MAHAMAYA TECHNICAL UNIVERSITY,
NOIDA

Syllabus

For

B. TECH. (BIOTECHNOLOGY)

Of

SECOND YEAR

(Effective from the Session: 2013-14)
<table>
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<td>1</td>
<td>HU-301/AS-306</td>
<td>Human Behaviour (Include Human Sociology and Psychology)/Technical Writing</td>
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<td>2</td>
<td>BT-301/AS-302</td>
<td>Statistical Techniques (Mathematics-III)/Basics of System Modelling and Simulation</td>
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<td>3</td>
<td>BT-302/BT-303</td>
<td>Instrumentation &amp; Techniques/Introduction to Bioinformatics</td>
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<td>Comp Audit course</td>
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<td>GP-301</td>
<td>General Proficiency</td>
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</table>

**L**: Lecture  **T**: Tutorial  **P**: Practical/Project  **CT**: Class Test  **TA**: Teacher’s Assessment  **Th**: Theory  **TOT**: Total

**TA** =10 (5 for teachers assessment plus 5 for attendance)  
**TA**=20 (10 for teachers assessment plus 10 for attendance)  
**P**= 15(4 marks for practical exam. 4 marks viva. 4 marks for lab. records and 3 marks for quiz)  
**P**= 30(10marks for practical exam. 10marks viva. 5marks for lab. records and 5 marks for quiz)

**Note-1**: AU-301/AU-401 may be offered in both the Semesters. A student has to clear this subject in second year or in any semester after second year  
**Note-2**: Grouping of batches will be done in a way that groups select either all subjects given in numerator or denominator, choice of mix of numerator and denominator is not permitted.
## SCHEME OF EVALUATION OF B.TECH. SECOND YEAR (BIOTECHNOLOGY)

(Effective from the session: 2013-14)

### SEMESTER - IV

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<tr>
<th>S.NO</th>
<th>Subject Code</th>
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<td>Th  P</td>
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<td>Technical Writing / Human Behaviour (Include Human Sociology and Psychology)</td>
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<td>Basics of System Modelling and Simulation / Statistical Techniques (Mathematics-III)</td>
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<td>15 10 25 15</td>
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<td>3</td>
<td>BT-403/ BT-402</td>
<td>Introduction to Bioinformatics/ Instrumentation &amp; Techniques</td>
<td>3 1 2</td>
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<td>Genetics &amp; Molecular Biology</td>
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<td>AU-401</td>
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<td>GP-401</td>
<td>General Proficiency</td>
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<thead>
<tr>
<th>L: Lecture</th>
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TA = 10 (5 for teachers assessment plus 5 for attendance)
TA = 20 (10 for teachers assessment plus 10 for attendance)
P = 15 (4 marks for practical exam. 4 marks viva. 4 marks for lab. records and 3 marks for quiz)
P = 30 (10 marks for practical exam. 10 marks viva. 5 marks for lab. records and 5 marks for quiz)
Objective of the Course: The course intends to impart knowledge and learning of different aspects of human behaviour especially in the organisational context that directs human behaviour. This has special significance to the professionals as these aspects of human behaviour needs to be accounted for while taking a decision with respect to enhancement of human productivity.

UNIT-I


UNIT-II


UNIT-III

Motivation: Meaning, Maslow’s, Herzberg, McClelland’s Theories of Motivation, Leadership: Style and Theories of Leadership-Trait, Behavioural and Situational Theories, Conflict Management: Conflict: Concept, Sources, Types, Classification of Conflict Intra, Individual, Interpersonal, Intergroup and Organisational, Resolution of Conflict.

UNIT-IV

Group Dynamics: Types of Group and their development stages, concept, status, norms size and cohesiveness. Power and Politics: Concept, Sources of Power, Distinction between Power, Authority and Influence, Approaches to Power, Political Implications of Power: Dysfunctional Uses of Power.
References:

1. Newstrom John W. - Organizational Behaviour: Human Behaviour at Work (Tata Mc Graw Hill,

2. Luthans Fred - Organizational Behaviour (Tata Mc Graw Hill, 10th edition)


4. Robbins Stephen P. - Organizational Behaviour (Pearson Education)

5. Hersey Paul, Blanchard, Kenneth H and Johnson Dewey E. - Management of Organisational Behaviour:


8. Ian Brooks : Organizational Behaviour, Pearson Learning

Objective of The Course

To impart basic skills in Technical Communication in various formats of technical writing to MCA and second year UG students in the English language. Having achieved the basic skills in professional communication in English through laboratory practice teaching, the students are required to learn various forms of technical writings. Communication is not restricted to forms of verbal interaction among the professionals. Every professional is required to be proficient in Technical Communication as well. Such proficiency is desired to be achieved through class room learning of different formats of technical writing which are usually used in any technical profession.

Desired Outcome of The Course

The students must be able to:

(a) Understand Communication as a process and channels of it in general and Technical Communication in particular.
(b) Learn Technical writing including sentence structure and be able to understand and use technology specific words.
(c) Write scientific articles, synopsis, reports (routine and annual) including Project and Sample Reports.
(d) Write Technical Notes, Proposals and Articles.
(e) Learn to records minutes of meetings, Seminars, workshops, make technical presentations and learn resume/CV writing.

Key Concepts

Communication as a process of interaction between originator and receiver.

Context of Technical Communication as means of indulgence in various forms and formats of technical writings as required in organizations-technological as well as commercial.

Writing Skills: Selection of words and phrases in technical writing leading to sentence structure as well as length and structure of paragraph. Writing scientific Articles, Reports, recording minutes and Notes, authoring and review of Research Articles.

Speaking Skills: Participation in Meetings, Seminars, Workshops and Technical Presentation.

Teaching Methodology

1. Equipping the student for competent techno-specific Technical Communication in English Language and enabling the student to be proficient in technical writing.
2. The teacher is required to teach the course through lectures, tutorials and samples of written technical formats.
3. The teacher must project himself as a proficient expert in technical writing of English language.
4. The course has to be taught in small batches so as to give individual attention to students – both, in the process of learning to write as well as participation in conferences, seminars, workshops and project presentations.
5. The Books suggested have portions of Technical Communication in each and as such the same be treated as base texts. Expansion of the parts be undertaken with the help of relevant matter through internet. Infact, the students be encouraged to enhance their technical writing skills by self learning.

Unit - I

Communication – Nature and process.
Channels of Communication– Down ward, upward and horizontal Communication.
Networks and Barriers to Communication.
Importance and Need for Technical Communication
Nature of Technical Communication- Aspects and Forms of Technical Communication
Technical Communication Skills- Listening, Speaking, Reading and Writing (Improving these with comprehensions).

Unit -II

Techniques of Writing, Selection of words and phrases in technical writing.
Difference between Technical Writing and General Writing.
Abstract and specific words
Sentence structure, Requisites of sentence construction.
Paragraph Length and structure
Jargons and Cliché.

Unit -III

Scientific Article Writing.
Synopsis Writing, Project writing and Dissertation /Thesis Writing.
Report Writing: meaning, significance, structure and style.
Different type of Reports-routine reports and annual reports.
Project Reports
Sample Reports
Technical Articles- nature, significance and types.
Journal Articles and Conference Papers.

Unit -IV

Technical Note Making
Mechanics and Note Writing Techniques.
Technical Proposals- meaning, structure, types and significance.
Types of Proposals
Review and Research Articles.
Elements of Technical Articles.

Unit - V

Meetings- Preparation of Agenda, participation, chairing and writing minutes of meetings.
Conferences, Seminars, Technical Presentations and Workshops.
Video Conferencing, technical description of engineering objects/produces and processes.
Slogan Writing, Speech advertising.
CV Writing, difference between Biodata, CV and Resume. Types of resume and tips for resume writing.
Text Books & References


Performance & Evaluation System

The students shall write two internal sessional tests as for other subjects besides the end-semester written exams. The internal sessionals will have a weightage of 20 marks and the end-semester theory examination shall carry 80 marks making the subject of Technical Writing worth 100 marks.

Assignments are to be given to reinforce the concepts and ensure total understanding of technical writing.

Suggested web-links:

http://www.ego4u.com/

http://www.english4today.com/

http://www.learnamericanenglishonline.com/

http://learnenglish.britishcouncil.org/en/

http://www.englisch-hilfen.de/en/

http://www.englishclub.com/

http://www.englishlearning.com/

http://learningenglish.voaenglish.com/

http://www.usingenglish.com/dictionary.html

1. **Work load per week**
   
a. **Lecture (L):** 3 hrs/week  
   **Total Lecture Hours per Semester:** 42

b. **Tutorials (T):** 1 hrs/week  
   **Total Tutorial Hours per Semester:** 14

c. **Total Credits:** \(L+T+P\)  
   4

d. One credit is defined as one lecture load per week and two hours of self-study to be connected with tutorial and assignments.

2. **Prerequisites of the course:** Knowledge of Statistics of Intermediate of U.P. Board or equivalent.

3. **Why you need to study this course:** Statistical Techniques is one of the important tools of engineering. It is essential for an engineering student to know the statistical terminology, concept and methods used in various engineering disciplines.

**Course Objective:**
Basic idea of this course will be to introduce the basic concept of statistics (diagrams and graphs), probability, distributions, hypothesis, control charts and experimental design to understand the different subjects of engineering as well as basic sciences.

4. **Learning outcomes expected from the course:**
   At the completion of this Course, student will have the basic skills required to:
   
a. Understand the concept of moments as well as distributions which are useful to all branches of engineering.
   
b. The concept of "expectation and moment generating function" in probability distribution will enable the students to obtain important results regarding mean, skewness, kurtosis and variance.
   
c. The concept of hypothesis and test will enable the students to understand errors in sample, to understand F Test, in ANOVA to find the total variation of the sample.
   
d. Be able to understand the Correlation, Regression, Statistical quality control and principals of experimental design.

5. **Details of the syllabus:**

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<td>II</td>
<td>Probability and Distributions</td>
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<td>• Introduction to probability</td>
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<td>• Normal distribution</td>
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<td>• Pearson and Mathew correlation coefficient</td>
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<td>• Rank Correlation</td>
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<th>Tests of Hypothesis and ANOVA</th>
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<td>• Hypothesis tests</td>
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<td>• Student’s t-test</td>
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<td>• Chi squire test</td>
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<td>• F-test and ANOVA, One way and two way analysis of variants.</td>
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<th>Design and Quality Control</th>
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<tr>
<td></td>
<td>• Principles of experimental design and analysis</td>
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<td>• Completely randomized design</td>
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<td>• Randomized block design</td>
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<td>• Latin square design</td>
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<td>• Types of quality control</td>
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<td>• Control chart for variables</td>
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<td>• Control chart for attributes</td>
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Text Books:

Reference Books:
1. N. T. J. Baily; Statistical methods in Biology; English University Press.
3. P. S. S. Sundar Rao; An Introduction to Biostatistics; Prentice Hall.
4. Zar J; Biostatistics; Prentice Hall, London.

6. Evaluation methodology to be followed: The evaluation and assessment plan consists of the following components:
   a. Class attendance and participation in class discussions etc.
   b. Quizzes
   c. Home-works and assignments
   d. Sessional examinations
   e. Final examination

7. Award classification

Assessment procedure will be as follows:
• Class attendance and participation in discussions will be based on:
  a. Substantial in-class contribution about class topics and discussion questions.
  b. Response to other students' queries
  c. Contribution in discussion and chat sessions
• Quizzes
  a. Quizzes will be of type multiple choice, fill-in-the-blanks or match the columns.
  b. Quizzes will be held periodically
• Home works and assignments
  a. The assignments/home-works may be of multiple choice type or comprehensive type.
  b. They will be available online but submission will be carried out in handwritten form.
  c. The grades and detailed solutions of assignments (of both types) will be accessible online after the submission deadline.
• Sessional and Final examinations
  a. These will be comprehensive examinations held on-campus (Sessionals) or off-campus (External) on dates fixed by the Mahamaya Technical University.
AS – 302/AS-402: Basics of System Modelling & Simulation

L.T.P: 3.1.0

Course Description:

This course will cover both theoretical & application aspects of mathematical modelling of existing or new basic systems to demonstrate the concepts of modelling, approach and use of simulation techniques and their relationships to the real world systems.

Course Objectives:

1. To present concepts of computer modelling and simulation to various natural, man-made, social and engineering systems.
2. The course will provide experience of modelling & simulation specifically suited to engineering systems to show how it can help in the analysis, design, performance evaluation, operational behaviour and assessment of performance & efficiency with respect to specific goals.

Learning Outcomes:

1. Understand the modelling concepts & types of models used to represent different classes of real world systems.
2. Applying various mathematical concepts & techniques to define physical, natural & social systems.
4. Understand how to evaluate, validate & verify models of simple systems.
5. Understand how complex and heterogeneous systems can be simplified and modelled for a specific task and thus understand the limitations of modelling & simulation.

Cognitive Skills learnt:

1. Ability to mathematically model any system from various fields.
2. Ability to implement simple numerical algorithms to solve various modelling equations that are used to describe real world systems.
3. Ability to select suitable techniques for generating system models, simulate them on computers and evaluate the system performance.

Course Pre-requisites: Probability & Statistical Method

Course Content:

Unit -I: Introduction to System Modelling & Simulation: (7 lectures)

Need & use of Simulation, system models, advantages & limitations of models, simplified representation of complex & large systems, Principals & Steps in creating system models, capturing
system environment, components of systems and selection of appropriate modelling techniques &
simulation methodologies; relationships between selected models & simulation techniques.

**Unit -II: System Modelling Concepts:** (8 Lectures)

Types of system models, continuous & discrete systems, comparison of analytical & simulation
methods, Event & Data Modelling, Model building, Data modelling & techniques of building useful
Input Data models, multivariate & time series input models. Steps in system model building; Monte
Carlo Method, verification, calibration & validation of models for simple systems.

**Unit -III: Probability & Random Number generation:** (7 Lectures)

Discrete & Continuous Random Variables, probability functions, descriptive characteristics of a
Distribution. Tests of Hypothesis and Estimation of Confidence Interval, Estimation of Error,

**Unit IV: Queuing Systems & Discrete System Simulation:** (6 Lectures)

Modelling & Generation of Arrival Patterns, Exponential & Poisson distribution, Service Times,
Normal Distribution Queuing Systems, Simulation of Single & Multiple Server Queuing Systems,
gathering statistics, Measuring occupancy & Utilization, Service Delay & Transit Times Estimation.

**Unit -V: Real World Application of Simulation:** (12 Lectures)

Transfer Line Model, Inventory System Model, Deadlock Detection Model, Computer Center Model,
Job Shop Model, Just-In-Time Model, Pi value estimation, Capital recovery Model, Economics of
Insurance policy, Reliability Estimation, Warranty Problem & Estimation, Computer Network Model.
Interpretation of Confidence Interval of a Parameter.

**References & Bibliography:**


URL: [www.insightmaker.com](http://www.insightmaker.com); Free web based Multi-user Modelling & Simulation Environment.


List of experiments:

2. Simulation of Disk Scheduling Algorithms.
4. Simulation of System Reliability of any given system and determine its reliability and average failure rate based on the given component reliability.
6. Telephone Exchange Modelling & Call rate & Call drop estimation based on exchange capacity.
7. Congestion Modelling & Analysing the impact of congestion control algorithms in Mobile systems/ Computer networks/ Assembly Line operations.

Note: Students shall perform practicals in tutorial periods using Sci Lab which is freely downloadable from www.
1. **Work load per week in terms of**
   a. Lectures (L): 3 hrs/wk  **Total Lecture Hours per Semester:** 42
   b. Tutorials: 1 hrs/wk  **Total Tutorial Hours per Semester:** 14
   c. Practicals: 2 hrs/week
   d. Total credit L+T+P based: 5
   e. One credit is defined as one lecture load per weekend two hours of self study to be connected with tutorial, practical work book and assignments.

2. **Prerequisites of the course if any**
   A Prerequisite for this course is the knowledge of Chemistry, Biology & Instrumentation

3. **Prerequisite for which next course if any:** This course is prerequisite for
   - Molecular Biology
   - Enzyme & Protein Engineering.
   - Advanced Analytical Techniques.

4. **Why you need to study this course:**
   The Analytical techniques deal with the Biological processes in living organisms, including structure and function of nucleic acids, proteins, and lipids. The elucidation of basic metabolic pathways in living organism has been a prerequisite to understanding the nature of many diseases. Study of Energy production and metabolic regulatory mechanism is very important to understand various physiological processes. Studying Bio-techniques underpins all the major developments in molecular medicine and biotechnology today. It is suitable at the bachelor's level for jobs in the biotechnology or pharmaceutical field.

**Course Objective**
The major objective of this subject is to introduce students to the basic and advanced biotechniques and its applications in the understanding of metabolic pathways, physiological processes. In brief the objectives can be listed as follows:
   - To provide an introduction to the concept of basic understanding of biochemical processes.
   - To provide an understanding of structure and function of the four major metabolic compounds (carbohydrates, lipids, proteins and nucleic acids) and other Biomolecules.
   - To provide students with a comprehensive understanding of the metabolic pathways involving the four major metabolic compounds: carbohydrates, lipids, amino acids and nucleotides; and the manner by which metabolism is normally integrated and regulated.
   - This course stresses both the normal analytical techniques used for understanding Biological process, Physiological processes and why disease states occur if normal metabolic processes are disrupted.
5. Learning outcomes expected from this course
At the completion of this Course, student will have the basic skills required to:
   a) Understand chemical and molecular aspects of life sciences.
   b) Understand the role of biomolecules in life processes & human diseases.
   c) To correlate analytical techniques and its application in biochemical processes with biotechnology applications in principle as well as in industry.

6. Details of syllabus:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Topic</th>
<th>Text Book / Topics</th>
<th>Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Microscopy</td>
<td>Bright field, Dark field, Fluorescent, Phase contrast, Confocal microscopy, SEM and TEM microscopy, Flow cytometry.</td>
<td>Text Book 1 1.7, 1.7.1, 1.7.2 Text Book 2 Chapter-6</td>
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<tr>
<td>IV</td>
<td>Unit IV Spectroscopy</td>
<td>General Principles, Types of spectra and their biochemical usefulness; Electromagnetic radiation and spectrum, Beer-Lamberts law; UV-VIS spectrophotometer, Atomic absorption and Atomic emission spectroscopy, Circular Dichroism (CD)-principles, instrumentation and applications, Basics of IR and NMR and their application in biotechnology and Basics of X-Ray diffraction analysis and their application in biotechnology</td>
<td>Text Book 1 9.1 - 9.9 and 10.1 - 10.6 Text Book 2: Chapter 8</td>
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<tr>
<td>V</td>
<td>UNIT V Centrifugation</td>
<td>Theory of centrifugation and sedimentation, use and design of different types of rotors; Types of centrifuges, Preparative and analytical centrifugation; Density gradient centrifugation (zonal and isopycnic), differential centrifugation, application of centrifugation for preparative and analytical purpose.</td>
<td>Text Book 1: 5.1 - 5.11 Text Book 2: Chapter 7</td>
</tr>
</tbody>
</table>
7. Text books to be used


8. Reference books & web sources:

   http://themedicalbiochemistrypage.org
   ull.chemistry.uakron.edu/biochem

9. Evaluation methodology to be followed:
   The evaluation and assessment plan consists of the following components:
   a. Class attendance and participation in class discussions etc.
   b. Quizzes
   c. Home-work and assignments
   d. Projects
   e. Sessional examinations
   f. Final examination

10. Award classification
    Assessment procedure will be as follows:
    • Class attendance and participation in discussions will be based on:
      a. Substantial in-class contribution to class topics and discussion questions
      b. Response to other students' queries
      c. Contribution to discussion and chat sessions

    • Quizzes
      a. Quizzes will be of multiple choice, fill-in-the-blanks or match the columns type.
      b. Quizzes will be held periodically

    • Home work and assignments
a. The assignments/home-work may be of multiple choice or comprehensive type.  
b. They will be available online but submission and be carried out in handwritten form.  
c. The grades and detailed solutions of assignments (of both types) will be accessible online after the submission deadline.

**Sessional and Final examinations**

a. There will be comprehensive examinations held on-campus (Sessionals) or off-campus (External) on dates fixed by Mahamaya Technical University.

Lab.BT-302P / BT-402 P

**List of Practicals:**

1. To study the structure & Function of basic microscope.
2. To study the tissue processing, cutting & staining for histological examination.
3. To study the paper chromatography for plant pigments
4. To study the Thin layer chromatography for Amino acids
5. To study the Analysis of DNA by Agarose gel Electrophoresis method.
6. To study the Analysis of protein by SDS- PAGE method
7. Estimation of Protein by Lowery’s Method
8. To study the structure & Function of Laboratory Centrifuge.

**Reference book:**

1. Work load per week in terms of
   a. Lectures (L): 3 hrs/wk  Total Lecture Hours per Semester: 42
   b. Tutorials: 1 hrs/wk  Total Tutorial Hours per Semester: 14
   c. Practicals: 2 hrs/week
   d. Total credit L+T+P based: 5
   e. one credit is defined as one lecture load per weekend two hours of self study to be connected with tutorial, practical work book and assignments.

2. Prerequisites of the course if any
A Prerequisite for this course is the knowledge of Biochemistry, Genetics, Molecular Biology & Computer Science.

3. Prerequisite for which next course if any: This course is prerequisite for
   • Advance Bioinformatics (EBT-502 Previously Bioinformatics-II)
   • Molecular Modeling & Drug Design(EBT-041)
   • Proteomics & Genomics (EBT-062)

5. Why you need to study this course:
   Bioinformatics is an interesting, and rapidly advancing field with many diverse challenges. For instance, you can become an expert in
   o Finding new genes and drug targets
   o Personalized treatment of cancer or other disease
   o Analysis of ancient DNA
   o Heuristic sampling methods
   o Predicting protein structure or conformation

   • There is a rapidly increasing need for bioinformatics expertise in both academia and industry
   • There are great possibilities for continuing as a PhD student after the master program

Course Objective
   • This course provides an introduction to the analysis of biological data using computational methods, as well as investigating problems in molecular and biology from a computational perspective. It is expected that, upon completion of this course, the students will achieve the following objectives:
     o Develop an understanding of the basic principles of molecular and cell biology.
     o Become familiar with existing tools and resources for computational analysis of biological data, including sequences, phylogenies, micro arrays, ontologies, and bio-molecular interactions. Develop an awareness of the computational problems that arise in the modeling and analysis of living systems.
     o Understand basic abstractions and computational approaches used to formulate and address these problems.
Be able to use and extend existing computational infrastructure for analyzing biological data

5. Learning outcomes expected from this course

Bioinformatics is a multidisciplinary field in which physical sciences, life sciences, computer science, and engineering are merged to solve both fundamental and applied problems in biology and medicine. The outcomes of bioinformatics and computational biology particularly include:

1. New and global perspectives into the organization and function of biological systems (fundamental biology);
2. New and novel targets for drug discovery and development; and
3. Genetic/proteomic profiling for pharmaco-genomics or personalized medicine.

6. Details of Syllabus

<table>
<thead>
<tr>
<th>Unit</th>
<th>Topics</th>
<th>Text Book / Topics</th>
<th>Lectures</th>
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<tbody>
<tr>
<td>I</td>
<td>Sequence Analysis: Various file formats for bio-molecular sequences: Genbank, Fasta, GCG, msf, nbrf-pir etc. Basic concepts of sequence similarity: identity and homology, definitions of homologues, orthologues, paralogues. Sequence patterns and profiles: Basic concept and definition of sequence patterns, motifs and profiles, various types of pattern representations viz. consensus, regular expression, (prosite-type) and profiles; profile-based database searches using PSI-BLAST, analysis and interpretation of profile-based searches.</td>
<td>Text Book 1,2 Ref.- 1,2</td>
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<td>Text Book 1 Ref Book 2</td>
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<td>Text Book 1,2 Ref Book 2</td>
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<tr>
<td>II</td>
<td>Sequence Alignment: Pairwise sequence alignments (Algorithmic concepts); Local Vs Global Multiple sequence alignment (Algorithmic concepts); Dynamic programming and progressive sequence alignment. Sequence analysis and dynamic programming. Multiple sequence alignments (MSA): the need for MSA, basic concepts of various approaches for MSA (e.g., progressive, hierarchical etc.). Algorithm of CLUSTALW and Pileup and their application for sequence analysis (including interpretation of results), concept of dendograms and their interpretation.</td>
<td>Text Book 1 Ref. book 2</td>
<td>8</td>
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<tr>
<td>III</td>
<td>Scoring Matrics: Basic concept of a scoring matrix, Dot matrix analysis Substitution matrices, Matrices for nucleic acid and proteins sequences, PAM and BLOSUM series, principles based on which these matrices are derived. Differences between distance &amp; similarity matrix, Sequence-based database searches: what are sequence-based database searches,</td>
<td>Text Book 1 Ref. Book 1,2</td>
<td>10</td>
</tr>
</tbody>
</table>
BLAST and FASTA algorithms, Various versions of basic BLAST and FASTA, Use of these methods for sequence analysis including the on-line use of the tools and interpretation of results.

IV

**Phylogenetics:** Phylogeny and concepts in molecular evolution; nature of data used in taxonomy and phylogeny; definition and description of phylogenetic trees and various types of trees; case studies in phylogenetic sequence analysis.

| Text Book 1 | Ref. Book 1,2 | 6 |

V

**Protein structure prediction and Visualization:** Secondary structure prediction (Chou Fasman method, GOR etc.) and tertiary structures Prediction (Homology Modelling etc.) Structure visualization methods (RASMOL, CHIME etc.) Protein Structure alignment and analysis. Application of Bioinformatics in drug discovery and drug designing.

| Text Book 1 | Ref. Book 3 | 8 |

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7. **Text books to be used**


8. **Reference books & web sources:**

3. A cell biologists' guide to modeling and bioinformatics; R. M. Holmes; Wiley Interscience, 2007.

9. **Evaluation methodology to be followed:**

The evaluation and assessment plan consists of the following components:

1) **Initial assessment:** It involves Class attendance and participation in class discussions, Quizzes etc.

2) **Formative assessment:** It involves Sessional examinations, Home-work and assignments etc.

3) **Summative assessment:** It involves Projects, Final examination etc.

10. **Award classification**

Assessment procedure will be as follows:

- Class attendance and participation in discussions will be based on:
  a. Substantial in-class contribution to class topics and discussion questions
  b. Response to other students' queries
  c. Contribution to discussion and chat sessions

- **Quizzes**
  a. Quizzes will be of multiple choices, fill-in-the-blanks or match the columns type.
  b. Quizzes will be held periodically

- **Home work and assignments**
  a. The assignments/home-work may be of multiple choice or comprehensive type.
  b. They will be available online but submission and be carried out in handwritten form.
c. The grades and detailed solutions of assignments (of both types) will be accessible online after the submission deadline.

● Sessional and Final examinations

There will be comprehensive examinations held on-campus (Sessionals) or off-campus (External) on dates fixed by Mahamaya Technical University

Lab.BT-303P / BT-403 P

List of Practicals
1. To find out five similar sequence for any DNA query sequence in FASTA format from NCBI.
2. Access and use of different online protein and gene alignment softwares
3. Gene finding related search for a given nucleotide sequence in order to predict the gene
4. ORF prediction for different proteins out of some given nucleotide sequences.
5. Exon identification using available softwares for a given nucleotide sequences
6. Secondary structure prediction for amino acid sequences of a given protein.
7. To visualize tertiary structure of any given protein sequence.
8. To carry out the alignment of genomes of given organisms.
9. To predict the homology model of any protein sequence.
1. Work load per week in terms of
   a. Lectures (L) :  3 hrs/wk   Total Lecture Hours per Semester: 42
   b. Tutorials (T)   :  1 hr/wk   Total Tutorial Hours per Semester: 14
   c. Practicals (P) :  2 hrs/ week
   d. Total credit L+T+P based: 5
   e. one credit is defined as one lecture load per weekend two hours of self study to be connected with tutorial, practical work book and assignments.

2. Prerequisites of the course, if any
   A Prerequisite for this course is the knowledge of Chemistry & Biology.

3. Prerequisite for which next course, if any: This course is prerequisite for
   • Molecular Biology
   • Enzyme & Protein Engineering
   • Proteomics & Genomics

4. Why you need to study this course:
The Biochemistry deals with the chemical processes in living organisms, including structure and function of nucleic acids, proteins, and lipids. The elucidation of basic metabolic pathways in living organism has been a prerequisite to understanding the nature of many diseases. Study of Energy production and metabolic regulatory mechanism is very important to understand various physiological processes. Studying biochemistry underpins all the major developments in molecular medicine and biotechnology today. It is suitable at the bachelor’s level for jobs in the biotechnology or pharmaceutical field.

Course Objective
The major objective of Biochemistry is to introduce students to the chemistry of biomolecules and complete understanding of metabolic pathways. In brief the objectives can be listed as follows:
   • To provide an introduction to the concept of pH & role of buffers and water in biochemical processes.
   • To provide an understanding of structure and function of the four major metabolic compounds (carbohydrates, lipids, proteins and nucleic acids).
   • To provide students with a comprehensive understanding of the metabolic pathways involving the four major metabolic compounds: carbohydrates, lipids, amino acids and nucleotides; and the manner by which metabolism is normally integrated and regulated.
   • This course stresses both the normal metabolic function, and why disease states occur if normal metabolic processes are disrupted.

5. Learning outcomes expected from this course
   At the completion of this Course, student will have the basic skills required to:
   d) Understand chemical and molecular aspects of life sciences.
   e) Understand the role of biomolecules in life processes & human diseases.
   f) To correlate biochemical processes with biotechnology applications.
### 6. Details of syllabi:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Topics</th>
<th>Text Book / Topics</th>
<th>Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Water - Structure, unusual properties, non-covalent interactions, role in biological processes Ionization of Water, pH scale, Weak Acids, and Weak Bases Buffers and buffering mechanism, Henderson Hasselbalch equation Buffering against pH Changes in Biological Systems: Phosphate buffer, Bicarbonate buffer, Protein buffer, Amino acid Buffer &amp; Hemoglobin Buffer System</td>
<td>Text Book 1 2.1, 2.2 Text Book 2 Chapter 3 Text Book 1 2.3</td>
<td>8</td>
</tr>
</tbody>
</table>
7. Text books to be used


8. Reference books & web sources:

2. Biochemistry: Voet and Voet, John Wiley and Sons, Inc. USA
3. Biochemistry: Zubey, WCB.
6. ull.chemistry.uakron.edu/biochem

9. Evaluation methodology to be followed:
The evaluation and assessment plan consists of the following components:

   a. Class attendance and participation in class discussions etc.
   b. Quizzes
   c. Home-work and assignments
   d. Projects
   e. Sessional examinations
   f. Final examination

10. Award classification
Assessment procedure will be as follows:

• Class attendance and participation in discussions will be based on:
  a. Substantial in-class contribution to class topics and discussion questions
  b. Response to other students’ queries
  c. Contribution to discussion and chat sessions

• Quizzes
  a. Quizzes will be of multiple choice, fill-in-the-blanks or match the columns type.
  b. Quizzes will be held periodically

• Home work and assignments
  a. The assignments/home-work may be of multiple choice or comprehensive type.
  b. They will be available online but submission and be carried out in handwritten form.
  c. The grades and detailed solutions of assignments (of both types) will be accessible online after the submission deadline.
• Sessional and Final examinations
  
a. There will be comprehensive examinations held on-campus (Sessionals) or off-campus (External) on dates fixed by Mahamaya Technical University.

Lab.BT-304 P

List of Practicals:
1. Introduction to Basic Biochemical Techniques: measurements, dilutions, molar and normal solutions.
2. Spectroscopy: determination of absorption maxima ($\lambda_{\text{max}}$) of a given solution.
3. Titration of weak acid-weak base.
5. Distinguish reducing and non-reducing sugars.
6. Quantitative estimation of proteins
7. Estimation of nucleic acids
8. Isoelectric precipitation
10. Extraction of lipids
11. Thin layer chromatography
12. Gel electrophoresis

Reference books
2. Plummer DT “An Introduction to Practical Biochemistry” III Edn., Tata McGrawhill
1. **Work load per week in terms of**
   a. Lectures (L): 3hrs/wk Total lecture hours per semester: 42
   b. Tutorials (T): 1 hr/wk Total Tutorial hours per semester: 14
   c. Practicals (P): 2hrs/wk
   d. Total credit L+T+P : 5
   e. one credit is defined as one lecture load per weekend two hours of self study to be connected with tutorial, practical work

2. **Prerequisites of the course, if any:** A prerequisite for this course is the knowledge of basics concepts of biology.

3. **Prerequisites for which next course, if any:** this course is prerequisite for
   - Molecular biology
   - Fermentation biotechnology
   - Bioprocess engineering

4. **Objective of the course:** to give a primary knowledge to students regarding harmful and useful microorganisms which are involved in various life processes.

5. **Learning outcomes expected from this course:** The course provides knowledge of different types of useful and harmful microorganisms which are involved in various life processes and related to human life. Through various microbiological techniques isolation of pure cultures of microorganisms that are involved in various processes should be done.

6. **Details of syllabus:**

<table>
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<tr>
<th>Unit</th>
<th>Topics</th>
<th>Text Book/ Topics</th>
<th>Lectures</th>
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<tbody>
<tr>
<td>I</td>
<td><strong>Bacteriology:</strong></td>
<td>Text book 1</td>
<td>8</td>
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<tr>
<td></td>
<td>-Microbial classification,</td>
<td>Ch.-3 (pp.8-14)</td>
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<tr>
<td></td>
<td>-Morphology of bacteria,</td>
<td>Ch.-5 (pp.73-96)</td>
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<td></td>
<td>-Culture media,</td>
<td>Ch.-6 (pp.103-106)</td>
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<td></td>
<td>-Culture techniques, Isolation and</td>
<td>Ch.-8 (pp.133-143)</td>
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<tr>
<td></td>
<td>preservation of cultures.</td>
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<td>II <strong>Microbial growth and control:</strong></td>
<td>Text book 1</td>
<td>10</td>
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<tr>
<td></td>
<td>-Microbial growth kinetics, cell</td>
<td>Ch.-7 (pp.115-132)</td>
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<td></td>
<td>cultivation system,</td>
<td>R.B.- 3, Ch.-3 (pp.9-34)</td>
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<td>-Strain improvement,</td>
<td>Ch.- 22, 23, 24 (pp. 469-540)</td>
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<td>-Control of microorganisms by</td>
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<td>physical agents, chemical agents,</td>
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<td>antibiotics.</td>
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<td>III <strong>Virology:</strong></td>
<td>Text book 1</td>
<td>8</td>
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<td></td>
<td>-General characteristics and structure of</td>
<td>Ch.-20 (pp.415-433)</td>
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<td>viruses, Outline classification of viruses:</td>
<td>Ch.-21 (pp.435-453)</td>
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<td>bacteriophages (lytic cycle, lysogeny),</td>
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<td>-Plant viruses, animal viruses; viroids,</td>
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<td>virusoids, prions.</td>
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<td>IV</td>
<td>Environmental and industrial microbiology:</td>
<td>Text book 2</td>
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<td></td>
<td>-Biological nitrogen fixation,</td>
<td>Ch.-14 (pp.258-261)</td>
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<td>-Biofertilizers,</td>
<td>T.B.- 3 (pp.463-488)</td>
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<td>-Bioremediation,</td>
<td>Ch.-17 (pp.294-313)</td>
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<td>-Microbiology of domestic water and waste water;</td>
<td>Ch.-12 (pp.237-245)</td>
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<td>-Industrial uses of micro-organisms.</td>
<td>Ch.-19 (pp.331-365)</td>
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<td>Medical microbiology:</td>
<td>Reference book 2</td>
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<td></td>
<td>Tuberculosis, typhoid, diarrhoea</td>
<td>Ch.-36 (pp.719-758)</td>
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<td>-Ameobiasis, Rabies and other applications.</td>
<td>Ch.-38 (pp.773-774)</td>
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<td>Cell biology:</td>
<td>Text book 4</td>
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<td>-Cell organelles such as cell wall, plasma membrane,</td>
<td>Ch.-5 (pp.112-153)</td>
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<td>-Endoplasmic reticulum,</td>
<td>Ch.-6 (pp.154-165)</td>
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<td>-Golgi bodies,</td>
<td>Ch.-7 (pp.166-174)</td>
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<td>-Mitochondria,</td>
<td>Ch.-10 (pp.191-219)</td>
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<td>-Chloroplast</td>
<td>Ch.-11 (pp.220-242)</td>
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<td></td>
<td>-Nucleus etc.;</td>
<td>Ch.-12 (pp.243-256)</td>
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<td>-Cell Division: mitosis and meiosis,</td>
<td>Ch.-18 (pp. 318- 341)</td>
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<td>-Biology of cancerous cells,</td>
<td>Ch.-5 (pp.719-758)</td>
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<td></td>
<td>-Protein targeting</td>
<td>R.B.- 3, Ch. 23 (pp. 467-475)</td>
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<td>R.B.- 3, Ch. 15 (pp. 363-366)</td>
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</table>

7. **Text books to be used**


8. **Reference Books**

9. Evaluation methodology to be followed:

The evaluation and assessment plan consists of the following components:

a. Class attendance and participation in class discussions etc.
b. Quizzes
c. Home-work and assignments
d. Projects
e. Sessional examinations
f. Final examination

10. Award classification

Assessment procedure will be as follows:

- Class attendance and participation in discussions will be based on:
  a. Substantial in-class contribution to class topics and discussion questions
  b. Response to other students' queries
  c. Contribution to discussion and chat sessions
- Quizzes
  a. Quizzes will be of multiple choices, fill-in-the-blanks or match the columns type.
  b. Quizzes will be held periodically
- Home work and assignments
  a. The assignments/home-work may be of multiple choice or comprehensive type.
  b. They will be available online but submission and be carried out in handwritten form.
  c. The grades and detailed solutions of assignments (of both types) will be accessible online after the submission deadline.
- Sessional and Final examinations
  a. There will be comprehensive examinations held on-campus (Sessionals) or off-campus (External) on dates fixed by Mahamaya Technical University.
List of Practicals:

1- To study the principle and working of Compound Microscope, Oven, Autoclave, Laminar air flow, Incubator and pH meter.

2- Preparation of solid medium (Nutrient agar medium) and liquid medium (nutrient broth).

3- Preparation of solid agar plate, agar slants and inoculation in liquid medium.

4- Isolation of microorganisms by streak plate method.

5- Isolation of pure culture from soil sample by using serial dilution technique (spread plate method).

6- Enumeration of bacterial colonies or fungal spores from given sample by using Neubauer hausser counting chamber/plate.

7- To perform the simple staining of given sample.

8- To perform the Gram’s staining of given sample.

9- To perform the negative staining of given sample.

10- To study the mounting of fungi by using lactophenol cotton blue.

11- To study the growth curve of bacteria.

12- To perform the antibiotic sensitivity test of microorganisms by disc-diffusion assay.

13- Identification and staining of different types of cells.

14- Measurement of various Cell Organelles.
BT-306: MOLECULAR DYNAMICS & BIOENERGETICS

1. Work load per week in terms of
   a. Lectures (L) :  3 hrs/wk   **Total Lecture Hours per Semester:** 42
   b. Tutorials (T):  1 hr/wk    **Total Tutorial Hours per Semester:** 14
   c. Practicals (P): 2 hrs/week
   d. Total credit L+T+P based : 5

   e. one credit is defined as one lecture load per weekend two hours of self study to be connected with tutorial, practical work book and assignments.

2. Prerequisites of the course, if any

   A Prerequisite for this course is the knowledge of Chemistry & Biology.

3. Prerequisite for which next course, if any: This course is prerequisite for
   - Molecular Biology
   - Mammalian Bioenergetics
   - Cell Biology

4. Why you need to study this course:

   The Molecular Dynamics and Bioenergetics deals with the chemical processes in living organisms, including structure and function of nucleic acids, proteins, and lipids. The elucidation of basic metabolic pathways in living organism has been a prerequisite to understanding the nature of many diseases. Study of Energy production and metabolic regulatory mechanism is very important to understand various physiological processes. Studying Bioenergetics underpins all the major developments in molecular medicine and biotechnology today. It is suitable at the bachelor’s level for jobs in the biotechnology or pharmaceutical field.

Course Objective

The major objective of Molecular Dynamics and Bioenergetics is to introduce students to the cell energy formation and complete understanding of metabolic pathways. In brief the objectives can be listed as follows:

   - To provide an introduction to the concept of cell function in biochemical processes.
   - To provide an understanding of structure and function of the basic metabolic processes leading to production of energy required for the cell function. To provide students with a comprehensive understanding of the metabolic pathways involving the four major metabolic compounds: carbohydrates, lipids, amino acids and nucleotides; and the manner by which metabolism is normally integrated and regulated.
   - This course stresses both the normal metabolic function, and why disease states occur if normal metabolic processes are disrupted.
5. **Learning outcomes expected from this course**
At the completion of this Course, student will have the basic skills required to:

- g) Understand chemical and molecular aspects of life sciences.
- h) Understand the role of biomolecules in life processes & human diseases.
- i) To correlate biochemical processes with biotechnology applications.

6. **Details of syllabi:**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Topics</th>
<th>Text Book / Topics</th>
<th>Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Biological membrane: structure, permeability, properties, passive transport and active transport, facilitated transport, energy requirement, mechanism of Na+/K+, glucose and amino acid transport; Organization of transport activity in cell; Active potentials; Role of transport in signal transduction processes. Signal Tansduction</td>
<td>Text Book 1 467 468,9.10 521,532</td>
<td>8</td>
</tr>
<tr>
<td>III</td>
<td>Metabolism and bioenergetics; Generation and utilization of ATP; Metabolism of Nitrogen containing compounds: nitrogen fixation, amino acids and nucleotides;</td>
<td>Text Book 2 Chapter -5</td>
<td>8</td>
</tr>
<tr>
<td>IV</td>
<td>Energetics of Metabolic Pathways; Energy Coupling (ATP &amp; NADH); Stoichiometry and energetic analysis of Cell Growth and Product Formation - elemental Balances, Degree of reduction concepts; available-electron balances; yield coefficients; Oxygen consumption and heat evolution in aerobic cultures; thermodynamic efficiency of growth.</td>
<td>Text Book 2 Chapter-5 5.10.1 5.10.2 5.10.3, 5.10.4</td>
<td>8</td>
</tr>
<tr>
<td>V</td>
<td>Electron Flow as source of ATP Energy, Site of Oxidative Phosphorylation, ATP synthetase, Electron- Transferring Reactions, Standard Oxidation, Electron Carrier, electron transportComplexes Incomplete reduction of Oxygen, Mechanism of Oxidative Phosphorylation,</td>
<td>Text Book 2 Chapter -5 5.2 5.3 5.4,5.5.5.6</td>
<td>8</td>
</tr>
</tbody>
</table>
7. Text books to be used:
   1- Cell – A molecular approach : Geoffrey M. Cooper.

8. Reference books & web sources:
   2. Biochemistry: Voet and Voet, John Wiley and Sons, Inc. USA
   6. ull.chemistry.uakron.edu/biochem

9. Evaluation methodology to be followed:
The evaluation and assessment plan consists of the following components:
   a. Class attendance and participation in class discussions etc.
   b. Quizzes
   c. Home-work and assignments
   d. Projects
   e. Sessional examinations
   f. Final examination

10. Award classification
    Assessment procedure will be as follows:
    • Class attendance and participation in discussions will be based on:
      a. Substantial in-class contribution to class topics and discussion questions
      b. Response to other students' queries
      c. Contribution to discussion and chat sessions
    • Quizzes
      a. Quizzes will be of multiple choice, fill-in-the-blanks or match the columns type.
      b. Quizzes will be held periodically
    • Home work and assignments
      a. The assignments/home-work may be of multiple choice or comprehensive type.
      b. They will be available online but submission and be carried out in handwritten form.
      c. The grades and detailed solutions of assignments (of both types) will be accessible online after the submission deadline.
    • Sessional and Final examinations
      a. There will be comprehensive examinations held on-campus (Sessionals) or off-campus (External) on dates fixed by Mahamaya Technical University

Lab.BT-306 P

List of Practicals:
   1. Selective Permeability of an Artificial Membrane.
2. Demonstration of the process of Active Transport.
3. To study the Demonstration of osmosis.
4. Effect of molecular size on permeability of the cell membrane.
5. Observation of osmosis under microscope.
6. Identifying the conditions needed for photosynthesis.
7. To study the extraction of starch by green leaves.
8. Investigating factors affecting the rate of photosynthesis.
10. To study the Isolation of Chloroplasts from spinach Leaves.
11. To study the structure & Function of refrigerated centrifuge
12. To study the structure & Function of Phase contrast microscope.
Human Values & Professional Ethics

(Syllabus for the Value Education Course to be introduced in MTU Colleges/Institutes)

Subject Code-AU-301/AU-401

Course Objective

This introductory course input is intended

a. To help the students appreciate the essential complementarily between ‘VALUES’ and ‘SKILLS’ to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

b. To facilitate the development of a Holistic perspective among students towards life, profession and happiness, based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of value based living in a natural way.

c. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behavior and mutually enriching interaction with nature.

Thus, this course is intended to provide a much needed orientational input in Value Education to the young enquiring minds.

Course Methodology

- The methodology of this course is universally adaptable, involving a systematic and rational study of the human being vis-à-vis the rest of existence.
- It is free from any dogma or value prescriptions.
- It is a process of self-investigation and self-exploration and not of giving sermons. Whatever is found as truth or reality is stated a proposal and the students are facilitated to verify it in their own right based on their Natural Acceptance and Experiential Validation.
- This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with and within the student himself/herself family.
- This self-exploration also enables them to evaluate their pre-conditionings and present beliefs.
Content for Lectures:

Unit-I

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Understanding the need, basic guidelines, content and process for Value Education.
2. Self Exploration-what is it? - its content and process; ‘Natural Acceptance’ and Experiential Validation-as the mechanism for self exploration
3. Continuous Happiness and Prosperity-A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facilities-the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly-A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Unit-II

Understanding Harmony in the Human Being-Harmony in Myself

7. Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’
8. Understanding the needs of Self (‘I’) and ‘Body’ - Sukh and Suvidha
9. Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of ‘I’ and harmony in ‘I’
11. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Swasthya
   -Practice Exercised and Case Studies will be taken up in Practice Sessions.

Unit-III

Understanding Harmony in the Family and Society -Harmony in Human-Human Relationship

13. Understanding harmony in the Family- the basic unit of human interaction
14. Understanding values in human - human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti;
   Trust (Vishwas) and Respect (Samman) as the foundational values of relationship
15. Understanding the meaning of Vishwas; Difference between intention and competence
16. Understanding the meaning of Samman, Difference between respect and differentiation;
   the other salient values in relationship
17. Understanding the harmony in the society (society being an extension of family):
   Samadhan, samridhi, Abhay, Sah-astitva as comprehensive Human Goals

18. Visualizing a universal harmonies order in society-Undivided Society (Akhand Samaj),
    Universal Order (Sarvabhaum Vyawastha) - from family to world family.
    -Practice Exercise and Case Studies will be taken up in Practice Sessions.

Unit-IV

**Understanding Harmony in the Nature and Existence - Whole existence as Co-existence**

19. Understanding the harmony in the Nature
20. Interconnectedness and mutual fulfillment among the four orders of nature-recyclability
    and self-regulations in nature
21. Understanding existence as Co-existence (Sah-astitva) of mutually interacting unites in all-
    pervasive space.
22. Holistic perception of harmony at all levels of existence
    -Practice Exercise and Case Studies will be taken up in Practice Sessions.

Unit-V

**Implications of the above Holistic Understanding of Harmony on Professional Ethics**

23. Natural acceptance of human values
24. Definitiveness of Ethical Human Conduct
25. Basis of Humanistic Education, Humanistic Constitution and Humanistic Universal Order
26. Competence in professional ethics;
    a. Ability to utilize the professional competence for augmenting universal human
       order.
    b. Ability to identify the scope and characteristics of people friendly eco-friendly
       production systems
    c. Ability to identify and develop appropriate technologies and management
       patterns for above production systems.
27. Case studies of typical holistic technologies, management models and production systems
28. Strategy for transition from the present state to universal Human Order;
    a. At the level of individual: as socially and ecologically responsible engineers,
       technologies and mangers.
    b. At the level of society: as mutually enriching institutions and organizations

Content for Practice Sessions:
Unit-I

**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**

**PS 1:** Introduction yourself in detail. What are the goals in your life? How do you set your goals
in your life? How do you differentiate between right and wrong? What have been your
achievements and shortcomings in your life? Observe and analyze them.

**Expected Outcome:** the students start exploring themselves; get comfortable to each other and to
the teacher and start finding the need and relevance for the course.
PS 2: Now a days, there is a lot of voice about many techno-genic maladies such as energy and natural resource depletion, environment pollution, global warming, ozone depletion, deforestation, soil degradation, etc. - all these seem to be man-made problems threatening the survival of life on Earth - What is the root cause of these maladies & what is the way out in your opinion?

On the other hand, there is rapidly growing danger because of nuclear proliferation, arms race, terrorism, criminalization of politics, large scale corruption, scams, breakdown of relationships, generation gap, depression & suicidal attempts, etc - what do you thing, is the root cause of these threats to human happiness and peace - what could be the way out in your opinion?

**Expected Outcome:** the students start finding that technical education without study of human values can generate more problems than solutions. They also start feeling that lack of understanding of human values is the root cause of all problems and the sustained solution could emerge only through understanding of human values and value based living. Any solution brought fear, temptation or dogma will not be sustainable.

PS 3:

1. Observe that each one of us has Natural Acceptance, based on which one can verify right or not right for him. Verify this in case of:
   (i) What is Naturally Acceptable to you in relationship-Feeling of respect or disrespect?
   (ii) What is Naturally Acceptable to you - to nurture or to exploit others?
   Is your living the same as your natural acceptance or different?

2. Out of the three basic requirements for fulfillment of your aspirations-right understanding, relationship and physical facilities, observe how the problems in your family are related to each. Also observe how much time & effort your devote for each in your daily routine.

**Expected Outcome**

1. The students are able to see that verification on the basis of natural acceptance and experiential validation through living is the only way to verify right or wrong, and referring to any external source like text or instrument or nay other person cannot enable them to verify with authenticity; it will only develop assumptions.

2. The students are able to see that their practice in living is not in harmony with their natural acceptance most of the time and all they need to do is to refer to their natural acceptance to remove this disharmony.

3. The students are able to see that lack of right understanding leading to lack of relationship is the major cause of problems in their family and not the lack of physical facilities in most of the cases, while they have given higher priority to earning of physical facilities in their life ignoring relationships and not being aware that right understanding is the most important requirement for any human being.

**Unit-II**

**Understanding Harmony in the Human Being-Harmony in Myself**

**PS 4:** List down all your desires. Observe whether the desire is related to Self (I) or Body. If it appears to be related to both, see which part of it is related to Self (I) and which part is related to Body.
**Expected Outcome:** the students are able to see that they can enlist their desires and the desires are not vogue. Also they are able to relate their desires to ‘I’ and ‘Body’ distinctly. If any desire appears related to both, they are able to see that the feeling is related to I while the Physical facility is related to the body. They are also able to see that ‘I’ and ‘Body’ are two realities, and most of their desires are related to ‘I’ and not body, while their efforts are mostly centered on the fulfillment of the needs of the body assuming that it will meet the needs of ‘I’ too.

**PS 5:**

1. (a) Observe that any physical facility you use, follows the given sequence with time: Necessary & tasteful-unnecessary & tasteful-unnecessary & tasteless-intolerable

   (b) In contrast, observe that any feeling in you is either naturally acceptable or not acceptable at all. If naturally acceptable, you want it continuously and if not acceptable, you do not want it any moment.

2. List down all your activities. Observe whether the activity is of ‘I’ or of Body or with the participation of both ‘I’ and Body.

3. Observe the activities within ‘I’. Identify the object of your attention for different moments (over a period of say 5 to 10 minutes) and draw a line diagram connecting these points. Try to observe the link between any two nodes.

**Expected Outcome:**

1. The students are able to see that all physical facilities they use are required for limited time in limited quantity. Also they are able to see that in case of feelings, they want continuity of the naturally acceptable feelings and they do not want feelings which are not naturally acceptable even for a single moment.

2. The students are able to see that activities like understanding, desire, thought and selection are the activities of ‘I’ only, the activities like breathing, palpitation of different parts of the body are fully the activities of body with the acceptance of ‘I’ while the activities they do with their sense organs like hearing through ears, seeing through eyes, sensing through touch, tasting through tongue and smelling through nose or the activities they do with their work organs like hands, legs etc. are such activities that require the participation of both ‘I’ and body.

3. The students become aware of their activities of ‘I’ and start finding their focus of attention at different moments. Also they are able to see that most of their desires are coming from outside (through preconditioning or sensation) and are not based on their natural acceptance.

**PS 6:**

1. Chalk out programs to ensure that you are responsible to your body-for the nurturing, protection and right utilization of the body.

2. Find out the plants and shrubs growing in and around your campus. Find out their use for curing different diseases.
Expected Outcome: The Students are able to list down activities related to proper upkeep of the body and practice them in their daily routine. They are also able to appreciate the plants wildly growing in and around the campus which can be beneficial in curing different diseases

Unit-III

Understanding Harmony in the Family and Society -Harmony in Human-Human Relationship

PS 7: From small groups in the class and in that group initiate dialogue and ask the eight questions related to trust. The eight questions are:

1 a. Do I want to make myself happy?  
1b. Am I able to make myself always happy?
2 a. Do I want to make the other happy?  
2b. Am I able to make the other always happy?
3 a. Does the other want to make him happy?  
3b. Is the other able to make him always happy?
4 a. Does the other want to make me happy?  
4b. Is the other able to make me always happy?

What is the answer?  What is the answer?

Intention (Natural Acceptance)  Competence

Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate your intention & competence as well as the others’ & competence.

Expected Outcome: The students are able to see that the first four questions are related to our Natural Acceptance i.e. intention and the next four to our Competence. They are able to note that the intention is always correct, only competence is lacking! We generally evaluate ourselves on the basis of our intention and others on the basis of their competence! We seldom look at our competence and others’ intentions as a result we conclude that I am a good person and other is a bad person.

PS 8:

1. Observe on how many occasions you are respecting your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under-evaluation, over-evaluation or otherwise evaluation.
2. Also observe whether your feeling of respect is based on treating the other as yourself or on differentiations based on body, physical facilities or beliefs.

Expected Outcome: the students are able to see that respect is right evaluation, and only right evaluation leads to fulfillment in relationship. Many present problem in the society are and outcome of differentiation (lack of understanding of respect), like gender biasness, generation gap, caste conflicts, class struggle, dominations through power play, communal violence, clash of isms, and so on so forth. All these problems can be solved by realizing that the other is like me as he has the same natural acceptance, potential and program to ensure a happy and prosperous life for him and for others though he may have different body, physical facilities or beliefs.
PS 9:

1. Write a note in the form of story, poem, skit, essay, narration, dialogue to educate a child. Evaluate it in a group
2. Develop three chapters to introduce ‘social science-its need, scope and content’ in the primary education of children

Expected Outcome: The students are able to use their creativity for education children. The students are able to see that they can play a role in providing value education for children. They are able to put in simple words the issues that are essential to understand for children and comprehensible to them. The students are able to develop an outline of holistic model for social science and compare it with the exiting model.

Unit-IV

Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

PS 10: List down units (things) around you. Classify them in for orders. Observe and explain the mutual fulfillment of each unit with other orders.

Expected Outcome: The students are able to differentiate between the characteristics and activities of difference orders and study the mutual fulfillment among them. They are also able to see that human beings are not fulfilling to other orders today and need to take appropriate steps to ensure right participants (in terms of nurturing, protection and utilization) in the nature.

PS 11:

1. Make a chart for the whole existence. List down different courses of studies and relate them to different units or levels in the existence.

2. Choose any one subject being taught today. Evaluate it and suggest suitable modifications to make it appropriate and holistic.

Expected Outcome: The students feel confident that they can understand the whole existence; nothing is a mystery in this existence. They are also able to see the interconnectedness in the nature, and pint out how different courses of study related to the different units and levels. Also they are able to make out how these courses can be made appropriate and holistic.

Unit-V

Implications of the above Holistic Understanding of Harmony on Professional Ethics

PS 12: Choose any two current problems of different kind in the society and suggest how they can be solved on the basis of natural acceptance of human values. Suggest steps you will take in present conditions.

Expected Outcome: the students are able to present sustainable solutions to the problems in society and nature. They are also able to see that these solutions are practicable and draw roadmaps to achieve them.
1. Suggest ways in which you can use your knowledge of Technology/Engineering/Management for universal human order, from your family to the world family.
2. Suggest one format of humanistic constitution at the level of nation from your side.

**Expected Outcome:** The students are able to grasp the right utilization of their knowledge in their streams of Technology/Engineering/Management to ensure mutually enriching and recyclable productions systems.

**PS:14** The course is going to be over now. Evaluate your state before and after the course in terms of:


Do you have any plan to participate in the transition of the society after graduating from the institute? Write a brief note on it.

**Expected Outcome:** The students are able to sincerely evaluate the course and share with their friends. They are also able to suggest measures to make the course more effective and relevant. They are also able to make us of their understanding in the course for a happy and prosperous society.

**Term Paper**

**Text Book and Reference Material**

a. **The text book:**

b. **Teacher’s Manual:**

   Video CD of Teacher Orientation Workshop will be made available on website.

c. **Reference Books**
   7. AN Tripathy, 2003, Human Values, New Age International Publishers
   8. Subhas Palekar, 2000, How to practice Natural farming, Pracheen (vaidik) Krishi Tantra Shodh, Amravati
   9. EG Seebauer & Robert L Berry, 2000, Fundamentals of Ethics for Scientists & Engineers,
Oxford University Press

d. **Relevant websites, CDs, Movies and Documentaries:**
1. Value Education website, [http://www.uptu.ac.in](http://www.uptu.ac.in)
3. AL Gore, An Inconvenient Truth, Paramount Classics, USA
4. Charlie Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology-the Untold Story
6. Anand Gandhi, Right here right now, Cyclewala Production
BT- 404: Enzyme Engineering

1. Title of the course: Enzyme Engineering

2. Work load per week in terms of
   a. Lectures (L) : 3 hrs/wk  **Total Lecture Hours per Semester:** 42
   b. Tutorials (T) : 1 hr/wk  **Total Tutorial Hours per Semester:** 14
   c. Practicals (P) : 2 hrs/ week
   d. Total credit L+T+P based: 5
   e. One credit is defined as one lecture load per weekend two hours of self study to be connected with tutorial, practical work book and assignments.

3. Prerequisites of the course, if any

   A Prerequisite for this course is the knowledge of Biology, Metabolism and Biochemistry

4. Prerequisite for which next course, if any: This course is prerequisite for
   - Enzyme & Protein Engineering
   - Proteomics & Genomics

Course Objective

The major objective of Enzyme Engineering is to introduce students to the chemistry of Enzymes/ Proteins and complete understanding of metabolic pathways. In brief the objectives can be listed as follows:

- Purification of enzymes from various sources
- Understanding of kinetic properties
- Development of enzyme assay
- To know about the immobilization of enzymes
- To develop skills of the students in the area of Enzyme Engineering with emphasis on Biosensor & Bioreactor design etc.

5. Learning outcomes expected from this course

   At the end of course, the students would have knowledge about enzymes, their sources, methods of extraction and purification, factors affecting activity of enzymes. This would help student in developing enzyme assay. Knowledge of immobilisation would help in designing biosensors & bioreactors. It would provide a wide range applicability of enzymes in different industries.
## 6. Details of syllabus

<table>
<thead>
<tr>
<th>Unit</th>
<th>Topics</th>
<th>Text Book / Topics</th>
<th>Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Introduction, Properties of enzymes, specificity, cofactors, coenzymes. Brief classification of enzymes. Extraction of crude enzyme from plant, animal and microbial source; some case study Purification of enzymes by the help of different methods. Methods of characterization of enzymes; Development of enzyme assays.</td>
<td>T1-1/1-5; R2 R1-24/43; R2 R2/ T1-295/308 T-1/277-287 R2 T1-277-287</td>
<td>8</td>
</tr>
<tr>
<td>II</td>
<td>Mechanisms of Enzyme action; Concept of active site, factors affecting enzyme action/kinetics. Kinetics of single substrate reactions: Michaelis Menton &amp; Briggs-Heldane approach; Derivation of Michaelis Menton equation, difference of Km &amp; Ks, turnover number; Estimation of Michalis-Menton Parameters. Significance of Km &amp; Vmax values ; Multi-Substrate reaction mechanisms and kinetics.</td>
<td>T1-181/183; T2-191/196 T1-3/14 T1-137/150 T187/126 T1126/127</td>
<td>10</td>
</tr>
<tr>
<td>III</td>
<td>Enzyme Inhibition: Introduction, Reversible enzyme inhibition; Competitive inhibition &amp; kinetics; Non-competitive inhibition &amp; kinetics; Uncompetitive inhibition &amp; kinetics, Mixed inhibition; Substrate and Product inhibition. Allosteric enzymes: properties, mechanism &amp;regulation of allosteric behaviour.</td>
<td>T1-127-152; R2 R2 T1-241/252 R2; T2-253-277</td>
<td>8</td>
</tr>
<tr>
<td>IV</td>
<td>Enzyme Immobilization: Methods of immobilization, Adsorption, Matrix entrapment, Encapsulation, Cross linking, Covalent binding and their examples; Advantages and disadvantages of different immobilization techniques. Properties of immobilized enzymes: stability, kinetic properties (partition &amp; diffusion effects. Uses of immobilized enzymes.</td>
<td>T2-489-497; R2 R1-243-275 T2-478/487 R2; T1-356/361; T1-340-350</td>
<td>8</td>
</tr>
<tr>
<td>V</td>
<td>Introduction to Biosensors, Components &amp; working of Biosensors. Design of enzyme electrodes and their application as biosensors in industry, Healthcare and environment. Introduction of immobilized enzyme reactors: Stirred tank, Continuous flow stirred tank, Packed bed, Fluidized bed reactors.</td>
<td>T3 12-1, 12-2, 12-6; R3 112/117 T3 11-28; R3-357/362</td>
<td>8</td>
</tr>
</tbody>
</table>
7. **Text books to be used**

   **T-1** Enzyme; Biochemistry, Biotechnology and Clinical Chemistry, by Trevor Palmer, Horwood Publishing, Chichester.

   **T-2** Fundamentals of Enzymology, Price and Stevens.

   **T-3** Comprehensive Enzyme Technology, by B.S. Chauhan

8. **Reference books & web sources:**

   **R-1** Enzymology, Dixon and Web. **R-2** Internet wab page **R-3** Biocatalysis and Enzyme Technology; Buchholz, Bornscheuer and Volker

9. **Evaluation methodology to be followed:**

   The evaluation and assessment plan consists of the following components:
   
   a. Class attendance and participation in class discussions etc.
   b. Quizzes
   c. Home-work and assignments
   d. Projects
   e. Sessional examinations
   f. Final examination

11. **Award classification**

   Assessment procedure will be as follows:
   
   • Class attendance and participation in discussions will be based on:
     a. Substantial in-class contribution to class topics and discussion questions
     b. Response to other students’ queries
     c. Contribution to discussion and chat sessions

   • Quizzes
     a. Quizzes will be of multiple choice, fill-in-the-blanks or match the columns type.
     b. Quizzes will be held periodically

   • Home work and assignments
     a. The assignments/home-work may be of multiple choice or comprehensive type.
     b. They will be available online but submission and be carried out in handwritten form.
     c. The grades and detailed solutions of assignments (of both types) will be accessible online after the submission deadline.

   • Sessional and Final examinations
     a. There will be comprehensive examinations held on-campus (Sessionals) or off-campus (External) on dates fixed by Mahamaya Technical University.
Lab.BT-404P

List of Practicals

1. Isolation of Enzyme from microbial/plant sources.
2. Standardization of medium composition for the optimum production of enzymes.
5. Study of time course of enzyme catalyzed reaction.
6. Effect of enzyme concentration on rate of enzyme catalyzed reaction.
7. Determination of optimum pH & temperature of a particular enzyme.
8. Identification of Enzyme by different assay
9. Method of checking the purity of the enzyme -SDS-PAGE.
10. Molecular weight determination of enzyme by Gel filtration method.
11. Immobilization of enzymes –Different Techniques such as adsorption, entrapment, encapsulation and crosslinking.

Reference books

Reference books
1. Title of the course : Immunology

2. Work load per week in terms of
   a. Lectures (L) : 3 hrs/wk  Total Lecture Hours per Semester: 42
   b. Tutorials (T) : 1 hr/wk  Total Tutorial Hours per Semester: 14
   c. Practicals (P) : 2 hrs/ week
   d. Total credit L+T+P based : 5
   e. one credit is defined as one lecture load per weekend two hours of self study to be connected with tutorial, practical work book and assignments.

3. Prerequisites of the course: As a prerequisite for this course are two aware about the Immune System, its component, and knowledge of general mechanism of immunological response against various antigen and pathogen.

4. Prerequisite for which next course: This course is prerequisite for
   - EBT-031 Vaccine Technology & Immunoinformatics
   - EBT-051 Biotechnology in Health Care

5. Why you need to study this course:
The purpose of the Immunology course is to provide a basic knowledge of the immune response and its involvement in health and disease. It focused on applied immunological concepts.

Course Objective:
Basic idea of the course will be to introduce the basic concepts required to understand the Immune Systems. The course has been built for second year biotechnology undergraduate students.

6. Learning outcomes expected from the course:
At the completion of this Course, student will have the basic skills required to:
   - Develop a basic understanding of fundamental immunological processes.
   - Identify the major cellular and tissue components which comprise the innate and adaptive immune system
   - Demonstrate an understanding of how white blood cells, including lymphocytes, develop from undifferentiated precursors
   - Learn how highly variable lymphocyte receptors are generated from a limited amount of genetic information.
   - Acquire a basic understanding of the fundamental of the Major Histocompatibility Complex
   - Understand how immune responses by CD4 and CD8 T cells, and B cells, are initiated and Regulated
   - Be able to discuss how the immune system distinguishes self from non-self
   - To understand the concept of immune-based diseases as either a deficiency of components or excess activity as hypersensitivity
**Aims:** This course will provide a basic grounding in key aspects of immunology with an emphasis on immunotechnology:
- Common features of immune systems
- Structure and function of antigen and antibody
- Antigen processing and presentation
- Serological techniques
- Immunity against infectious diseases
- Autoimmunity and Transplantation immunology.

### 7. Details of the syllabus

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<th>Unit</th>
<th>Topics</th>
<th>Text Book/Topic</th>
<th>Lectures</th>
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- Structure, function and application of cytokines 302-321
- regulation of immune response 297
- immune tolerance 402-407

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- precipitation reactions 151-152
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- RIA 154
- western blotting 158
- Production and application of monoclonal antibodies 105-106
- Vaccines. 475-488

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- Hyper-sensitivity 371-396
- Autoimmunity 407-421
- Cancer 525-542
- AIDS 493-518
- Transplantation immunology 425-443
8. Text books:
   1. Immunology by Kuby (Free man publication)
   2. Immunology and immunotechnology by Ashim k. Chakravarty (Oxford university Press)
   3. Immunology by C. Fatima

9. Reference materials / books:
   1. Essentials of immunology by Roitt (Blackwell scientific publication)
   2. Immunology by Benacera

10. Evaluation methodology to be followed:
The evaluation and assessment plan consists of the following components:
   a. Class attendance and participation in class discussions etc.
   b. Quizzes
   c. Home-works and assignments
   d. Projects
   e. Sessional examinations
   f. Final examination

11. Award classification
Assessment procedure will be as follows:

● Class attendance and participation in discussions will be based on:
   a. Substantial in-class contribution about class topics and discussion questions
   b. Response to other students’ queries
   c. Contribution in discussion and chat sessions

● Quizzes
   a. Quizzes will be of type multiple choice, fill-in-the-blanks or match the columns.
   b. Quizzes will be held periodically

● Home works and assignments
   a. The assignments/home-works may be of multiple choice type or comprehensive type.
   b. They will be available online but submission will be carried out in handwritten form.
   c. The grades and detailed solutions of assignments (of both types) will be accessible online after the submission deadline.

● Projects
   a. Will be assigned in the mid-part of the course and should be completed and submitted before the end of the course.
   b. The presentation and grading will be available online.

● Sessional and Final examinations
   a. These will be comprehensive examinations held on-campus (Sessionals) or off-campus (External) on dates fixed by the Mahamaya Technical University.
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List of Practicals

1. To determine the blood group of given blood
2. To determine the Rh factor of given blood
3. To perform single radial immunodiffusion
4. To perform double immunodiffusion
5. To perform rocket immune electrophoresis
6. To perform counter current immune electrophoresis
7. To perform Sand-witch ELISA
8. To perform Indirect ELISA
9. To perform Competitive ELISA
10. To prepare the blood smear and stain with leishman stain
11. To identify the blood cells/ immune cell with the help of leishman stain
12. To perform differential count (DLC) of given sample

Reference books
2. Practical Immunology- Hudson L. and Hay H. C. Blackwell Scientific Publications.
BT-406 : Genetics & Molecular Biology

1. Title of the course: Genetics and Molecular Biology

2. Work load per week in terms of

   a. Lectures (L) : 3 hrs/wk   **Total Lecture Hours per Semester:** 42
   b. Tutorials(T) : 1 hr/wk   **Total Tutorial Hours per Semester:** 14
   c. Practicals(P) : 2 hrs/week
   d. Total credit L+T+P based: 5
   e. One credit is defined as one lecture load per weekend two hours of self study to be connected with tutorial, practical work book and assignments.

3. Prerequisites of the course, if any

   A Prerequisite for this course is the knowledge of Chemistry, Biology and Bioscience.

4. Prerequisite for which next course, if any: This course is prerequisite for

   - Genetic Engineering
   - Enzyme & Protein Engineering
   - Proteomics & Genomics

5. Why you need to study this course:

   Genetics is the study of heredity and variations. By understanding the mechanisms which govern the way genetic information is received and expressed by individual organisms during their life and also how it is passed onto succeeding generations, scientists are increasingly able to understand the biochemical processes of all living things. Geneticists study what genes are, how they are duplicated and transferred, and how they change by mutation and selection during evolution. Genetics is a component of virtually every area of biology and can be found in many subfields within biology including: evolution, behaviour genetics, developmental biology, cytogenetics, population genetics, clinical and molecular genetics. Molecular biology encompasses the molecular aspects of biochemistry, genetics and cell biology. It seeks to explain the relationships between the structure and function of biological molecules and how these relationships contribute to the operation and control of biochemical processes. Molecular biology concentrates on the interplay between genes and biochemical function and allows us to determine the precise role of DNA-based information (genes) in the activity of all living things.

6. Course Objective

   The major objective of Genetics and Molecular Biology is to introduce students to the study of heredity and variations and complete understanding of biological molecules and how these relationships contribute to the operation and control of biochemical processes. In brief the objectives can be listed as follows:

   - Mendelian and non-Mendelian modes of inheritance that govern passage of genetic traits across generation to generation and trait analysis responsible for inheritance and population genetics, quantitative genetics and the genetics underpinning development processes.
   - The basic structure and function of DNA and the study of sex linked inheritance.
To the study of molecular biology technologies, gene structure and function, gene regulation, mutation, how to detect the mutations, mutagens, transposones and an operon.

The student capabilities will be developed through their involvement in both individual problem solving exercises and in group problem based activities designed to use knowledge capabilities and technical awareness to tackle new problems in genetic and molecular biology that require in depth critical analysis and problem solving.

7. Learning outcomes expected from this course
At the completion of this Course, student will have the basic skills required to:

a) Students will understand/able/assessed on these learning outcomes by the key concepts underpinning genetics of inheritance that govern genetic traits across generation and use this knowledge of inheritance to track alleles through generations to categorize and predict genotypes and phenotypes.

b) Understand the Hardy-Weinberg equilibrium equation and the study of requirements for maintaining this equilibrium in populations.

c) The basics of the molecular processes of DNA replication, transcription, translation and transposones as well as the important characteristics of the genetic code and an operon.

d) Enhance students problem-solving skills, In-class quizzes and activities, reading questions, homework problems and in-class exams are the outcomes of this course

8. Details of syllabus

<table>
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<th>Unit</th>
<th>Topics</th>
<th>Text Book / Topics</th>
<th>Lectures</th>
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<tbody>
<tr>
<td>I</td>
<td>Qualitative genetic inheritance, monohybrid and dihybrid crosses, incomplete dominance, co dominance, multiple alleles, epistasis, lethal gene, chi-square test</td>
<td>Text Book 1, Chapter 3,5 Ref Book 7, Chapter 3,4 Ref Book 8, Chapter 6,7,8,9</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Quantitative genetic inheritance, Genetic variation, Hardy-Weinberg, non-random matting, Changes in allelic frequencies.</td>
<td>Text Book 1, Chapter 22 Ref Book 7, Chapter 5,25 Ref Book 8, Chapter 14</td>
<td></td>
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<tr>
<td></td>
<td>Sex determination, sex linked, sex limited and sex influenced inheritance.</td>
<td>Text Book 1, Chapter 4 Ref Book 7, Chapter7 Ref Book 8, Chapter 12</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Classification of mutation, types of mutation, Phenotypic effects of mutation, Causes of mutation, applications of mutation, mutation detection techniques, DNA repair.</td>
<td>Text Book 1, Chapter 17 Ref Book 7, Chapter 14 Ref Book 8, Chapter 23,24</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Linkage and recombination, crossing over and genetic mapping, gene mapping by two point and three point test crosses.</td>
<td>Text Book 1, Chapter 7 Ref Book 7, Chapter 6 Ref Book 8, Chapter 16,17</td>
<td></td>
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</tbody>
</table>
| III | DNA and RNA as genetic material, DNA replication, modes of replication, DNA polymerases the DNA replicating enzymes, mechanism and regulation of DNA replication in prokaryotes and eukaryotes

Various RNA species and their properties, mRNA processing, Addition of 5’cap, poly (A) tail, lariat formation, RNA splicing. | Text Book 1, Chapter 10,12  
Ref Book 7, Chapter 9,10  
Text Book 2, Chapter 13,14  
Text Book 1 Chapter 14  
Ref Book 7, Chapter 27  
Text Book 2, Chapter 24 |
| IV | Synthesizing mRNA from a DNA template, transcription unit, substrate for transcription, transcription apparatus, RNA polymerases, mechanism and regulation of transcription in prokaryotes and eukaryotes, Role of sigma factor in transcription, role of promoters and enhancers.

The genetic code, properties of genetic code, wobble hypothesis, Molecular chaperones | Text Book 1 Chapter 13  
Ref Book 7, Chapter12  
Text Book 2, Chapter 9,21  
Text Book 1 Chapter 15  
Ref Book 7, Chapter 12  
Text Book 2, Chapter 7,8 |
| V | Mechanism and regulation of translation in prokaryotes and eukaryotes, Control of gene expression, nucleosomes modal

Operon structure, negative and positive control, the lac Operon of E.coli, The trp operon of E.coli, attenuation, Split Genes, RNA silencing,

Transposable elements, Transposition, Transposition by replicative and non -replicative mechanisms, The genetics of pattern formation in Drosophila. | Text Book 1 Chapter 15  
Ref Book 7, Chapter 13  
Text Book 2, Chapter 6,20  
Text Book 1 Chapter 16  
Ref Book 7, Chapter 17  
Text Book 2, Chapter 10  
Text Book 1 Chapter 11,21  
Ref Book 7, Chapter 14,11,22.3  
Text Book 2, Chapter 16 |

9. Text books to be used


10. Reference books & web sources:
5. Essentials of Molecular Biology 4thed, Malacinski, G. M. Jones & Bartlet publishers, Boston
11. Evaluation methodology to be followed:
The evaluation and assessment plan consists of the following components:
   a. Class attendance and participation in class discussions etc.
   b. Quizzes
   c. Home-work and assignments
   d. Projects
   e. Sessional examinations
   f. Final examination

12. Award classification
Assessment procedure will be as follows:
   • Class attendance and participation in discussions will be based on:
     a. Substantial in-class contribution to class topics and discussion questions
     b. Response to other students' queries
     c. Contribution to discussion and chat sessions
   • Quizzes
     a. Quizzes will be of multiple choices, fill-in-the-blanks or match the columns type.
     b. Quizzes will be held periodically
   • Home work and assignments
     a. The assignments/home-work may be of multiple choice or comprehensive type.
     b. They will be available online but submission and be carried out in handwritten form.
     c. The grades and detailed solutions of assignments (of both types) will be accessible online after the submission deadline.
   • Sessional and Final examinations
     a. There will be comprehensive examinations held on-campus (Sessionals) or off-campus (External) on dates fixed by Mahamaya Technical University.

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List of Practicals:
1. Demonstration of Mendelian genetics.
2. Chi - square test and probability numeric problem exercise analysis.
3. Genotypic and allelic frequencies numeric problem analysis?
5. To study the mutation and detect the mutation.
6. Model organism: Drosophila melanogester to study with lifecycle, sex differentiation and mutation
7. Gel Electrophoresis techniques.
8. Isolation of genomic DNA from eukaryotic cells.
9. Isolation and extraction of RNA.
10. Isolation of proteins from eukaryotic cells.
11. PCR amplification of DNA and visualization by gel electrophoresis.
12. Blotting techniques in molecular biology