylglycerol as second messengers.

**Module IV: Replication**

Replication of DNA, Role of DNA polymerases & proteins involved in DNA replication, Compare and contrast eukaryote and prokaryote DNA replication, telomeres, telomerase and altered telomerase function in aging and disease.

**Recombination & Repair:** Mutations and types of site mutations: substitution, transition, transversion, insertion, deletion, tautomer, frameshift and nonsense mutation. Repair mechanisms: dimer repair, excision repair, mismatch repair, trans-lesion repair, and recombinational repair.

**Module V**

**Transcription -** RNA transcription and the proteins required for each step, maturation of the RNA transcript derived from a eukaryotic gene, structure of prokaryote and eukaryote promoter and the function of promoter sequences, inhibitors of prokaryote and eukaryote transcription and their mechanisms of action. Concept of operon, inducer, operator and polycistronic transcript, expression of the lac operon and trp operon in *E. coli,* catabolite repression, leader peptide and attenuator site, enhancer and transcription factors, four common DNA-binding motifs found in transcription factors, mRNA stability and alternative splicing in gene expression

**Translation-**Genetic code and the concept of colinearity of the gene and protein, components required for translation, basic steps involved in initiation, elongation, and termination of protein translation, inhibitors of protein translation. Compare and contrast the spatial and temporal differences in prokaryotic and eukaryotic transcription and translation

**Examination Scheme:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Text & References:**

***Text:***


- Albert, B. (2002). Molecular Biology of the Cell 4th Ed., Garland Science New York.
- Darnell, L. and Baltimore (2012). Molecular Biology, Mac Millan
- Watson et al., (2013). Molecular Biology of the gene, 7th Ed., Pearson.


***References:***


- Lewis, B. (2003). Genes VIII, Benjamin Cummings.
- Goodenough, U. W. (1984). Genetics 2nd Ed. Saunders (W.B.) Co Ltd.
- Swanson, C. P., Merz, T. & Young, W.J. (1981). Cytogenetics, Prentice Hall
- Berg, J. M., Tymoczco, J. L. & Stryer, L. (2002). Biochemistry, 3rd Ed. W.H. Freeman and Company, ,
- Brown, T.A. (1990). Genomes 2nd Ed. Oxford: Wiley-Liss,

## BIOCHEMISTRY AND METABOLIC REGULATION -Lab

**Course Code: MSB121** **Credit Unit:01**

**Course Contents:**

**Module I: Proteins**

Identification of protein by Biuret test, quantitation of protein by Bradford method, Separation of proteins by SDS-PAGE, Enzyme: Determination of serum alkaline phosphatase activity

**Module II: Nucleic Acid**

Biochemical estimation of DNA, RNA. Separation of DNAsamples on Agarose gel.

**Carbohydrate:** Color reactions of different type of carbohydrates, Biochemical estimation of blood sugar

**Lipids:** Blood Cholesterol estimation.

**Examination Scheme:**

| IA | | | | EE | | |
|---|---|---|---|---|---|---|
| **Practical (Mid Term)** | **Viva** | **Regular Performance** | **Attendance** | **Practical (End Term)** | **Practical Record** | **Viva** |
| 20 | 15 | 10 | 05 | 25 | 10 | 15 |

**Note:** Minor variation could be there depending on the examiner.

## ADVANCED MICROBIOLOGY -Lab

**Course Code: MSB122** **Credit Unit:01**

**Course Contents:**

**Module I**

Preparation of culture media for cultivation of specific microorganism. Isolation of microbes from air, soil and water samples, their identification by staining techniques – simple staining, differential Gram staining, lacto phenol cotton blue staining for fungi

**Module II**

Biochemical test – Indole test, methyl red test, voges proskaeur test, citrate utilization, starch hydrolysis, protease, catalase test and oxidase test. Identification of microbes in water samples; standard plate count, presumptive and confirmed coli form test, BOD and COD

**Examination Scheme:**

| IA | | | | EE | | |
|---|---|---|---|---|---|---|
| **Practical (Mid Term)** | **Viva** | **Regular Performance** | **Attendance** | **Practical (End Term)** | **Practical Record** | **Viva** |
| 20 | 15 | 10 | 05 | 25 | 10 | 15 |

**Note:** Minor variation could be there depending on the examiner.

## BIOINFORMATICS -Lab

**Course Code: MSB123** **Credit Unit:01**

**Course Objective:**

To demonstrate the techniques and soft wares used for sequence analysis, alignment, structure prediction of the proteins and other compounds and finding the phylogenetic relationships

**Course Contents:**

**Module I**

Basics of sequence analysis Retrieving a sequence-nucleic acid/Protein

**Module II**

Local and Global Alignment- concepts Pair wise sequence alignment, multiple sequence alignment Dynamic Programming – Smith Watermann Algorithm Needleman Wunsch Algorithm

**Module III**

Motif and pattern searching, Structure prediction, Protein structure classification resources, Structure superposition tools, Energy minimization and simulated annealing

**Module IV**

Phylogenetic prediction and analysis

**Module V**

Docking small molecules/peptides in active site of protein. Use of automated docking procedures. Free energy calculation.

**Module VI**

Finding transcription regulatory signals

**Examination Scheme:**

| IA | | | | EE | | |
|---|---|---|---|---|---|---|
| **Practical (Mid Term)** | **Viva** | **Regular Performance** | **Attendance** | **Practical (End Term)** | **Practical Record** | **Viva** |
| 20 | 15 | 10 | 05 | 25 | 10 | 15 |

**Note:** Minor variation could be there depending on the examiner.

# CELL AND MOLECULAR BIOLOGY -Lab

## Course Code: MSB124 Credit Unit:01

**Course Objective:**

The laboratory experiments in Recombinant DNA Technology would certainly help to comprehend the theoretical aspects of the subject.

**Course Contents:**

1. Isolation of genomic DNA from prokaryotic and Eukaryotes
2. Isolation of plasmid.
3. Study of apoptosis by TUNEL method
4. Isolation of cell organelles by ultracentrifugation.
5. Study of in vitro transcription.
6. Study of DNA repair mechanism
7. Site-directed mutagenesis

**Examination Scheme:**

| IA | | | | EE | | |
|---|---|---|---|---|---|---|
| **Practical (Mid Term)** | **Viva** | **Regular Performance** | **Attendance** | **Practical (End Term)** | **Practical Record** | **Viva** |
| 20 | 15 | 10 | 05 | 25 | 10 | 15 |

**Note:** Minor variation could be there depending on the examiner.

# INSTRUMENTATION IN BIOTECHNOLOGY

## Course Code: MSB130 Credit Unit:03

**Theory**

**Course Objective:**

To demonstrate a thorough knowledge of the equipment and operating modes of instrumentation systems used in the area of biotechnology and critically discuss the limitations and biohazards of the equipment and techniques employed in biotechnology.

**Course Contents:**

**Module I: Ultracentrifugation**

Sedimentation equilibrium and sedimentation velocity methods, Analytical and Preparative centrifuges, application of density gradient and differential centrifugation.

**Module II: Gel electrophoresis**

Agarose and Polyacrylamide, Two-dimensional electrophoresis, Isoelectric focussing, Capillary electrophoresis, Pulse-field gel electrophoresis, Immunoelectrophoresis.

**Module III**

TLC gas chromatography, gel filtration, ion-exchange chromatography, affinity chromatography and HPLC, FPLC.

**Module IV**

UV and visible Spectroscopy, Spectrofluorimetry, Atomic absorption spectrophotometry, Mass Spectrometry, Infrared Spectroscopy, MALDITOF, Nuclear Magnetic Resonance and Electron Spin Resonance Spectroscopy, Magnetic Resonance Imaging. X -Ray diffraction.

**Module V**

Optical and Electron Microscopy, Transmission and Scanning Electron Microscopy, Tunneling Electron Microscopy, Polarization and Fluorescence microscopy.

Radio tracers, GM Counter, Proportional and Scintillation Counters, Autoradiography, Radio-immunoassay.

**Examination Scheme:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Text & References:**

***Text:***


- Wilson, K. & Walker, J. (2000). Practical Biochemistry, Principles & Techniques 5th Ed. Cambridge University Press.
- Friefelder, D. (1982). Physical Biochemistry: Applications to Biochemistry and Molecular Biology 2nd Ed. W. H. Freeman


***References:***


- Hoppert, M. (2005). Microscopic Techniques in Biotechnology, Wiley-Blackwell.
- Venn, R. F. (2002). Principles and Practice of Bioanalysis 1st Ed. Taylor and Francis, London.
- Van Impe, J.F.M., Vanrolleghem, P. A. & Iserentant, D. M. (1998). Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes, Springer Science + Business media
- Glusker, J.P. & Trueblood, K.N. (1985).Crystal Structure Analysis: a primer by Oxford University Press.
- Rhodes, G. (1993).Crystallography Made Crystal Clear: A Guide for Users of Macromolecular Models, Academic Press Inc.
- Gunter, H. (1992).NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry, Wiley India Pvt. Limited.
- Van Holde, K. E., Johnson, W. C. & Ho, P. S. (2006). Principles of Physical Biochemistry" by Prentice Hall

# IPR & DRUG REGULATORY AFFAIRS

**Course Code: MSB131** **Credit Unit:03**

**Theory:**

**Course Objective:**

It will familiarize the students of the IPR issues and regulatory issues pertaining to health care industries. The unit will also cover the regulatory legislation and associated approvals and permissions required to conduct high-quality single-centre, national and international clinical trials.. Ethical issues will be considered throughout the unit.

**Module-I (Intellectual Property Rights-I)**

Regulatory affairs and its importance.

General Principles of Intellectual Property: Copyright, Trademark, Inventions-Patentable, Geographical Indications, Industrial Designs, Integrated Circuits, Trade Secrets.Patents: need of patents, major types of patents, International registration of patents, patent term and extension The Patents Act, 1970 – Salient features.

**Module-II (Intellectual Property Rights-II)**

Organization: Intellectual Property Rights, World Trade Organization (WTO), World Intellectual Property Organization (WIPO), Paris Convention, Berne Convention, TRIPS Agreement, the Doha Declaration, Patent Cooperation Treaty (PCT), Madrid Protocol.

**Module-III (Drug Regulatory Affairs-I)**

New Drug Application: Steps involved in the development of new drug. New drug applications as per WHO guidelines and abbreviated NDA. Requirement and guidelines on clinical trials, Investigational New Drug Application(IND).

**Module-IV (Drug Regulatory Affairs-II)**

Generic Drug Products: Drug Regulations – IND and NDA, Drug Regulations – ANDA, Generic Drug Product Development, Generic Drug Product Approval, SUPAC.

Introduction about GMP, cGMP, GLP, GCP, CDSCO, CPCSEA, US-FDA

**Module-V (Drug and Cosmetic Act)**

Introductory drugs Jurisprudence: Drugs & Cosmetic Act & Rules

**Evaluation:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Texts & References**


1. Dr. N.S. Vyawahare and Sachin Itkar, (2011). Drug Regulatory Affairs, Nirali Prakashan
2. C.V.S. Subrahmanyam & J. ThimmaSetty, (2012). Pharmaceutical Regulatory Affairs, Vallabh Prakashan
3. Quality Assurance of Pharmaceutics Vol I & II (1999).WHO publications
4. WIPO website study material
5. Nair, Kanakkan Raghavan Gangadharan, and Ashok Kumar, (1994), Intellectual property rights. No. 1. Allied Publishers.
6. Cell, I. P. R. (2002), "Intellectual property rights."
7. Yan, Huang. (1996), "Intellectual property rights."

# INDUSTRIAL SAFETY AND HAZARDS

**Course Code: MSB132** **Credit Unit:03**

**Theory**

**Course Objective:**

Course addresses management and engineering design concepts required for process safety in chemical and biotechnology systems, with pharmaceutical manufacturing applications. Content focuses on sound engineering principles and practices as they apply to industrial situations, project design, risk mitigation, process and equipment integrity, and engineering codes and standards.

**Course Contents:**

**Module I: Hazards**

Chemical hazards classification. Radiation hazards and control of exposure to radiation. Types of fire and fire prevention methods. Mechanical hazards. Electrical hazards

**Module II: Psychology and Hygiene**

Industrial psychology Industrial hygiene. Safety in plant site selection and plant layout. Industrial lighting and ventilation. Industrial noise.

**Module III: Occupational diseases and control**

Occupational diseases and prevention methods. Safe housekeeping, Instrumentation for safe operation. Personal protective equipments. Safety in chemical operations and processes.

**Module IV: Management**

Safety organization – safety committee – safety education and training. Management process. Philosophy and need for Industrial safety. Role of Government in Industrial safety.

**Module V: Laws**

Factory Act. ESI Act, Environmental Act. Workment - comperation Act. Advantages of adopting safety laws.

**Examination Scheme:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Text & References:**

***Text:***

- Guide for Safety in the Chemical laboratory second edition, Manufacturing Chemists Allocation. Van vostrand Reinhold Company, New York.
- Anonymous (1972). Guide for Safety in the Chemical Laboratory , 2nd Ed., Van Nostrand Reinhold Co., Litton Educational Publishing, Inc., New York
- Fawcett, H.H. & Wood, W.S. (1982). Safety and Accident Prevention in Chemical Operation, 2nd Ed. John Wiley and sons, New York.

***References:***

- Industrial Safety and Laws by Indian School of Labour Education, Madras.

# COMMUNICATION SKILLS – I

**Course Code: BCS111** **Credit Unit:01**

**Course Objective:**
The Course is designed to give an overview of the four broad categories of English Communication thereby enhance the learners' communicative competence.

**Course Contents:**

**Module I: Listening Skills**
Effective Listening: Principles and Barriers
Listening Comprehension on International Standards

**Module II: Speaking Skills**
Pronunciation and Accent
Reading excerpts from news dailies & magazines
Narrating Incident; Story telling.
Extempore & Role Plays

**Module III: Reading Skills**
Vocabulary: Synonyms, antonyms, diminutives, homonyms, homophones
Idioms & phrases
Foreign words in English

**Module IV: Writing Skills**
Writing Paragraphs
Précis Writing
Letter writing
Coherence and structure
Essay writing

**Module V: Activities**
News reading
Picture reading
Movie magic
Announcements

**Examination Scheme:**

| Components | CT1 | CT2 | CAF | V | GD | GP | A |
|---|---|---|---|---|---|---|---|
| Weightage (%) | 20 | 20 | 25 | 10 | 10 | 10 | 5 |

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

**Text & References:**


- Working in English, Jones, Cambridge
- Business Communication, Raman – Prakash, Oxford
- Speaking Personally, Porter-Ladousse, Cambridge
- Speaking Effectively, Jermy Comfort, et.al, Cambridge

# Behavioural Science I
# (Self Development and Interpersonal Skills)

**Course Code: BSS111** **Credit Unit:01**

**Course Objective:**
This course aims at imparting an understanding of:

Self and the process of self exploration

Learning strategies for development of a healthy self esteem

Importance of attitudes and their effect on work behaviour

Effective management of emotions and building interpersonal competence.

**Course Contents:**

**Module I: Understanding Self**

Formation of self concept

Dimension of Self

Components of self

Self Competency

**Module II: Self-Esteem: Sense of Worth**
Meaning and Nature of Self Esteem

Characteristics of High and Low Self Esteem

Importance & need of Self Esteem

Self Esteem at work

Steps to enhance Self Esteem

**Module III: Emotional Intelligence: Brain Power**

Introduction to EI

Difference between IQ, EQ and SQ

Relevance of EI at workplace

Self assessment, analysis and action plan

**Module IV: Managing Emotions and Building Interpersonal Competence**
Need and importance of Emotions

Healthy and Unhealthy expression of emotions

Anger: Conceptualization and Cycle

Developing emotional and interpersonal competence

Self assessment, analysis and action plan

**Module V: Leading Through Positive Attitude**

Understanding Attitudes

Formation of Attitudes

Types of Attitudes

Effects of Attitude on

Behaviour

Perception

Motivation

Stress

Adjustment

Time Management

Effective Performance

Building Positive Attitude

**Module VI: End-of-Semester Appraisal**
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

**Examination Scheme:**

| Components | SAP | A | Mid Term Test (CT) | VIVA | Journal for Success (JOS) |
|---|---|---|---|---|---|
| Weightage (%) | 20 | 05 | 20 | 30 | 25 |

**Text & References:**


- Towers, Marc: Self Esteem, 1st Edition 1997, American Media
- Pedler Mike, Burgoyne John, Boydell Tom, A Manager's Guide to Self-Development: Second edition, McGraw-Hill Book Company.
- Covey, R. Stephen: Seven habits of Highly Effective People, 1992 Edition, Simon & Schuster Ltd.
- Khera Shiv: You Can Win, 1st Edition, 1999, Macmillan
- Gegax Tom, Winning in the Game of Life: 1st Edition, Harmony Books
- Chatterjee Debashish, Leading Consciously: 1998 1st Edition, Viva Books Pvt. Ltd.
- Dr. Dinkmeyer Don, Dr. Losoncy Lewis, The Skills of Encouragement: St. Lucie Press.
- Singh, Dalip, 2002, Emotional Intelligence at work; First Edition, Sage Publications.
- Goleman, Daniel: Emotional Intelligence, 1995 Edition, Bantam Books
- Goleman, Daniel: Working with E.I., 1998 Edition, Bantam Books.

# FRENCH – I

**Course Code:** FLT 111 **Credit Unit:02**

**Course Objective:**
To familiarize the students with the French language

- with the phonetic system
- with the syntax
- with the manners
- with the cultural aspects

**Course Contents:**

**Module A: pp. 01 to 37: Unités 1, 2, Unité 3 Objectif 1,2**
Only grammar of Unité 3: objectif 3, 4 and 5

**Contenu lexical: Unité 1 : Découvrir la langue française : (oral et écrit)**

1. se présenter, présenter quelqu'un, faire la connaissance des autres, formules de politesse, rencontres
2. dire/interroger si on comprend
3. Nommer les choses

**Unité 2: Faire connaissance**

1. donner/demander des informations sur une personne, premiers contacts, exprimer ses goûts et ses préférences
2. Parler de soi: parler du travail, de ses activités, de son pays, de sa ville.

**Unité 3: Organiser son temps**

1. dire la date et l'heure

**Contenu grammatical:**

1. organisation générale de la grammaire
2. article indéfini, défini, contracté
3. nom, adjectif, masculin, féminin, singulier et pluriel
4. négation avec « de », "moi aussi", "moi non plus"
5. interrogation : Inversion, est-ce que, qui, que, quoi, qu'est-ce que, où, quand, comment, quel(s), quelle(s)
   Interro-négatif : réponses : oui, si, non
6. pronom tonique/disjoint- pour insister après une préposition
7. futur proche

**Examination Scheme:**

| Components | CT1 | CT2 | C | I | V | A |
|---|---|---|---|---|---|---|
| Weightage (%) | 20 | 20 | 20 | 20 | 15 | 5 |

C – Project + Presentation
I – Interaction/Conversation Practice

**Text & References:**

- le livre à suivre: Campus: Tome 1

# GERMAN – I

## Course Code: FLG 111 Credit Unit:02

**Course Objective:**

To enable the students to converse, read and write in the language with the help of the basic rules of grammar, which will later help them to strengthen their language.

To give the students an insight into the culture, geography, political situation and economic opportunities available in Germany

**Course Contents:**

**Module I: Introduction**

Self introduction: heissen, kommen, wohnwn, lernen, arbeiten, trinken, etc.

All personal pronouns in relation to the verbs taught so far.

Greetings: Guten Morgen!, Guten Tag!, Guten Abend!, Gute Nacht!, Danke sehr!, Danke!, Vielen Dank!, (es tut mir Leid!),

Hallo, wie geht's?: Danke gut!, sehr gut!, prima!, ausgezeichnet!,
Es geht!, nicht so gut!, so la la!, miserabel!

**Module II: Interviewspiel**

To assimilate the vocabulary learnt so far and to apply the words and phrases in short dialogues in an interview – game for self introduction.

**Module III: Phonetics**

Sound system of the language with special stress on Dipthongs

**Module IV: Countries, nationalities and their languages**

To make the students acquainted with the most widely used country names, their nationalitie and the language spoken in that country.

**Module V: Articles**

The definite and indefinite articles in masculine, feminine and neuter gender. All Vegetables, Fruits, Animals, Furniture, Eatables, modes of Transport

**Module VI: Professions**

To acquaint the students with professions in both the genders with the help of the verb "sein".

**Module VII: Pronouns**

Simple possessive pronouns, the use of my, your, etc.

The family members, family Tree with the help of the verb "to have"

**Module VIII: Colours**

All the color and color related vocabulary – colored, colorful, colorless, pale, light, dark, etc.

**Module IX: Numbers and calculations – verb "kosten"**

The counting, plural structures and simple calculation like addition, subtraction, multiplication and division to test the knowledge of numbers.

"Wie viel kostet das?"

**Module X: Revision list of Question pronouns**

W – Questions like who, what, where, when, which, how, how many, how much, etc.

**Examination Scheme:**

| Components | CT1 | CT2 | C | I | V | A |
|---|---|---|---|---|---|---|
| Weightage (%) | 20 | 20 | 20 | 20 | 15 | 5 |

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**


- Wolfgang Hieber, Lernziel Deutsch
- Hans-Heinrich Wangler, Sprachkurs Deutsch
- Schulz Griesbach, Deutsche Sprachlehre für Ausländer
- P.L Aneja, Deutsch Interessant- 1, 2 & 3
- Rosa-Maria Dallapiazza et al, Tangram Aktuell A1/1,2
- Braun, Nieder, Schmöe, Deutsch als Fremdsprache 1A, Grundkurs

## SPANISH – I

**Course Code: FLS 111** **Credit Unit:02**

**Course Objective:**
To enable students acquire the relevance of the Spanish language in today's global context, how to greet each other. How to present / introduce each other using basic verbs and vocabulary

**Course Contents:**

**Module I**
A brief history of Spain, Latin America, the language, the culture…and the relevance of Spanish language in today's global context.
Introduction to alphabets

**Module II**
Introduction to '*Saludos*' (How to greet each other. How to present / introduce each other).
Goodbyes (despedidas)
The verb *llamarse* and practice of it.

**Module III**
Concept of Gender and Number
Months of the years, days of the week, seasons. Introduction to numbers 1-100, Colors, Revision of numbers and introduction to ordinal numbers.

**Module IV**
Introduction to *SER* and *ESTAR* (both of which mean To Be).Revision of '*Saludos*' and '*Llamarse*'. Some adjectives, nationalities, professions, physical/geographical location, the fact that spanish adjectives have to agree with gender and number of their nouns. Exercises highlighting usage of *Ser* and *Estar*.

**Module V**
Time, demonstrative pronoun (Este/esta, Aquel/aquella etc)

**Module VI**
Introduction to some key AR /ER/IR ending regular verbs.

**Examination Scheme:**

| Components | CT1 | CT2 | C | I | V | A |
|---|---|---|---|---|---|---|
| Weightage (%) | 20 | 20 | 20 | 20 | 15 | 5 |

C – Project + Presentation
I – Interaction/Conversation Practice

**Text & References:**

- Español, En Directo I A
- Español Sin Fronteras

# CHINESE – I

**Course Code:** FLC 111 **Credit Unit:02**

**Course Objective:**
There are many dialects spoken in China, but the language which will help you through wherever you go is Mandarin, or Putonghua, as it is called in Chinese. The most widely spoken forms of Chinese are Mandarin, Cantonese, Gan, Hakka, Min, Wu and Xiang. The course aims at familiarizing the student with the basic aspects of speaking ability of Mandarin, the language of Mainland China. The course aims at training students in practical skills and nurturing them to interact with a Chinese person.

**Course Contents:**

**Module I**
Show pictures, dialogue and retell.
Getting to know each other.
Practicing chart with Initials and Finals. (CHART – The Chinese Phonetic Alphabet Called "Hanyu Pinyin" in Mandarin Chinese.)
Practicing of Tones as it is a tonal language.
Changes in 3rd tone and Neutral Tone.

**Module II**
Greetings
Let me Introduce
The modal particle "ne".
Use of Please 'qing" – sit, have tea …….. etc.
A brief self introduction – Ni hao ma? Zaijian!
Use of "bu" negative.

**Module III**
Attributives showing possession
How is your Health? Thank you
Where are you from?
A few Professions like – Engineer, Businessman, Doctor, Teacher, Worker.
Are you busy with your work?
May I know your name?

**Module IV**
Use of "How many" – People in your family?
Use of "zhe" and "na".
Use of interrogative particle "shenme", "shui", "ma" and "nar".
How to make interrogative sentences ending with "ma".
Structural particle "de".
Use of "Nin" when and where to use and with whom. Use of guixing.
Use of verb "zuo" and how to make sentences with it.

**Module V**
Family structure and Relations.
Use of "you" – "mei you".
Measure words
Days and Weekdays.
Numbers.
Maps, different languages and Countries.

**Examination Scheme:**

| Components | CT1 | CT2 | C | I | V | A |
|---|---|---|---|---|---|---|
| Weightage (%) | 20 | 20 | 20 | 20 | 15 | 5 |

C – Project + Presentation
I – Interaction/Conversation Practice

**Text & References:**

- "Elementary Chinese Reader Part I" Lesson 1-10

# GOOD LABORATORY PRACTICES

**Course Code: NCC001 Duration: 30 hrs Credit: Non Credit**

**Objective:** Good Laboratory Practices (GLP) are so important to modern laboratory operations, this course will incorporate many of the principles that are part of GLP in contemporary commercial laboratories. It will be useful for the graduate's individuals seeking careers in the industry(food, agriculture, pharmaceutical, clinical, biotech, cosmetics, environmental, etc.)who need practical skills and expertise for the food, pharmaceutical, biotechnology and healthcare workforce.

**Course Contents:**

**Introduction to GLP**

Good laboratory practices-Introduction, WHO guidelines on GLP and GMP
History of Good Laboratory Practices
Quality assurances in Good Laboratory Practices, Including SOP, Log Books, Stock register

**Quality Standards and Quality Assurances**

Quality Standards- Advantages and Disadvantages, Concept of Quality Control
Quality Assurance- Their functions and advantages
Quality assurance and quality management in industry
Customer requirement of quality
Government and trade standards of quality Federal Food and Drug Law FDA Action BSTI Laws, BSTI action and activities Other food laws (Legalization)
Trade and Company Standards Control by National, International, Social Organizations (example:FAO, WHO, UNICEF, CAB), Society (example: NSB, Professional societies)

**Good Manufacturing Practices in Pharmaceutical and Food Industries**

Types of validation in Pharma industry
Scope and importance of Validation
Organization and Elements of validation (Q, OQ, PQ and DQ) Cleaning Validation
Validation of Analytical Procedures as per ICH Guidelines Implications of cGMP and Food plant sanitation
The regulations of cGMPs Planning of Plant Sanitation Programs and Construction factors Hygeinic design of food plants and equipments Sanitation in warehousing, storage, shipping, receiving, containers and packaging materials Control of rats, rodents, birds, insects and microbes.
Cleaning and Disinfection: Physical and Microbiological Approach

**Biosafety& Hazards**

Introduction: Historical Background, Biosafety in Laboratory/ institution.
Laboratory associated infections and other hazards
Assessment of Biological Hazards and levels of biosafety
Prudent biosafety practices in the laboratory/institution Introduction to Biological safety cabinets
Primary Containment of Biohazards, Biosafety Levels
Recommended Biosafety Levels for Infectious Agents and Infected Animals Biosafet guidelines
Government of India Guidelines, Definition of Genetically Modified Organisms (GMOs)

**Examination Scheme:**

| **Criteria** | Assignment | Case Study | Presentation |
|---|---|---|---|
| **Grade** | Pass/ Not Pass | | |

**Text Book:**


1. Pharmaceutical Analysis- Modern methods – Part B - J W Munson, Volume 11, Marcel Dekker Series
2. Implementing Juran's Road Map for Quality Leadership: Benchmarks and Results, By Al Endres, Wiley, 2000
3. Understanding, Managing and Implementing Quality: Frameworks, Techniques and Cases, By Jiju Antony; David Preece, Routledge, 2002
4. The Quality Management Sourcebook: An International Guide to Materials and Resources By Christine Avery; Diane Zabel, Routledge, 1997
5. Quality Assurance Guide by organization of Pharmaceutical Procedures ofIndia, 3rd revised edition, Volume I & II, Mumbai, 1996.
6. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol.69, Marcel Dekker Series, 1995.

# ADVANCE PLANT BIOTECHNOLOGY

## Course Code: MSB201 Credit Unit: 03

**Theory**

**Course Objective:**

The present course aims to give an exposure to advancement in plant biotechnology, where students will learn about culture of plants, cloning, induced genetic variability, genetic engineering and their practical importance. The course will improve skills related to plant biotechnology.

**Course Contents:**

**Module I**

**Micropropagation:** Concept of totipotency, Importance of micropropagation, Nutrient media, process, various methods of micropropagation, factors affecting micropropagation, acclimatization, somaclonal variation, applications, advantages and limitation of micropropagation.

**Module II**

Protoplast culture: Importance, isolation, purification and viability of protoplast, protoplast culture methods, various methods of fusion, isolation of desired fusion product, protoplast regeneration and factors affecting, fate of fusion, application of protoplast culture

**Module III**

**Suspension culture:** Concept, Significance and application of suspension culture, different methods of suspension culture, factors affecting culture, secondary metabolite production through in vitro culture methods, hairy root culture, advantages and limitation of suspension culture.

**Module IV**

Genetic engineering: Concept, Importance, gene, markers, vectors, recombinant DNA, indirect and direct gene transfer techniques, gene expression, *Agrobacterium* as a natural genetic engineer.

**Module V**

Application of transgenic plants and bioethics

**Examination Scheme:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Text & References:**

**Text**

- Plant Tissue Culture: Theory and Practice by S.S. Bhojwani and M.K. Razdan, Elsevier New York, a revised Ed (1996).
- Introduction to plant tissue culture by M.K. Razdan, Science Publishers Inc., New Hampshire USA, 2nd Ed (2002).
- Plant Biotechnology by K.G. Ramawat, S. Chand Publication, New Delhi (2004).

**Reference**


- Plant Propagation by Tissue Culture by Annonymous: the background.volume 1. (Eds. George, Edwin F, Hall, M. A and De Klerk, Geert-Jan) Springer, 3rd Edition Dordrecht, London (2007).
- Acclimatization of tissue-cultured plants by B. N. Hazarika, Current Science, 85 (12): 1704-1712 (2003).
- Endosperm culture: a novel method for triploid plant production by T. D. Thomas and R. Chaturvedi, Plant Cell Tiss Organ Cult 93:1–14 (2008).
- Embryo Rescue In: Plant Development and Biotechnology by S. M. Reed Publisher: CRC Press LLC, pp 235-239 (2005).
- An epigenetic view of plant cells cultured *in vitro*: somaclonal variation and beyond by Ce´ lia Miguel and L. Marum Journal of Experimental Botany, 1-13 (2011).

# ADVANCED ANIMAL BIOTECHNOLOGY

## Course Code: MSB 202 Credit Unit: 03

**THEORY**

**Course Objective:** The aim of the course is to provide equal importance to areas like in vitro fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

**Course Contents:**

**Module I**

Culture media – Natural and defined media, Primary culture – Steps, Mechanical and enzymatic disaggregation, Cell lines – Maintenance of cell line, Tissue and organ culture, Cell growth kinetics; Cryopreservation, Contamination

**Module II**

Polyclonal and monoclonal antibodies, Advantages and disadvantages of monoclonal antibodies, Production strategy, Use of monoclonal antibodies, Therapeutic monoclonal antibodies.

**Module III**

Vaccines; Types of vaccines - First generation vaccine, Second generation vaccine, Recombinant subunit vaccine, Peptide vaccine, Nucleic acid vaccines.

**Module IV**

In vitro fertilization–steps, Embryo transfer –Steps, Advantages and disadvantages of IVF-ET; Gene transfer methods – Viral and non viral methods, Expression vector systems,

**Module V**

Biopharming - transgenic animals as bioreactors for producing pharmaceutically important compounds and therapeutic proteins; Bioethical issues related to animal biotechnology

**Examination Scheme**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Text books:**

1. Ramdass, P. (2014). Animal Biotechnology Recent concepts and developments. MJP publishers
2. Masters, J. R. (Ed.). (2000). Animal cell culture: a practical approach (pp. 3-10). New York: Oxford University Press.

**Reference Books:**

1. Freshney, R. I. (Ed.). (1986). Animal cell culture: a practical approach (Vol. 8). Oxford: IRL press.

# ADVANCED STRUCTURAL BIOLOGY

## Course Code: MSB 203 Credit Unit: 03

**Course Objective:**
The course aims to provide an understanding of the principles and applications of proteins, enzymes and nucleic acids for their role in biochemical pathway as well as interactions among themselves.

**Course Contents:**

**Module I: Introduction to structural biology and Fundamentals of protein structure**
Structural biology Introduction and applications; Side chain structure and function in protein folding and functionality: Secondary structure of proteins-helices, sheets, loops and turns; Structural and functional proteins. Tertiary structure of proteins: alpha domain structures beta domain structures, alpha-beta domain structures, homo and hetero-dimers, trimers and tetramers; forces governing protein-protein interactions; open tertiary structure; Classification of proteins; Sequence and structural motifs in proteins,

**Module II: Structural and Functional relationships of Proteins**
Structure and function of an antibody; structure of hemoglobin, structure of muscle proteins; structure of viruses and viral proteins: structure and function of membrane proteins.

**Module III: Determination of protein structures**
Techniques used for three dimensional structure determinations of proteins: X-ray diffraction, NMR spectroscopy and electron microscopy.

**Module IV: Protein solubility and stabilization**
Salting in and salting out, Parameters affecting; enthalpic and entropic stabilization, mutations increasing stability, .helix capping; Native, partially denatured and denatured proteins; Protein denaturation, Physical and chemical denaturants; Refolding

**Module V: DNA structure**
Covalent structure of DNA, base pairing, hydrogen bonding, DNA melting and annealing, difference between AT and GC pairing, DNA models, The Watson Crick model; Crystal structure of B-DNA, major and minor groves, dyad symmetry, base pair stacking, propellor twist, A and Z- DNA, triple stranded DNA, telomeric sequences and structure, G-quartcts, palindromic and tandem sequences, Base pair flipping and DNA bulges, DNA methylation; Protein-DNA interactions; drug-DNA interactions; Databases of sequences and structure for protein and DNA, public domain softwares for visualizing and modeling biomolecules -Rasmol, Deepview, Whatif, RCSB.

**Examination Scheme:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Text & References:**
***Text:***
- Introduction to Protein Structure, C. Branden and J Tooze, Garland Publishing Company, New York. 2010.
- Textbook of Structural Biology, Anders Liljas, Lars Liljas and Poul, World Scientific Publishing Co Pte Ltd.

***References:***
- Protein Structure, M. Perutz, Oxford University Press.
- Structural Biology of Viruses, Wah Chiu, Roger M. Burnett and Robert Garce, Oxford University Press.
- Structure and Mechanism in Protein Science, Alan Fersht.

# ADVANCED BIOSTATISTICS FOR BIOLOGISTS

**Course Code: MSB204** **Credit Unit: 03**

**Theory**

**Course Objective:**

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques.

**Course Contents:**

**Module I: Descriptive statistics**

Measures of Central Tendency (Mean, Median, Mode), Measures of dispersion (Range, Mean Deviation, Standard Deviation, Quartile Deviation), combined mean and variance, covariance, Graphs (Bar Chart, Pie Chart, Box Plot, Histogram, Ogive, scatter plot)

**Module II**

Probability (Addition and Multiplication Theorem), Binomial, Poisson and Normal distribution. Correlation and linear regression.

**Module III: Inferential statistics**

Formulation of Hypothesis (One-tailed & Two-tailed), Type I and Type II errors, power of a test, Significance of a test, P-value testing,

**Module IV:** Hypothesis Testing (students T-test, Z-test, Chi-square test). Analysis of variance (ANOVA)

**Module V:** Applications of statistical methods using statistical software

**Examination Scheme:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Text & References:**

***Text:***

- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Biostatistics, P.N Arora and P.K Malhan. Publisher: Himalaya Publishing House.

***References:***

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee .Publisher: Elsevier.
- Biostatistics: A foundation for analysis in the Health Sciences, W.W Daniel. Publisher: John Wiley and Sons.
- Statistical Methodology, S.P Gupta. Publisher: S. Chand & Co.
- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. Visweswara Rao. Publisher: Jaypee Brothers.
- Fundamentals of Mathematical Statistics, S.C Gupta and V.K Kapoor. Publisher: S. Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers.
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics by H.C. Saxena and V.K. Kapoor. Publisher: S. Chand & Co

# RESEARCH METHODOLOGY AND SCIENTIFIC WRITING

**Course Code: MSB205** **Credit Unit: 03**

**Theory**

**Course Objective:**

To develop understanding of information and library science research issues in the domain of bioinformatics through review of journal articles, invited talks, and critical group discussions of methods. The main objectives for this course are to develop: familiarity with information and library science-oriented problems in the biomedical sciences, an understanding of research methods in the biomedical domain, critical thinking and evaluation skills and presentation and summarization skills.

**Course Contents:**

**Module I**

Introduction: Science, Scientific Field and Biological research. Role of a researcher in different stages of a project, Routes to research funding (academic and commercial)

**Module II**

Research – Definition – Importance and Meaning of research – Characteristics of research – Types of Research – Steps in research – Identification, Selection and formulation of research problem – Research questions – Research design – Formulation of Hypothesis – Review of Literature.

**Module III: Sampling techniques**

Sampling theory – types of sampling – Steps in sampling – Sampling and Non-sampling error – Sample size – Advantages and limitations of sampling. Collection of Data: Primary Data – Meaning – Data Collection methods – Secondary data – Meaning - Relevance's, Limitations and cautions. Statistics in Research.

**Module IV**

Type of Articles (review, letters etc). Scientific paper format (Abstract, Introduction, Materials and Methods, Results, Discussion). Writing, evaluating, presenting and publishing the results of scientific research in the academic press (journals, conferences etc). Choosing the appropriate journal (Sources, Information, Instructions to authors, peer review system, journal evaluation)

**Module V**

Case studies of areas of current research. Formulating a research plan and its presentation

**Examination Scheme:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Text & References:**

***Text*:**

- Statistical Methods By S.P. Gupta

***References*:**

- Research Methodology Methods and Techniques by C.R. Kothari
- Statistics(Theory and Practice) by B.N. Gupta
- Research Methodology Methods and statistical Techniques by Santosh Gupta
- Scientific journals and magazines

## ADVANCE PLANT BIOTECHNOLOGY -Lab

**Course Code: MSB221** **Credit Unit: 01**

**Course Objective:**

The present course aims to acquaint the students with lab-scale *in vitro* propagation of plants.

**Course Contents:**

**Module I**

Media preparation and sterilization.

**Module II**

Effect of cytokinins and auxins on explants.

**Module III**

Embryo rescue.

**Module IV**

Seed viability test and in vitro seed germination study

**Examination Scheme:**

| IA | | | | EE | | |
|---|---|---|---|---|---|---|
| **Practical (Mid Term)** | **Viva** | **Regular Performance** | **Attendance** | **Practical (End Term)** | **Practical Record** | **Viva** |
| 20 | 15 | 10 | 05 | 25 | 10 | 15 |

**Note:** Minor variation could be there depending on the examiner.

## ADVANCED ANIMAL BIOTECHNOLOGY -Lab

**Course Code: MSB222** **Credit Unit: 01**

**Course Contents:**

1. To study the establishment of animal cell culture lab
2. Reagent preparation for cell culture
3. Culture and maintenance of cells
4. Passaging of cells
5. Cells quantitation
6. Cell viability assay
7. Apoptosis assay
8. Study of cytotoxicity under invitro model.
9. Cryopreservation of cells

**Examination Scheme:**

| IA | | | | EE | | |
|---|---|---|---|---|---|---|
| **Practical (Mid Term)** | **Viva** | **Regular Performance** | **Attendance** | **Practical (End Term)** | **Practical Record** | **Viva** |
| 20 | 15 | 10 | 05 | 25 | 10 | 15 |

# ENVIRONMENTAL BIOTECHNOLOGY

**Course Code: MSB230** **Credit Unit: 03**

**Theory**

**Course Objective:**

The objective of this course is to familiarize the students with the processes and micro organism that can be employed for a cleaner environment. The students will be applying basic knowledge of microbiology for developing the practices for a cleaner environment, water, fuel, fertilizer, pesticides etc. The course also aims to make the students aware of legislation and acts prevalent to control the degradation of our eco system.

**Course Contents:**

**Module I**

Treatment of municipal wastes and industrial effluents (Physico-Chemical, biological analysis of waste water), Rr. Sec and test waste water treatment sludge treatment and disposal treatment of wastes from paper, textile, dairy, petrochemical and pharmaceutical industry .

**Module II**

Bioremediation and phytoremediation of toxic compounds like pesticides, hydrocarbons, polymers, surfactants, biotransformation and bioaccumulation

**Module III**

Renewable and non-renewable energy resources, clean fuel technology, biofuels.

**Module IV**

Biofertilizers and biopesticides – a cleaner agricultural practice, concept of $N_2$ - fixation, azolla, cyanobacteria, Rhizobium and VAM as biofertilizers.

**Module V**

Biomining – microbe assisted microbial leaching, bioaccumulation and bio sorption
Biosensors and biomarkers for ecotoxicity measurement, EIA and Environmental audit.
Principles in ecotoxicology; animal toxicity tests; statistical concepts of $LD_{50}$; dose-effect and dose response relationship; frequency response and cumulative response; Biological and chemical factors and influence toxicity; global dispersion of toxic substance; dispersion and circulating mechanisms of pollutants; Aquatic toxicity testes; statistical tests; response of planktons to toxicants; $EC_{50}$;

**Examination Scheme:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Text & References:**

***Text*:**

- Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter
- Introduction to Environmental Biotechnology, Milton Wainwright

***References*:**

- Waste Water Engineering, Metcalf and Eddy. Publisher: Tata McGraw hill
- Agricultural Biotechnology, S.S. Purohit
- Environmental Microbiology: Methods and Protocols, Alicia L. Ragout De Spencer, Jonh F.T. Spencer
  Principles of Environmental Engineering, Gilbert Masters

# MEDICAL BIOTECHNOLOGY

## Course Code: MSB231 Credit Unit: 03

**Theory**

**Course Objective:**

To develop an understanding of role of biochemistry and molecular biology in the diagnosis and clinical management of disease.

**Course Contents:**

**Module I**

Clinical significance of biochemical tests and their role in the diagnosis and monitoring of disease, Clinical characteristic of disease. Role of pharmacological testing in clinical management of disease. Role of clinical biochemistry in detection, diagnosis and therapy of genetically inherited diseases and cancer.

**Module II**

Genetic disease, type of inheritance, single-gene and multifactorial inheritance, example of genetic diseases.Therapeutic intervention in blood disorder by stem cell transplantation/gene therapy**.**

**Module III**

Clinically important taxonomic grouping of bacteria, Staphylococci, Streptococci etc. Isolation and identification strategies of bacteria. Etiology-identification of disease agents and their source, transmission, portals of entry, nosocomial infections. Anti- microbial chemotherapy. Modes of action of major groups of antibiotics.

**Module IV**

Current topics in animal and cellular and molecular biology- cellular and molecular mechanism of human diseases,(cancer /diabetts) transgenesis-animal models of human diseases, animals for pharmaceutical protein production.

Manipulation of reproduction and development for application in medicine, agriculture, aquaculture and conservation.

**Module V** Epidemiology-epidemics, pandemics and endemics disease. Control measure of microbial diseases-public health control methods.Hygiene regulations, population screening for disease. Management of Clinical Data.

**Examination Scheme:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

Text & References:

***Text:***

- Marshall, W J, Clinical Chemistry, 3rd edition, Mosby, 1997.
- Harper's Biochemistry K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw Hill/ Appleton and Lange

***References*:**

- Sudbery, P. Human molecular genetics. Addison Wesley Longman (1998)
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox. , Worth Publishing
- Principles of Physical Biochemistry, K.E. Van Holde, W.C. Johnson, Prentice Hall
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Biochemistry (Fifth Edition), Lubert Stryer
- Physical Biochemistry, David Freifeider
- Annual Review of Biochemistry (1995-2004)
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience
- Industrial Enzymes & their applications, H. Uhlig., John Wiley and Sons Inc.

**PHARMACEUTICAL TECHNOLOGY & BIOTECHNOLOGY**

**Course Code: MSB232** **Credit Unit: 03**

**Theory**

**Course Objective:**

The main objectives are to cover representative pharmaceutical dosage forms and general issues of formulation, production, quality requirements, validation and uses and to gain an understanding of the challenges associated with quality pharmaceutical manufacturing

**Pharmaceutical Technology:**

**Module –I:**

**Introduction to Physical Pharmaceutics** – Metrology, Calculations and Posology.

**Pharmacopoeias & Formularies:** IP,BP,USP

**Packaging of Pharmaceuticals:** Polymer Science and Applications, Formulations and Development, Packaging

**Particulate Technology**: Particle Size, Size reduction, Size Separation, Powder Flow and Compaction

**Unit Operations**: Mixing, Evaporation, Filtration, Centrifugation, Extraction, Distillation, Sterilization, and Drying

**Module-II**

**Pharmaceutical Dosage Forms & New Drug Delivery Systems:**

Introduction to different dosage forms, their classification with examples (Official formulation), their relative application. Various route of drug administration.

Drug delivery systems: transdermal, parenteral, oral, mucosal, ocular, buccal, rectal and pulmonary delivery. Novel formulation approaches for better delivery of biotechnology derived drugs, such as reverse micelles, liposomes, microemulsions and microencapsulation.

**Pharmaceutical Biotechnology:**

**Module III**

**Immunity & Immunological preparations.**

Introduction about Immunity, Types of Immunity, Immunological preparations, Classification of Immunological preparations, Bacterial & Viral Vaccinces, Method of preparation using animals, Alternative method using eggs, Diagnostic preparations containing bacterial toxins, Preparation containing antibodies used to produce passive immunity.

Blood & blood Products:

**Module-IV**

**Blood Products and Plasma Substitutes:** Collection, processing and storage of whole human blood, concentrated human RBCs, dried human plasma, human fibrinogen, human thrombin, human normal immunoglobulin, human fibrin, fibrin foam, plasma substitutes: ideal requirements, PVP, dextran.

**Module-V**

**Pharmaceutical Biotechnology based drug Products:**

Introduction, Method of Preparation and Use of :Activase, Humulin,Streptokinase Humatrope, Hepatitis B vaccine.

Introduction, Method of Preparation and Use of : Penicillins, streptomycins, tetracyclines, vitamin B12 & ethanol.

**Examination Scheme:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Suggested Books:**


1. Pharmaceutical Biotechnology, by Daan J. A. Crommelin, Robert D. Sindelar. Informa Healthcare USA, Inc, 3rd edition.
2. Textbook of Pharmaceutical Biotechnology, By Chandrakant Kokate, Pramod H.J, SS Jalalpure , Publisher: Elsevier India Pvt Ltd.
3. Vyas SP, Dixit VK."Pharmaceutical Biotechnology", 1st edition ,2007, CBS Publishers & Distributors, New Delhi

# COMMUNICATION SKILLS - II

## Course Code: BCS211 Credit Unit: 01

**Course Objective:**
To enrich the understanding of English language and communication, structure, style, usage, and vocabulary for global business purposes.

**Course Contents:**

**Module I: Fundamentals of Communication**
Role and purpose of communication: *7 C's of communication*
Barriers to effective communication
Enhancing listening
Forms of Communication: one-to-one, informal and formal

**Module II: Verbal Communication (Written)**
Business Letter
Social correspondence
Writing resume and Job applications

**Module III: Speaking skills**
Conversational English
Guidelines to give an effective presentation
Activities to include:
Presentations by students
Just a minute

**Examination Scheme:**

| Components | CT1 | CT2 | CAF | V | GD | GP | A |
|---|---|---|---|---|---|---|---|
| Weightage (%) | 20 | 20 | 25 | 10 | 10 | 10 | 5 |

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

**Text & References:**


- Business Communication, Raman – Prakash, Oxford
- Textbook of Business Communication, Ramaswami S, Macmillan
- Speaking Personally, Porter-Ladousse, Cambridge

## Behavioural Science – II
## (Behavioral Communication and Relationship Management)

**Course Code: BSS211** **Credit Unit: 01**

**Course Objective**:
This course aims at imparting an understanding of:

Process of Behavioural communication

Aspects of interpersonal communication and relationship

Management of individual differences as important dimension of IPR

**Course Contents:**

**Module I: Behavioural Communication**

Scope of Behavioural Communication

Process – Personal, Impersonal and Interpersonal Communication

Guidelines for developing Human Communication skills

Relevance of Behavioural Communication in relationship management

**Module II: Managing Individual Differences in Relationships**

Principles

Types of issues

Approaches

Understanding and importance of self disclosure

Guidelines for effective communication during conflicts

**Module III: Communication Climate: Foundation of Interpersonal Relationships**

Elements of satisfying relationships

Conforming and Disconfirming Communication

Culturally Relevant Communication

Guideline for Creating and Sustaining Healthy Climate

**Module IV: Interpersonal Communication**

Imperatives for Interpersonal Communication

Models – Linear, Interaction and Transaction

Patterns – Complementary, Symmetrical and Parallel

Types – Self and Other Oriented

Steps to improve Interpersonal Communication

**Module V: Interpersonal Relationship Development**

Relationship circle – Peer/ Colleague, Superior and Subordinate

Initiating and establishing IPR

Escalating, maintaining and terminating IPR

Direct and indirect strategies of terminating relationship

Model of ending relationship

**Module VI: End-of-Semester Appraisal**
Viva based on personal journal
Assessment of Behavioural change as a result of training
Exit Level Rating by Self and Observer

**Examination Scheme:**

| Components | SAP | A | Mid Term Test (CT) | VIVA | Journal for Success (JOS) |
|---|---|---|---|---|---|
| Weightage (%) | 20 | 05 | 20 | 30 | 25 |

**Text & References:**


- Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
- Julia T. Wood. Interpersonal Communication everyday encounter
- Simons, Christine, Naylor, Belinda: Effective Communication for Managers, 1997 1st Edition Cassell
- Harvard Business School, Effective Communication: United States of America
- Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.

# FRENCH - II

**Course Code:** FLT 211 **Credit Unit: 02**

**Course Objective:**

- To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French.
- To make them learn the basic rules of French Grammar.

**Course Contents:**

**Module A: pp.38 – 47 : Unité 3 : Objectif 3, 4, 5. 6**

**Module B: pp. 47 to 75 Unité 4, 5**

**Contenu lexical:**

**Unité 3: Organiser son temps**

1. donner/demander des informations sur un emploi du temps, un horaire SNCF – Imaginer un dialogue
2. rédiger un message/ une lettre pour …
   i) prendre un rendez-vous/ accepter et confirmer/ annuler
   ii) inviter/accepter/refuser
3. Faire un programme d'activités
   imaginer une conversation téléphonique/un dialogue
   Propositions- interroger, répondre

**Unité 4: Découvrir son environnement**

1. situer un lieu
2. s'orienter, s'informer sur un itinéraire.
3. Chercher, décrire un logement
4. connaître les rythmes de la vie

**Unité 5: s'informer**

1. demander/donner des informations sur un emploi du temps passé.
2. donner une explication, exprimer le doute ou la certitude.
3. découvrir les relations entre les mots
4. savoir s'informer

**Contenu grammatical:**

1. Adjectifs démonstratifs
2. Adjectifs possessifs/exprimer la possession à l'aide de :
   i. « de » ii. A+nom/pronom disjoint
3. Conjugaison pronominale – négative, interrogative - construction à l'infinitif
4. Impératif/exprimer l'obligation/l'interdiction à l'aide de « il faut…. »/ «il ne faut pas… »
5. passé composé
6. Questions directes/indirectes

**Examination Scheme:**

| Components | CT1 | CT2 | C | I | V | A |
|---|---|---|---|---|---|---|
| Weightage (%) | 20 | 20 | 20 | 20 | 15 | 5 |

C – Project + Presentation
I – Interaction/Conversation Practice

**Text & References:**

- le livre à suivre: Campus: Tome 1

## GERMAN – II

**Course Code: FLG 211** **Credit Unit: 02**

**Course Objective:**
To enable the students to converse, read and write in the language with the help of the basic rules of grammar, which will later help them to strengthen their language.
To give the students an insight into the culture, geography, political situation and economic opportunities available in Germany
Introduction to Grammar to consolidate the language base learnt in Semester I

**Course Contents:**

**Module I: Everything about Time and Time periods**
Time and times of the day.
Weekdays, months, seasons.
Adverbs of time and time related prepositions

**Module II: Irregular verbs**
Introduction to irregular verbs like to be, and others, to learn the conjugations of the same, (fahren, essen, lessen, schlafen, sprechen und ähnliche).

**Module III: Separable verbs**
To comprehend the change in meaning that the verbs undergo when used as such
Treatment of such verbs with separable prefixes

**Module IV: Reading and comprehension**
Reading and deciphering railway schedules/school time table
Usage of separable verbs in the above context

**Module V: Accusative case**
Accusative case with the relevant articles
Introduction to 2 different kinds of sentences – Nominative and Accusative

**Module VI: Accusative personal pronouns**
Nominative and accusative in comparison
Emphasizing on the universal applicability of the pronouns to both persons and objects

**Module VII: Accusative prepositions**
Accusative propositions with their use
Both theoretical and figurative use

**Module VIII: Dialogues**
Dialogue reading: 'In the market place'
'At the Hotel'

**Examination Scheme:**

| Components | CT1 | CT2 | C | I | V | A |
|---|---|---|---|---|---|---|
| Weightage (%) | 20 | 20 | 20 | 20 | 15 | 5 |

C – Project + Presentation
I – Interaction/Conversation Practice

**Text & References:**

- Wolfgang Hieber, Lernziel Deutsch
- Hans-Heinrich Wangler, Sprachkurs Deutsch
- Schulz Griesbach, Deutsche Sprachlehre für Ausländer
- P.L Aneja, Deutsch Interessant- 1, 2 & 3
- Rosa-Maria Dallapiazza et al, Tangram Aktuell A1/1,2
- Braun, Nieder, Schmöe, Deutsch als Fremdsprache 1A, Grundkurs

# SPANISH – II

## Course Code: FLS 211 Credit Unit: 02

**Course Objective:**
To enable students acquire more vocabulary, grammar, Verbal Phrases to understand simple texts and start describing any person or object in Simple Present Tense.

**Course Contents:**

**Module I**
Revision of earlier modules.

**Module II**
Some more AR/ER/IR verbs. Introduction to root changing and irregular AR/ER/IR ending verbs

**Module III**
More verbal phrases (eg, Dios Mio, Que lastima etc), adverbs *(bueno/malo, muy, mucho, bastante, poco).*
Simple texts based on grammar and vocabulary done in earlier modules.

**Module IV**
Possessive pronouns

**Module V**
Writing/speaking essays like my friend, my house, my school/institution, myself….descriptions of people, objects etc, computer/internet related vocabulary

**Examination Scheme:**

| Components | CT1 | CT2 | C | I | V | A |
|---|---|---|---|---|---|---|
| Weightage (%) | 20 | 20 | 20 | 20 | 15 | 5 |

C – Project + Presentation
I – Interaction/Conversation Practice

**Text & References:**

- Español, En Directo I A
- Español Sin Fronteras

# CHINESE – II

## Course Code: FLC 211 Credit Unit: 02

**Course Objective:**
Chinese is a tonal language where each syllable in isolation has its definite tone (flat, falling, rising and rising/falling), and same syllables with different tones mean different things. When you say, "ma" with a third tone, it mean horse and "ma" with the first tone is Mother. The course aims at familiarizing the student with the basic aspects of speaking ability of Mandarin, the language of Mainland China. The course aims at training students in practical skills and nurturing them to interact with a Chinese person.

**Course Contents:**

**Module I**
Drills
Practice reading aloud
Observe Picture and answer the question.
Tone practice.
Practice using the language both by speaking and by taking notes.
Introduction of basic sentence patterns.
Measure words.
Glad to meet you.

**Module II**
Where do you live?
Learning different colors.
Tones of "bu"
Buying things and how muchit costs?
Dialogue on change of Money.
More sentence patterns on Days and Weekdays.
How to tell time. Saying the units of time in Chinese. Learning to say useful phrases like – 8:00, 11:25, 10:30 P.M. everyday, afternoon, evening, night, morning 3:58, one hour, to begin, to end ….. etc.
Morning, Afternoon, Evening, Night.

**Module III**
Use of words of location like-li, wais hang, xia
Furniture – table, chair, bed, bookshelf,.. etc.
Description of room, house or hostel room.. eg what is placed where and how many things are there in it?
Review Lessons – Preview Lessons.
Expression 'yao", "xiang" and "yaoshi" (if).
Days of week, months in a year etc.
I am learning Chinese. Is Chinese difficult?

**Module IV**
Counting from 1-1000
Use of "chang-chang".
Making an Inquiry – What time is it now? Where is the Post Office?
Days of the week. Months in a year.
Use of Preposition – "zai", "gen".
Use of interrogative pronoun – "duoshao" and "ji".
"Whose"??? Sweater etc is it?
Different Games and going out for exercise in the morning.

**Module V**
The verb "qu"
Going to the library issuing a book from the library
Going to the cinema hall, buying tickets
Going to the post office, buying stamps
Going to the market to buy things.. etc
Going to the buy clothes …. Etc.
Hobby. I also like swimming.
Comprehension and answer questions based on it.

**Examination Scheme:**

| Components | CT1 | CT2 | C | I | V | A |
|---|---|---|---|---|---|---|
| Weightage (%) | 20 | 20 | 20 | 20 | 15 | 5 |

C – Project + Presentation
I – Interaction/Conversation Practice

**Text & References:**

- "Elementary Chinese Reader Part I" Lesson 11-20

# BIOPROCESS AND INDUSTRIAL BIOTECHNOLOGY

## Course Code: MSB 301 Credit Unit:03

**Course Objective:**

The objective of the course is to apply the principles of biochemical engineering in large scale cultivation of microorganism for production of important products.

***Course Contents:***

***Module I***

Advantage of bioprocess over chemical process. Basic principle in bioprocess technology. Media formulation sterilization, thermal death kinetics, batch and continuous sterilization system. Sterilization of Industrial Media, Air and Fermenter

**Module II**

Transport phenomena in bioprocess – Mass transfer, mass transfer co-efficient for gases and liquids. Rate of oxygen transfer. Determination of oxygen transfer coefficient. Rheological properties of medium. Biological heat transfer, Heat transfer coefficients.

Bioprocess control and monitoring variables such as temperature, agitation, pressure etc.

***Module III***

**Kinetics of microbial growth**, substrate utilization and product formation Batch, Fed-batch, types of reactors – CSTR, tower, airlift, bubble column, packed bed, immobilized cells, Control and monitoring, online and off-line control, Computers in bioprocess control systems.

**Module IV**

**Downstream Processing**

Aqueous - two-phase extraction; Adsorption-desorption processes; Membrane based separation: Dialysis, Electro dialysis, Micro filtration, Ultra filtration.

Chromatographic methods of separation based on size, charge, reverse phase, hydrophobic interactions, and biological affinity, HPLC, FPLC, MS-LC, Gas chromatography.

Electrophoresis, principle, types on the basis of support media, 1D, 2D gel electrophoresis, continuous and capillary electrophoresis.

Crystallization, Drying, Case studies.

Biomass: Bakers and distillers yeast production using various raw materials, "bio" factors for growth, Crabtree effect, harvesting, mushroom production from agro based raw materials and uses.

**Module V**

**Industrial production of enzymes:** cellulase, amylase, protease; organic acids: citric acid, acetic acid, lactic acid; ethanol, biomass, antibiotics: classification, penicillins, tetracyclins, chloramphenicol; vitamins: $B_{12}$, riboflavin, fermented dairy products.

**Ethanol:** Production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. po wer alcohol – definition, uses, merits and demerits of various technologies for its production.

**Antibiotics:** Various penicillin as precursor and 'R' – side chain, penicillianase, 6-APA, pencillin production, harvest and recovery, **Streptomycin:** Chemical structure, production, harvest and recovery, uses by-product of streptomycin fermentation.

**Examination Scheme:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Text & References:**

***Text*:**

- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Text Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International
- Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers

***References*:**

- Biochemical Engineering, Bailley and Ollis.
- Principples of Biochemical Engineerin, Humphrey.

# Molecular Genetics and Developmental Biology

## Course Code: MSB 302 Credit Unit:03

**THEORY**

**Course Objective:**

It aims to promote an understanding and knowledge of genetics at molecular level as well as fundamentals and basic mechanisms of development biology

**Course Contents:**

**Module I: Mendelian Genetics**

Mendelian laws of inheritance, Monohybrid cross and the law of segregation, Dihybrid cross and law of independent assortment, Chromosome theory of inheritance, Multiple allele, lethal allele, Blood group, Rh factor

**Module II: Fine Structure of Genes and Chromosomes**

The concept of promoter, Coding sequence, Terminator, Induction of gene for expression. Structural organisation of chromatids, Centromeres, Telomeres, Chromatin, Nucleosome organisation; Euchromatin and heterochromatin; Special chromosomes (e.g., polytene and lampbrush chormosomes), Structural and numerical aberrations involving chromosomes; Hereditary defects - Kleinefelter, Turner, Cri-du-Chat and Down syndromes. Mutations - spontaneous and induced, Chemical and physical mutagens.

**Module III: Extrachromosomal inheritance and Molecular Genetics**

Coiling of shell in snails, Mitochondrial and chloroplast genetic systems, population genetics: Hardy-Weinberg equilibrium, Gene and genotypic frequencies.

**Module IV**

Introduction to the basic concepts of embryology and developmental biology. Gametogenesis: Spermatogenesis, its cellular and hormonal regulation. Oogenesis-Folliculogenesis and oocyte maturatiom. Fertilization-The cellular and molecular events-cell surface molecules in sperm-egg recognition in animals and union of gametes.

**Module V**

Cleavage patterns in animals. Early embryonic development and role of maternal contributions. Blastula formation and embryonic fields. Gastrulation and formation of germ layers. Morphogenesis, morphogenetic cells and molecules.

**Examination Scheme**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Text books:**

1. Pierce, B. A. (2010). Genetics: A conceptual approach. Macmillan.
2. Berk, A., & Zipursky, S. L. (2000). Molecular cell biology (Vol. 4). New York: WH Freeman.

**Reference Books:**

1. Alberts, B., Bray, D., Hopkin, K., Johnson, A., Lewis, J., Raff, M., ... & Walter, P. (2013). Essential cell biology. Garland Science.
2. Brown, T. A. (1992). Genetics: a molecular approach (No. Ed. 2). Chapman & Hall.

# ENZYME TECHNOLOGY AND IMMUNOTECHNOLOGY

## Course Code: MSB 303 Credit Unit:03

**Course Objective:**

The course objective covers an understanding of the principles and application of protein, secondary metabolites and enzyme biochemistry applicable to industrial bioprocesses. Process design, operation strategies of various
enzyme reactors.

Role of antibody engineering in biomedical applications and the importance of immuno genetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

**Course Contents:**

**Module I: Enzymology**

Nomenclature of enzymes, Catalytic mechanisms, Regulation strategies, Inhibition of enzymes Single and multiple substrate systems, Allosteric enzymes, Enzyme kinetics.

**Module II Enzyme technology and applications**

Immobilization of enzymes, Process design and operation strategies for immobilized enzyme reactors of enzyme and Immobilization of multiple enzyme system, Abzymes, ADAPT and ADEPT, Application of enzyme - Industrial, Analytical and therapeutics, Textile processing

**Module III:**

Innate and acquired immunity, clonal nature of Immune Response.

Nature and Biology of antigens and super antigens Antibody structure and function; Types of immunity- innate, acquired, active and passive. Major Histocompatibilty Complex, BCR and TCR, Complement system

**Module IV:**

Cells of the immune system, Hematopoiesis and differentiation, lymphocyte trafficking, B-Lymphocytes, T - Lymphocytes, macrophages, dendritic cells, natural killer, lymphokines and lymphokine activated killer cells, eosinophils, neutrophils and mast cells. Regulation of immune response , Antigen processing and presentation, activation of B and T lymphocytes, cytokines and their role in immune regulation, T cell regulation and MHC restriction, immunological tolerance,

**Module V:** Cell mediated toxicity, Hypersensitivity**,** Autoimmunity, Tumor immunology, Transplantation Immunology, Synthetic vaccines, Immunological Techniques: Immuno diffusion, immuno-electrophoresis, ELISA, RIA, fluorescence activated cell sorter, Hybridoma technology and its applications

**Examination Scheme:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Text & References:**

***Text:***


- Enzyme Technology, M.F. Chaplin and C. Bucke, Cambridge University Press.
- Enzyme Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palmer.
- Steiner, K., & Schwab, H. (2012). Recent advances in rational approaches for enzyme engineering. Computational and Structural Biotechnology Journal, 2, e201209010. http://doi.org/10.5936/csbj.201209010
- Allan Svendsen Enzyme Functionality: Design: Engineering, and Screening 2003 CRC Press Ist edition.
- Turanli-Yildiz, B., Alkim, C., & Cakar, Z. P. (2012). *Protein Engineering Methods and Applications*. INTECH Open Access Publisher.
- Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
- Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc.


***References:***


- Enzyme: A Practical Introduction to structure, Mechanism and data analysis, R.A. Copeland, John Wiley & Sons Inc.
- James C. Samuelson Enzyme Engineering: Methods and Protocols (Methods in Molecular Biology) 2013 Humana Press
- Immunology, Roitt, Mosby – Yearbook Inc.
- Kuby Immunology, R.A. Goldsby, T.J. Kindt, and B.A. Osborne, Free

# RECOMBINANT DNA TECHNOLOGY

## Course Code: MSB 304 Credit Unit:03

**Course Objective:**
A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR for the cloning and expression of genes implication can be obtained through the course. The successful application of biotechnology largely depends on these advanced molecular techniques.

**Course Contents:**

**Module I**
Basic tools, specialized enzymes and specialized cloning vectors (e.g. Antarctic Phosphatase), Specialized cloning vectors (e.g. TOPO, TA, Gateway)

**Module II: Gene isolation**
Expression libraries and their screening, Techniques for analysis of genomic libraries (e.g. 3' RACE, 5' RACE, chromosome walking, chromosome jumping), T-DNA and transposon mediated gene traps

**Module III: Heterologous gene expression (bacteria and yeast)**
Advances in engineering of genes (codon optimization, translational enhancers, mRNA stabilizing factors), vectors (targeting signals, selection markers, purification and solubility tags) and hosts for overexpression and analysis

**Module IV: Studying gene regulation and control**
In-vitro transcription translation, run-on assays, protein-protein and protein-DNA interactions, promoter characterization, differential display. Manipulation of gene expression: Genome wide mutagenesis, gene silencing, RNAi, aptamers, constitutive and tissue specific promoters, expression enhancing elements, terminator technology

**Module V:**
**Automation and robotic advances in RDT**
DNA & protein isolation (alternatives to conventional methods) and sequencing (example from Human Genome Project and other sequencing projects), PCR machines, imaging and gel documentation
**Laboratory, industrial and environmental applications of RDT**
High throughput research, disease diagnosis and cure, forensics, DNA vaccines, drug discovery, maintaining genetic diversity, transgenic technology, marker-free GMOs

**Examination Scheme:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Text & References:**

***Text:***
- Recombinant DNA by J.D. Watson et al., W.H. Freeman and Company
- Recombinant DNA Technology by T. A. Brown
- Principles of Gene Manipulation: An Introduction to Genetic Engineering by R.W. Old and S. B Primrose, Blackwell Science Inc

***References:***
- Molecular Biotechnology: Principles and Applications of Recombinant DNA by B.R. Grick and J.J. Pasternak, ASM Press
- Molecular and Cellular Cells Methods in Biology and Medicine by P.B. Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- "Milestones in Biotechnology: Classic Papers on Genetic Engineering" by J.A. Bavies and W.S.
- Reznikoff, Butterworth Heinemann.
- "Gene Expression Technology" by D.V. Goeddel in Methods in Methods in Enzymology, Academic
- Press Inc.
- "DNA Cloning: A Practical Approach" by D.M. Glover and B.D. Hames, IRL Press.

# GENOMICS AND PROTEOMICS

## Course Code: MSB 305 Credit Unit:02

**Course Objective:**
The course helps in developing a detailed understanding of eukaryotic complexity and organization. Current research on the molecular basis of the control of gene expression in eukaryotic has developed a detailed
understanding of techniques of gene diagnostics and DNA profile to acquire the fundamental of genomics and
bioinformatics, it is desirable to have in depth study on these lines.

**Course Contents:**

**GENOMICS**

**Module I: Introduction to Genomics**
Contents of genomes, Molecular markers, Bioinformatics for the analysis of sequence data.

**Module II: Transcriptomes**
Genome expression; RNA Contents,

**Module III**
Strategies for large-scale sequencing projects. The structure, function and evolution of the human genome. The
human genome project. Human disease genes.

**PROTEOMICS**

**Module IV: Introduction to proteomics**
Protein structure**:** secondary structural elements, super-secondary structure, domains, mechanisms of protein folding, tertiary folds. Formation of oligomers. Protein solubility and interaction with solvents and solute. The activity of protein. Protein engineering principles.

**Module V**
Fundamental methods used in proteomics, Relationship between protein structure and function. Post
translational protein modification. Protein - protein interaction.

**Examination Scheme:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Text & References:**

***Text:***
- Genomes II, T.A. Brown
- Recombinant DNA (Second edition) , James D. Watson and Mark Zoller.

***References:***
- A primer of genome Science, Greg Gibson and Spencer V. Muse.
- Gene cloning and DNA analysis – An introduction (fourth edition), T.A. Brown.

## BIOPROCESS AND INDUSTRIAL BIOTECHNOLOGY LAB

**Course Code: MSB 321** **Credit Units: 01**

**Course Contents:**

**Module I**
Isolation of industrially important micro organisms for microbial processes.
Determination of Thermal Death Point and Thermal death time of micro organisms for design of a sterilizer
Determination of growth curve of a supplied micro organism and also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

**Module II**
Comparative studied of ethanol production using different substrates.
Microbial production of antibiotics (Penicillin)
Production and estimation of alkaline protease
Sauer Krant fermentation

**Module III**
Conventional filtration
Protein precipitation and recovery
Aqueous two-phase separation
Ion exchange chromatography
Gel filtration
Membrane based filtration i.e. Micro filtration and cross filtration in cross flow Modules.

**Examination Scheme:**

| IA | | | | EE | | |
|---|---|---|---|---|---|---|
| **Practical (Mid Term)** | **Viva** | **Regular Performance** | **Attendance** | **Practical (End Term)** | **Practical Record** | **Viva** |
| 20 | 15 | 10 | 05 | 25 | 10 | 15 |

# ENZYME TECHNOLOGY AND IMMUNOTECHNOLOGY LAB

**Course Code: MSB 323** **Credit Units: 01**

**Course Contents:**

1. Effect of pH and temperature on enzyme activity
2. Determination of Km and Vm from LB plot.
3. Solid/ liquid state fermentation
4. Immobilization of enzyme
5. Blood film preparation and identification of cells.
6. Identification of blood group.
7. Isolation of serum.
8. Radial Immuno Diffusion Test
9. Ouchterlony Double diffusion Test
10. DOT ELISA, SANDWICH ELISA
11. Purification of lgG through affinity chromatography

**Examination Scheme:**

| IA | | | | EE | | |
|---|---|---|---|---|---|---|
| **Practical (Mid Term)** | **Viva** | **Regular Performance** | **Attendance** | **Practical (End Term)** | **Practical Record** | **Viva** |
| 20 | 15 | 10 | 05 | 25 | 10 | 15 |

**Note:** Minor variation could be there depending on the examiner.

# RECOMBINANT DNA TECHNOLOGY LAB

**Course Code: MSB 324** **Credit Units: 01**

**Course Contents:**

1. Preparation and Transformation of competent cells by $CaCl_2$ method.
2. Restriction digestion
3. Ligation
4. Southern hybridization
5. Western blotting
6. RFLP
7. PCR

**Examination Scheme:**

| IA | | | | EE | | |
|---|---|---|---|---|---|---|
| **Practical (Mid Term)** | **Viva** | **Regular Performance** | **Attendance** | **Practical (End Term)** | **Practical Record** | **Viva** |
| 20 | 15 | 10 | 05 | 25 | 10 | 15 |

**Note:** Minor variation could be there depending on the examiner.

## GENOMICS AND PROTEOMICS LAB

**Course Code: MSB 325** **Credit Units: 01**

**Course Contents:**

1. Gene finding tools and Genome annotation
2. Comparison of two given genomes
3. Micro array and Micro array data analysis
4. Inference of protein function from structure
5. Two-hybrid methods

**Examination Scheme:**

| IA | | | | EE | | |
|---|---|---|---|---|---|---|
| **Practical (Mid Term)** | **Viva** | **Regular Performance** | **Attendance** | **Practical (End Term)** | **Practical Record** | **Viva** |
| 20 | 15 | 10 | 05 | 25 | 10 | 15 |

**Note:** Minor variation could be there depending on the examiner.

# ADVANCED FOOD TECHNOLOGY

**Course Code: MSB 330** **Credit Unit:03**

**Course Objective:**

The purpose of the food biotechnology major is to produce professional with a wide range of pertinent knowledge and skills in food chemistry, food microbiology and safety, quantitative skills, engineering and processing, marketing and consumer research.

**Course Contents:**

**Module I**

Processing and preservation technologies used in food industry: heating, drying, and baking, irradiation (infrared, microwave and radio frequency), concentration, freezing, chemical preservation, chilling, fermentation, a combination of those technologies.

**Module II**

Pre and post-harvest technologies for extension of storage life and better handling and transportation of fresh fruits and vegetables, to sustain freshness and reduce spoilage.

**Module III**

Development of environment - friendly packaging materials based on product characteristic and performance properties packaging materials, and finished package forms, process schedules for thermal processing of foods in cans, glass, tin-free steel and aluminum containers, and retortable pouches based on heat penetration studies and sterilization value.

**Module IV**

Starter culture, prebiotics, probiotics - their use as flavor enhancer and diseases/ infection combats, application in production of cheese, butter, ice-cream, yoghurt, application in biomedical research, e.g. recombinant LABs as vaccine; modified milk proteins.

**Module V**

Production of SCP (Single cell protein), baker's yeast, brewing industry, application of transgenic plants in food production, transgenic fish, transgenic poultry.

**Examination Scheme:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Text & References:**

***Text:***

- Food technology by Fraziar.
- Food Microbiology, 2nd edition by Adams and Moss.

***References:***

- Introduction to food Biotechnology. Green, Perry Johnson 2002. CRC Press, Boca Raton Florida.
- Food Biotechnology- Techniques and application. Gauri S. Mittal 1992. Technomic Publishing Co., Inc., Lancaster.

# TISSUE ENGINEERING

## Course Code: MSB 331 Credit Unit:03

**Course Objective:**
This course will cover topics related to the design and functional assessment of bioengineered tissue substitutes. Strategies for engineering tissues with a load-bearing function will be of particular focus. Strategies to study cell-surface and cell-cell interactions to physical stimuli, bioreactors, biological scaffolds and 3D cell-tissue constructs will be explored through recent papers.

**Course Contents:**

**Module I: Fundamentals of tissue engineering**
Basic definition, History, Concepts and overview, Principles and components, current scope of development; use in therapeutics and in vitro testing

**Module II: Engineering materials**
Scaffolds: Functions, Types (ECM-like Scaffolds, Tissue-Derived Scaffolds, Fibrin Gel, Natural Sponge; Injectable Scaffolds, Elastic Scaffolds, Inorganic Scaffolds Composite Scaffolds). Biomaterials: properties, cellular adhesion, surface modifications. Polymers (Natural such as Protein and Polysaccharides; Synthetic such as Poly(α-hydroxyacids, Hydrogels and Polyurethanes), Composite.

**Module III: Cell Sources:**
Fundamental properties of cells, autologous, allogeneic, syngeneic, and xenogeneic cells, and genetically engineered cells, Stem and progenitor cells. Cell Extraction, Biomolecules /synthetic ECM: Growth Factors (Representative Growth factors), Delivery of Growth factors

**Module IV: Tissue Culture & Engineering Design Aspects**
Biomechanics aspects of tissue engineering: application of physical forces, Principles of Scaffold Design – Material considerations, 2 D cell expansion, 3D Tissue Architecture and Function Transport considerations, Bioreactors, Cell seeding and metabolism considerations, Design of Polymeric Scaffolds,
Interface Biology – Biocompatibility/Immunogenicity.

**Module V: Case Studies**
Musculoskeletal Tissue Engineering, Cardiovascular Tissue Engineering, Neural Tissue Engineering, Visceral Tissue Engineering. Other Key Issues and Emerging Areas of Interest: Nanobiotechnology, Ethical Issues, FDA and Regulatory Issues, Tissue Engineering Market

**Examination Scheme:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Text & References:**

***Text*:**
- Frontiers in Tissue Engineering (ISBN 0080426891), Patrick, Mikos, McIntire, Pergamon
- Principles of Tissue Engineering (ISBN 0124366309), Lanza, Langer, Vacanti, Academic Press

***References*:**
- Tissue Engineering: Engineering Principles for the Design of Replacement Organs and Tissues By W. Mark Saltzman; Published Oxford University Press US, 2004, pp 523
- Tissue engineering Fundamentals and Applications By Yoshito Ikada, Published Elsevier, 2006, pp 469
- Tissue Engineering Methods & Protocols (ISBN 0896035166, Morgan and Yarmush, Humana Press.

# DRUG DISCOVERY & DEVELOPMENT

## Course Code: MSB 332 Credit Unit:03

**Course Objective:**
The above course will be aimed to identify and design drugs that could be potentially useful in the identification of the candidate drugs, which have efficacy in cell culture or animal models, and thus the most effective compounds could be employed based on the above results for being moved through preclinical studies to clinical trials.

**Module: I**
**Drug discovery & development:**
General Introduction of drug design and development, Strategies for Target Identification and validation, Lead Identification and Optimization, Pre-Clinical Research and Clinical Research & Pharmacovigilance.
**Module: II**
**Drug development considerations:**
Introduction to Pharmacology, Sources of drugs, Dosage forms and routes of administration, mechanism of action, Combined effect of drugs, Factors modifying drug action, tolerance and dependence, Pharmacogenetics.
**Module: III**
**Pharmacokinetics:**
Pharmacokinetic, Pharmacodynamic and Toxicological considerations in drug development, Physiochemical properties of drugs in relations to their biological activity, Rout of drugs administrations, Various types of dosage formulations, Stability of drugs.
**Module: IV**
**Drug Receptor Theories:**
Principles of drug action, Mechanisms of drug action, Drug-receptor interactions, Types of drug targets, G-Protein coupled receptor, Ion Channels, Ligand Gated Ion Channels, Enzymatic drug receptor and Transducer mechanisms, Dose response relationship, Factors modifying drug action.
**Module: V**
**Rational Drug Design:**
Introduction, Types of drugs design: Legand based, Structure based, Rational drug discovery, Computer Aided drug design, De novo drug design methodologies.
Structure activity relationships in drug design, Statistical techniques behind QSAR, Molecular descriptors 3D QSAR and COMFA, Molecular modeling, Molecular docking and dynamics.

**Examination Scheme:**

| Components | Mid Term | Attendance | Assignment/ Project/Seminar/Quiz | Class Test | Viva | EE |
|---|---|---|---|---|---|---|
| Weightage (%) | 15 | 5 | 10 | 10 | 10 | 50 |

**Suggested Books:**


- New Drug Development: Design, Methodology, and Analysis, by J. Rick Turner, Published by John Wiley & Sons, 2007.
- Essentials of Medical Pharmacology by K D Tripathi, Published by JAYPEE Brothers Medical Publishers (P) Ltd. 7th Edition 2010.
- Biopharmaceutics & Pharmacokinetics by DM Brahmankar & SB Jaiswal, Published by Vallabh Prakashan; 3rd Edition 2012.
- Drug Discovery and Clinical Research, by S.K Gupta, Published by JAYPEE Brothers Medical Publishers (P) Ltd

# COMMUNICATION SKILLS - III

## Course Code: BCS311 Credit Units: 01

**Course Objective:**
To initiate the learners with the basic mechanics of writing skills and facilitate them with the core skills required for communication in the professional world.

**Course Contents:**

**Module I: Mechanics and Semantics of Sentences**
Writing effective sentences
Style and Structure

**Module II: Developing writing skills**
Inter - office communication: Business Letter; E mails; Netiquette
Intra – office communication: Memos, Notices, Circulars, Minutes
Report Writing

**Module III: Business Presentations**
Planning, design and layout of presentation
Information Packaging
Audience analysis
Audio visual aids
Speaking with confidence
Case Studies

**Examination Scheme:**

| Components | CT1 | CT2 | CAF | V | GD | GP | A |
|---|---|---|---|---|---|---|---|
| Weightage (%) | 20 | 20 | 25 | 10 | 10 | 10 | 5 |

CAF – Communication Assessment File
GD – Group Discussion
GP – Group Presentation

**Text & References:**


- Krishnaswamy, N, Creative English for Communication, Macmillan
- Raman Prakash, Business Communication, Oxford.

# Behavioral Science III
# (Leading Through Teams)

**Course Code: BSS311** **Credit Units: 01**

**Course Objective:**
This course aims to enable students to:

Understand the concept and building of teams

Manage conflict and stress within team

Facilitate better team management and organizational effectiveness through universal human values.

**Course Contents:**

**Module I: Teams: An Overview**

Team Design Features: team vs. group
Effective Team Mission and Vision
Life Cycle of a Project Team
Rationale of a Team, Goal Analysis and Team Roles

**Module II: Team & Sociometry**

Patterns of Interaction in a Team

Sociometry: Method of studying attractions and repulsions in groups

Construction of sociogram for studying interpersonal relations in a Team

**Module III: Team Building**

Types and Development of Team Building

Stages of team growth

Team performance curve

Profiling your Team: Internal & External Dynamics

Team Strategies for organizational vision

Team communication

**Module IV: Team Leadership & Conflict Management**

Leadership styles in organizations

Self Authorized team leadership

Causes of team conflict

Conflict management strategies

Stress and Coping in teams

**Module V: Global Teams and Universal Values**

Management by values

Pragmatic spirituality in life and organization

Building global teams through universal human values

Learning based on project work on Scriptures like Ramayana, Mahabharata, Gita etc.

**Module VI: End-of-Semester Appraisal**
Viva based on personal journal
Assessment of Behavioural change as a result of training

Exit Level Rating by Self and Observer

**Examination Scheme:**

| Components | SAP | A | Mid Term Test (CT) | VIVA | Journal for Success (JOS) |
|---|---|---|---|---|---|
| Weightage (%) | 20 | 05 | 20 | 30 | 25 |

**Text & References:**


- Organizational Behaviour, Davis, K.
- Hoover, Judhith D. Effective Small Group and Team Communication, 2002,Harcourt College Publishers
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- J William Pfeiffer (ed.) Theories and Models in Applied Self Development and Interpersonal Skills, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

# FRENCH - III

## Course Code: FLT311 Credit Units: 02

**Course Objective:**
To provide the students with the know-how

- To master the current social communication skills in oral and in written.
- To enrich the formulations, the linguistic tools and vary the sentence construction without repetition.

**Course Contents:**

**Module B: pp. 76 – 88 Unité 6**

**Module C: pp. 89 to103 Unité 7**

**Contenu lexical:** **Unité 6: se faire plaisir**

1. acheter : exprimer ses choix, décrire un objet (forme, dimension, poids et matières) payer
2. parler de la nourriture, deux façons d'exprimer la quantité, commander un repas au restaurant
3. parler des différentes occasions de faire la fête

**Unité 7: Cultiver ses relations**

1. maîtriser les actes de la communication sociale courante (Salutations, présentations, invitations, remerciements)
2. annoncer un événement, exprimer un souhait, remercier, s'excuser par écrit.
3. caractériser une personne (aspect physique et caractère)

**Contenu grammatical:**

1. accord des adjectifs qualificatifs
2. articles partitifs
3. Négations avec de, ne…rien/personne/plus
4. Questions avec combien, quel…
5. expressions de la quantité
6. ne…plus/toujours - encore
7. pronoms compléments directs et indirects
8. accord du participe passé (auxiliaire « avoir ») avec l'objet direct
9. Impératif avec un pronom complément direct ou indirect
10. construction avec « que » - Je crois que/ Je pense que/ Je sais que

**Examination Scheme:**

| Components | CT1 | CT2 | C | I | V | A |
|---|---|---|---|---|---|---|
| Weightage (%) | 20 | 20 | 20 | 20 | 15 | 5 |

C – Project + Presentation
I – Interaction/Conversation Practice

**Text & References:**

- le livre à suivre : Campus: Tome 1

# GERMAN - III

## Course Code: FLG311 Credit Units: 02

**Course Objective:**
To enable the students to converse, read and write in the language with the help of the basic rules of grammar, which will later help them to strengthen their language.
To give the students an insight into the culture, geography, political situation and economic opportunities available in Germany

**Course Contents:**

**Module I: Modal verbs**
Modal verbs with conjugations and usage
Imparting the finer nuances of the language

**Module II: Information about Germany (ongoing)**
Information about Germany in the form of presentations or "Referat"– neighbors, states and capitals, important cities and towns and characteristic features of the same, and also a few other topics related to Germany.

**Module III: Dative case**
Dative case, comparison with accusative case
Dative case with the relevant articles
Introduction to 3 different kinds of sentences – nominative, accusative and dative

**Module IV: Dative personal pronouns**
Nominative, accusative and dative pronouns in comparison

**Module V: Dative prepositions**
Dative preposition with their usage both theoretical and figurative use

**Module VI: Dialogues**
In the Restaurant,
At the Tourist Information Office,
A telephone conversation

**Module VII: Directions**
Names of the directions
Asking and telling the directions with the help of a roadmap

**Module VIII: Conjunctions**
To assimilate the knowledge of the conjunctions learnt indirectly so far

**Examination Scheme:**

| Components | CT1 | CT2 | C | I | V | A |
|---|---|---|---|---|---|---|
| Weightage (%) | 20 | 20 | 20 | 20 | 15 | 5 |

C – Project + Presentation
I – Interaction/Conversation Practice

**Text & References:**

- Wolfgang Hieber, Lernziel Deutsch
- Hans-Heinrich Wangler, Sprachkurs Deutsch
- Schulz Griesbach, Deutsche Sprachlehre für Ausländer
- P.L Aneja, Deutsch Interessant- 1, 2 & 3
- Rosa-Maria Dallapiazza et al, Tangram Aktuell A1/1,2
- Braun, Nieder, Schmöe, Deutsch als Fremdsprache 1A, Grundkurs

# SPANISH – III

## Course Code: FLS311 Credit Units: 02

**Course Objective:**
To enable students acquire knowledge of the Set/definite expressions (idiomatic expressions) in Spanish language and to handle some Spanish situations with ease.

**Course Contents:**

**Module I**
Revision of earlier semester modules
Set expressions (idiomatic expressions) with the verb *Tener*, *Poner, Ir….*
Weather

**Module II**
Introduction to *Gustar*…and all its forms. Revision of *Gustar* and usage of it

**Module III**
Translation of Spanish-English; English-Spanish. Practice sentences.
How to ask for directions (using estar)
Introduction to IR + A + INFINITIVE FORM OF A VERB

**Module IV**
Simple conversation with help of texts and vocabulary
En el restaurante
En el instituto
En el aeropuerto

**Module V**
Reflexives

**Examination Scheme:**

| Components | CT1 | CT2 | C | I | V | A |
|---|---|---|---|---|---|---|
| Weightage (%) | 20 | 20 | 20 | 20 | 15 | 5 |

C – Project + Presentation
I – Interaction/Conversation Practice

**Text & References:**

- Español, En Directo I A
- Español Sin Fronteras -Nivel Elemental

# CHINESE – III

## Course Code: FLC311 Credit Units: 02

**Course Objective:**
Foreign words are usually imported by translating the concept into Chinese, the emphasis is on the meaning rather than the sound. But the system runs into a problem because the underlying name of personal name is often obscure so they are almost always transcribed according to their pronciation alone. The course aims at familiarizing the student with the basic aspects of speaking ability of Mandarin, the language of Mainland China. The course aims at training students in practical skills and nurturing them to interact with a Chinese person.

**Course Contents:**

**Module I**
Drills
Dialogue practice
Observe picture and answer the question.
Introduction of written characters.
Practice reading aloud
Practice using the language both by speaking and by taking notes.
Character writing and stroke order

**Module II**
Measure words
Position words e.g. inside, outside, middle, in front, behind, top, bottom, side, left, right, straight.
Directional words – beibian, xibian, nanbian, dongbian, zhongjian.
Our school and its different building locations.
What game do you like?
Difference between “hii” and “neng”, “keyi”.

**Module III**
Changing affirmative sentences to negative ones and vice versa
Human body parts.
Not feeling well words e.g. ; fever, cold, stomach ache, head ache.
Use of the modal particle “le”
Making a telephone call
Use of “jiu” and “cal” (Grammar portion)
Automobiles e.g. Bus, train, boat, car, bike etc.
Traveling, by train, by airplane, by bus, on the bike, by boat etc.

**Module IV**
The ordinal number “di”
“Mei” the demonstrative pronoun e.g. mei tian, mei nian etc.
use of to enter to exit
Structural particle “de” (Compliment of degree).
Going to the Park.
Description about class schedule during a week in school.
Grammar use of “li” and “cong”.
Comprehension reading followed by questions.

**Module V**
Persuasion-Please don’t smoke.
Please speak slowly
Praise – This pictorial is very beautiful
Opposites e.g. Clean-Dirty, Little-More, Old-New, Young-Old, Easy-Difficult, Boy-Girl, Black-White, Big-Small, Slow-Fast … etc.
Talking about studies and classmates
Use of “it doesn’t matter”
Enquiring about a student, description about study method.
Grammar: Negation of a sentence with a verbal predicate.

**Examination Scheme:**

| Components | CT1 | CT2 | C | I | V | A |
|---|---|---|---|---|---|---|
| Weightage (%) | 20 | 20 | 20 | 20 | 15 | 5 |

C – Project + Presentation
I – Interaction/Conversation Practice

**Text & References:**

- "Elementary Chinese Reader Part I, Part-2" Lesson 21-30

# PROJECT

## Course code: MSB 460 Credit Units: 24

**GUIDELINES FOR PROJECT FILE**

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

**In general, the File should be comprehensive and include**

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

**Report Layout**

The report should contain the following components:

- **Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

- **Acknowledgements** (optional)

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

- **Abstract**

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

- **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

- **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

- **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

- **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

- **Conclusion**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

- **Future prospects**

- **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

- **References/ Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

**Examples**

**For research article**

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect*, 8 (suppl 1): 116–117.

**For book**

Kowalski, M. (1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), 7: 63-67

**ASSESSMENT OF THE PROJECT FILE**

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution.
Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project.
Project execution is concerned with assessing how much work has been put in.
The File should fulfill the following ***assessment objectives:***

**Range of Research Methods used to obtain information**

**Execution of Research**

**Data Analysis**
Analyse Quantitative/ Qualitative information
Control Quality
**Draw Conclusions**

**Examination Scheme:** Evaluation will be done by external examiner

| | |
|---|---|
| Project Report | 50 |
| Viva Voce | 50 |
| **Total** | **100** |

# AANANDAM
## (RUSA – Govt. of Rajasthan)

**Course Code: AND001/002/003** **Credit:2 /sem**

**Ref:** 27.11, Academic Council of AUR

## INTRODUCTION

**Aanandam is a credited subject** that aims to instill **the joy of giving** and sharing in young people through community participation, helping them to be responsible citizens and be initiators of change for a healthy society. A daily act of goodness and charity will infuse the habit of community service in students. The faculty will emphasize shift in focus-Happiness is not in acquiring things, but permanent happiness comes from giving, sharing, and caring for someone.

The faculty will inspire students for Individual Social Responsibility (ISR) and will inculcate the qualities of compassion, an open mind, a willingness to do whatever is needed and positive attitude in students. Imagination and Creativity are to be appreciated. An aim and a vision are to be developed in students.

## OUTCOME OF AANANDAM COURSE

The student should develop:

- Awareness and empathy regarding community issues
- Interaction with the community and impact on society
- Interaction with mentor and development of Student teacher relationship
- Interaction among students, enlarge social network
- Cooperative and Communication skills and leadership qualities
- Critical thinking, Confidence and Efficiency

## AANANDAM: COMMUNITY SERVICE

- Community service programs are very effective for students' **personal** and **social**, ethical, and **academic** development. These effects depend on the characteristics of the programs chosen
- Involvement of students in community work has an impact on development of student **skills**, **creativity, critical thinking,** and **innovative powers. Passion and Positivity** are basic requirements for Community service
- They would **examine social challenges** /problems, **assess the needs** of the community, **evaluate** previous implemented projects, and **think of further solutions**
- They would learn to cooperate and collaborate with other agencies and inculcate leadership qualities.

## BENEFITS TO THE STUDENTS

Students should dedicate time as a volunteer as it helps them to:

- apply their knowledge and skills to solve specific community problem
- learn to plan, lead, and organize community events have a sense of belonging to their college campus and community and find something they are interested in doing during their free time
- make new friends, expand social network, and boost social skills and mental health.
- obtain employment

- be useful to society as it will protect them against stress, frustration, and depression

## ABOUT AANANDAM COURSE

Students are expected to engage in:

- An individual act of goodness – caring, sharing and giving (time and energy) everyday group activity – a project in service of the local community (Group Community Service Project)
- **Aanandam Day- will be celebrated once a month in the last week as decided by Director/HoIs.**
- **It is a credited subject. Marks/ Grades both will be entered in the marks sheet as per the university rules**.
- Two credits for a project in each semester
- 50 marks for each project to be completed in 4 Months.

## DIRECTIONS FOR STUDENTS

- Do at least one individual act of goodness each day and Record this act in a dedicated diary/register
- Share this dedicated diary/register in a 30-minute**Anandamperiod** with the mentor and share your experience with the class
- Students in **Semester scheme** must take up one Group Community Service Project per semester
- Students in **Annual scheme** must take up two Group Community Service Projects per year
- Take one Group Community Service Project from **August to November**
- Take one Group Community Service Project from **January to April**
- The students must take photographs to document their work
- The students can obtain certificate from the NGO/ Government Agency they are working with for Group Community Service Project
- The students may submit newspaper cuttings
- The students must participate in the **Aanandam Day** by displaying charts of their Group Community Service Project
- They can make power point presentations of their project which will help them get better grades

## ROLE OF FACULTY MENTOR

- The mentor will **maintain a register** wherein the entry of act of goodness will be tick mark and be submitted every day to the Director/HoIs
- Review every student's dedicated register to see if they have recorded an act of goodness for that day and mark in register. The **act will not be evaluated** - just if it was recorded or not.(**Be suggestive not judgmental)**
- In half an hour class some students and faculty will deliberate on the pleasure of giving and acts of goodness. This should be done by rotation so that all students get a chance to speak and express themselves
- The mentor will divide the class for the Group Community Service Project and record it in a register.**8-12 students can form a group** for project work.
- The students will opt the project of their choice.
- The mentors can mobilize the required resources and support for the projects. They can coordinate and collaborate with Government bodies or NGOs.
- The mentor will guide the students to write the Group Community Service Project Report.

- Mentors will review the project on monthly basis and submit the report to the nodal officer of the college to compile and share with higher authorities on Google spread sheet

## ROLE OF DIRECTOR/HOIS

- Allot one period of half an hour for Aanandam course
- Assign all faculty members as mentors for this period of half an hour for students
- Each faculty will have one class to mentor
- Appoint one faculty as department Aanandam Coordinator to monitor the program in their department and submit the monthly report to the University Nodal Officer which he/she will submit further to DCE – Govt. of Rajasthan.
- To coordinate the **Aanandam Day** activities
- To organize **Aanandam Day** in the last week of the month. A film or motivational lecture by some philanthropist (Bhamashah, Collector, Janpratinidhi) should be organized for the benefitof students (to motivate and inspire them for community service)
- Photographs of the **Aanandam Day** should be displayed in department and these should be uploaded in the gallery of University web page on HTE portal
- A **Project Assessment Committee** (PAC) to be constituted to assess the project report.

## PROJECT ASSESSMENT COMMITTEE

**Formation of Project Assessment Committee**

- **Director/HoIs**
- **One person from community**
- **Departmental Aanandam Coordinator**
- **Project Mentors (1 to 7 or more members)**

The number of mentors can vary depending on the number of projects and students in each department.

- University level PAC to be formed for university colleges and departments
- State level PAC to be formed at Commissionerate level for Universities

## PROJECTS: SUGGESTIVE LIST

The students and mentor as per their interest would support activities of community service such as:

- literacy programs, in today's digital age many organizations/individuals might also need help with email and websites
- livelihood projects,
- time giving activities to adopted communities(awareness regarding Govt. programmes)sports like yoga, meditation, drills, and physical exercises in adopted areas
- activities on arts and culture such as restoration of traditional art and culture and monuments.
- understand their responsibility in taking care of environment and appreciating cultural diversity
- While some students would be interested in awareness about environment such as protecting and preserving natural resources and animal species (the flora and the fauna). Plantation and animal care centers

- A few would be concerned with healthcare like medical and dental missions, first-aid training, etc.
- Another group may be formed for attending to old people(who have money but need assistance for market and groceries) [Time Bank]
- Another group may be formed for civic activities, awareness programmes.
- Local social problems to be taken up and solutions devised
- Innovations and Startups to be encouraged
- help plant a community garden, help out at a children's camp

## THE PROJECT REPORT

**The project report should be guided by the mentor and shall contain:**

- **Synopsis**: clearly stating objectives and activities to be undertaken. Problem identifying and problem-solving projects to be taken up.
- Details of the **Mentor and the Participants are to** be given (name of mentor, name of participants, phone number/mobile no, email, and address)
- Location / community where the work was carried out
- Details of Activities performed are to be given with date
- Number of beneficiaries and impact on the society(the object should be to empower the community and make them self-reliant)
- Photographs taken for documentation of work should be submitted
- Media coverage of the projects should be attached if any
- Students should also submit their certificates from the government bodies and or non government bodies they collaborate with, if any
- Photographs of **Display charts** or **ppt/video** prepared while presentation on the group community service in the **Aanandam Day** must be submitted along with the report
- The Group Community Service Project Report will be submitted by the Student group leader under the guidance of the mentor to the Director/HoIs of the Department.
- The Director/HoIs should get the best report (more than one if required) of the Group Community Service Project uploaded on the HTE website and on the University page
- The Director/HoIs will forward the best report of the department to the Nodal Officer of the University.
- University will forward the report to the state level committee.

## PROCEDURE FOR EVALUATION

- **Project Assessment Committee** will assess the Group Community Service Project Report
- submitted by the students, in the duly filled given format, based on:
- Submission of the student dedicated daily diary as per student attendance norms students' performance and interaction with the community
- presentation of the project report
- impact on society and the course outcome results

**Format for evaluation by Project Assessment Committee (Total max marks 50)**

- Submission of register of everyday activity mandatory (if register is not submitted by the student, he/she will not be evaluated and considered for the award)
- Report contains presentation /video **(max.10 marks)**
- Photographs of Students' participation and involvement of community **(max.10 marks)**
- Problem solving and challenging issues addressed/innovation **(max. 30 marks)**

## EVALUATION: GRADES EQUIVALENCE

Project Assessment Committee constituted will assess the projects
For 4 months Group Community Service Project the grade equivalence is as follows:

**Total: 64 Hrs**

**Grading Marks**
**C grade =32 hrs**
**B grade>32hrs to <=44hrs**
**A grade >44hrs to<=54hrs**
**O grade >54hrs to<=64hrs**

## AWARD AND RECOGNITIONDEPARTMENT, UNIVERSITY AND STATE LEVEL

- Based on the impact on society and Aanandam project outcome one Group Community Service Project will be selected by the Project Assessment Committee at department level for award of best project of the Department.

- The best project report of the University will be submitted to the Director, College Education/ Department of Higher and Technical Education for contesting the state level award
- State Level Project Assessment Committee will evaluate projects received from all the universities (one each).
- A certificate/letter of appreciation to the winning teams (Nodal officer of the university, students, and mentor of the project) will be given