




# NATIONAL INSTITUTE OF TECHNOLOGY, ARUNACHAL PRADESH

(Established by Ministry of Human Resources Development, Govt. Of India)

Yupia, District Papum Pare, Arunachal Pradesh - 791112

Fax: 0360 - 2284927, E-mail: [directornitap@gmail.com](mailto:directornitap@gmail.com)

## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

<b>Education</b>	<b>NATIONAL INSTITUTE OF TECHNOLOGY, ARUNACHAL PRADESH</b> (ESTABLISHED BY MINISTRY OF HUMAN RESOURCE DEVELOPMENT, GOVT. OF INDIA)	<b>Ethics</b>
In GOD's own land, a fusion of scholastic students, innovative & motivated researchers & teachers and fast moving visionary leaders.	 <b>COURSE STRUCTURE &amp; SYLLABUS FOR B-TECH IN BIOTECHNOLOGY</b>	Steeping Stone and Sky reaching ladder to success
<b>Research</b>	PO-Yupia,Dist.–PapumPare, Arunachal Pradesh,Pin–791112 PhNo:0360-2284801/2001582 FaxNo:0360-2284972 Email– <a href="mailto:nitarunachal@gmail.com">nitarunachal@gmail.com</a>	<b>Service to Society</b>



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

**Prof. (Dr.) Chandan Tilak Bhunia, Ph.D [Engg.], FIETE, FIE(I), SMIEEE**

***DIRECTOR***



### FORWARD

To achieve the target of being a global leader in the field of Technical Education, there is some sort of time bound urgency to work quickly, massively and strongly, in respect of National Institute of Technology, Arunachal Pradesh being an “ Institute of National Importance” (by an Act of Parliament) and being established only in five years back in 2010. I have therefore adopted a ‘B’ plan as stated below to achieve the primary goal of producing world class visionary Engineers and Exceptionally brilliant Researchers and Innovators:

#### B- Plan

- Best Teaching
- Best Research
- Best Entrepreneurship & Innovation practices
- Best Services to Society

In implementing the ‘B’ plan in letter and spirit, the framing of syllabi has been taken as important legitimate parameter. Therefore, extraordinary efforts and dedications were directed for the last few years to frame a syllabi in a framework perhaps not available in the country as of today, and with Indian perspective with Global context.

Besides attention on ‘B’ plan institute has given considerable importance to the major faults of current Technical Education while framing the syllabus. The major stumbling blocks in Technical Education today are:

- I. The present system is producing “Academic Engineers” rather than “Practical Engineers”.
- II. The present system of education makes the students to run after jobs rather than making them competent to create jobs.
- III. There is lack of initiative to implement the reality of “Imagination is more important than knowledge”.

Taking due consideration of the findings made above, to my mind credible syllabi has been framed in the institute in which the major innovations are introduction of:



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

- I. I-Course (Industrial Course) one in each semester at least one, which is targeted to be taught by the Industrial Expert at least up to 50% of its component.
- II. Man making and service to society oriented compulsory credit courses of NCC/NSS, values & ethics.
- III. Compulsory audit course on Entrepreneurship for all branches.
- IV. Many add-on courses that are (non-credit courses) to be offered in vacation to enhance the employability of the students.
- V. Many audit courses like French, German, and Chinese to enhance the communication skill in global scale for the students.
- VI. Research and imagination building courses such as Research Paper Communication.
- VII. Design Course as “Creative Design”.

Further, the syllabi is framed **not to fit in a given structure** as we believe structure is for syllabus and syllabus is not for structure. Therefore, as per requirement of the courses, the structure, the credit and the contact hours has been made available in case to case.

The syllabus is also innovative as it includes:

- I. In addition to the list of text and reference books, a list of journals and magazines for giving students a flexibility of open learning.
- II. System of examination in each course is conventional examination, open book examination and online examination.

Each course has been framed with definite objectives and learning outcomes. Syllabus has also identified the courses to be taught either of two models of teaching:

- I. J.C.Bose model of teaching where practice is the first theory.
- II. S.N.Bose model of teaching where theory is the first practice.

Besides the National Institute of Technology, Arunachal Pradesh has initiated a scheme of **simple and best teaching** in which for example:

- I. Instead of teaching RL, RC and RLC circuit separately, only RLC circuit will be taught and with given conditions on RLC circuits, RL and RC circuits will be derived and left to the students as interest building exercise.
- II. Instead of teaching separately High Pass Filter, Band Pass Filter and Low Pass Filter etc.; one circuit will be taught to derive out other circuits, on conditions by the students.

I am firmly confident that the framed syllabus will result in **incredible achievements, accelerated growth and pretty emphatic win over any other systems** and therefore **my students will not run after jobs rather jobs will run after.**

For the framing of this excellent piece of syllabus, **I like to congratulate all members of faculty, Deans and HODs in no other terms but “Sabash!”.**

*Prof. Dr. C.T. Bhunia*  
*Director,*  
*NIT, (A.P.)*

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### TEACHING GUIDELINES



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

In order to achieve the desired goal of excellence and innovations in each and every function of National Institute of Technology, Arunachal Pradesh and to implement 'B' Plan in totality, I call upon my distinguished members of Faculty to invest some of their valuable business time in doing Research on Teaching. In this context, I put forward the following general guidelines for teaching practices in the institute:

- 1) **J.C. Bose Model of Teaching:** As an example, In the Basic Electronics course instead of first teaching the colour codes of the resistors in a theoretical class, teacher may carry few resistors to class and note down on the blackboard the colours of resistors and their values. Thereafter, the teacher may ask the students to device the color code creating enthusiasm among students. Similarly, instead of teaching the characteristics of PN junction diode, teacher may guide the students in a laboratory to draw the characteristics curve, then may advise the students to analyse the behaviour of characteristics. Thereafter, the teacher may teach the theory of PN junction diode.
- 2) **S.N. Bose Model of Teaching:** This is the conventional model of teaching where theory is first practice but even then I suggest some unique ideas to improve imaginative power and creativity of students in the subject. For example, instead of teaching two algorithms for conversion of decimal to binary, one for integral part and another for fractional part, I call upon the teachers to design a single algorithm for both the purposes for inspiring teaching.
- 3) I also believe that noble teaching **will be simple and in simpler way**. Therefore, I call upon the teachers not to teach band pass filter, low pass filter, high pass filter separately. Teachers may design a single circuit for all filters and put on condition thereon can derive separately circuits for separate filters. Similarly, instead of teaching RL, RC and RLC circuits separately, I call upon the teachers to teach only RLC circuit and then putting suitable condition on RLC circuit; RL and RC circuits may be derived and taught.
- 4) **Last but not the least**, I call upon the teachers to **solve all the problems of all chapters of the main text book prescribed for a subject** in a teaching-learning process – 50% to be solved by teachers (may be of even ones) and 50% may be solved by students (may be odd ones).

**I solicit and anticipate full cooperation from all my brilliant pool of young and energetic faculty members to practice the noble and novel teaching procedures explained above without fail. Once procedures implemented by teachers are documented, we may proceed to file a patent on Research in Teaching on behalf of NIT, Arunachal Pradesh.**

*Prof. Dr. C.T. Bhunia*  
*Director,*  
*NIT, (A.P.)*



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

### SEMESTER - I

Subject Code	Subject	Model	P	L	T	Credit
MAS 101	Engineering Mathematics – I	S.N Bose	0	3	1	4
CHY 101	Engineering Chemistry	S.N Bose	2	3	0	4
PHY 101	Engineering Physics – I	S.N Bose	2	3	0	4
BIO 101	Life Science	S.N Bose	0	3	0	3
CE 101	Engineering Drawing	J.C Bose	4	0	0	2
ME 101	Engineering Mechanics	S.N Bose	0	3	0	3
ME 102	Workshop Practice	J.C Bose	4	0	0	2
EEE 101	Basic Electrical & Electronics Engineering	J.C Bose	2	3	0	4
HSS 101	Communication Skill	S.N Bose	2	0	0	1
HSS 102	NSS / NCC	J.C Bose	2	0	0	1
HSS 103	Foreign Language (French / Korean) (Audit)	J.C Bose	2	0	0	1
			20	18	1	29

### SEMESTER - II

Subject Code	Subject	Model	P	T	L	Credit
MAS 201	Engineering Mathematics II	S.N Bose	0	1	3	4
ME 201	Basic Elements of Mechanical Engineering	S.N Bose	0	0	3	3
CSE 201	Programming in C	J.C Bose	8	0	0	4
CHY 201	Environmental Science	J.C Bose	0	0	3	3
PHY 201	Engineering Physics II	S.N Bose	2	0	3	4
ECE 201	Digital Electronics & Logic Design	J.C Bose	2	0	3	4
HSS 201	Historiography of Science & Technology	J.C Bose	0	0	3	3
CE 201	Basic Civil Engineering	J.C Bose	3	0	0	2
ME 202	Workshop Practice II	J.C Bose	3	0	0	2
			18	1	18	29

### SEMESTER - III

Subject Code	Subject	Model	P	T	L	Credit
BT 301	Biochemistry 1	J. C. Bose	2	0	3	4
BT302	Principle and Chemistry of Food Preservation	S. N. Bose	0	0	3	3
ME 302	Material Science and Engineering					
BT 303	Genetics	J. C. Bose	2	0	3	4
BT 304	Microbiology 1	J. C. Bose	2	0	3	4
CSE 302	Data Structure and Algorithm	J. C. Bose	2	0	3	4
BT 305	Enzyme Engineering	S. N. Bose	0	0	3	3
HSS 301	Behavioral Science	S. N. Bose	0	0	2	2
			8		20	24



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

### SEMESTER – IV

Subject Code	Subject	Model	P	T	L	Credit
BT 401	Biochemistry II	S. N. Bose	0	0	3	3
BT 402	Microbiology II	S. N. Bose	0	0	3	3
BT 403	Plants Cell and Tissue Culture	J. C. Bose	2	0	3	4
BT 404 Or EE 404	Cell Biology or Introduction to Microprocessors and microcontrollers	J. C. Bose	2	0	3	4
BT 405	Molecular Biology	S. N. Bose	0	0	3	3
HSS 401	Entrepreneurship and innovation	S. N. Bose	0	1	3	4
			4	1	18	21

### SEMESTER – V

Subject Code	Subject	Model	P	T	L	Credit
BT 501	Immunology	J. C. Bose	2	0	3	4
BT 502	Bioinformatics	J. C. Bose	2	0	3	4
BT 503 Or CSE 503	Enzyme Technology Or Database Management System	J. C. Bose	2	0	3	4
BT 504	Secondary Metabolites in Plants	S. N. Bose	0	0	3	3
CHE 504 (IC)	Chemical Process Calculations	J. C. Bose	0	1	3	4
HSS 501	Industrial Management	S. N. Bose	0	0	3	3
			6	1	18	22

### SEMESTER – VI

Subject Code	Subject	Model	P	T	L	Credit
BT 601	Environmental Biotechnology	S. N. Bose	0	0	3	3
BT 602(IC)	Bio-separation Technology	J. C. Bose	2	0	3	4
BT 603	Recombinant DNA Technology	J. C. Bose	2	0	3	4
BT 604(IC) Or ECE 601 Or CSE-601	Herbal Technology Or Fiber Optics Communication Or Computer Networking	S. N. Bose S. N. Bose J.C Bose	0 0 3	0 0 0	3 3 3	3 3 4
HSS 601	Engineering Ethics & IPR	S. N. Bose	0	0	3	3
HSS 602	Disaster Management	S. N. Bose	0	0	2	2
			4	0	17	19



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

### SEMESTER – VII

Subject Code	Subject	Model	P	T	L	Credit
BT 701	Nano Biotechnology	S. N. Bose	0	0	3	3
BT 702 (IC)	Bioreactor Analysis and Design	S. N. Bose	3	0	3	4
BT 7XX	Elective I	S. N. Bose	0	0	3	3
BT 7XX	Elective II	S. N. Bose	0	0	3	3
HSS 702	Research Paper Communication	S. N. Bose	2	0	0	1
HSS 701	Mass Communication for Technology	S. N. Bose	2	0	0	1
			4	0	12	18



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

### List of Electives I and II

Subject Code	Subject	Model	P	T	L	Credit
BT 701(A)	Food Technology	S. N. Bose	0	0	3	3
BT 702(A)	Molecular Genetics	S. N. Bose	0	0	3	3
BT 703 (A)	Protein Engineering					
BT 704(B)	Immunotechnology	S. N. Bose	0	0	3	3
BT 705(B)	Metabolic Engineering	S. N. Bose	0	0	3	3
BT 706(B)	Development Biology	S. N. Bose	0	0	3	3

### SEMESTER – VIII

Subject Code	Subject	Model	P	T	L	Credit
BT 8XX	Elective III	S. N. Bose	0	0	3	3
BT 8XX	Elective IV	S. N. Bose	0	0	3	3
XXX 803	Industrial Training		2	0	0	1
XXX 804	Project Work		16	0	0	8
XXX 805	Seminar		2	0	0	1
XXX 806	Grand Viva		8	0	0	4
			28	0	6	20

### List of Electives III and IV

Subject Code	Subject	Model	P	T	L	Credit
BT 801(A)	Biofuel Technology	S. N. Bose	0	0	3	3
BT 802(A)	Cancer Biology	S. N. Bose	0	0	3	3
BT 803(A)	Virology and Infectious Diseases	S. N. Bose	0	0	3	3
BT 804(B)	Drug Design and Delivery	S. N. Bose	0	0	3	3
BT 805(B)	Systems Biology	S. N. Bose	0	0	3	3
BT 806(B)	Tissue Engineering and Regenerative Medicine	S. N. Bose	0	0	3	3





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### SEMESTER – I

Subject Code	Subject	Model	P	L	T	Credit
MAS 101	Engineering Mathematics – I	S.N Bose	0	3	1	4
CHY 101	Engineering Chemistry	S.N Bose	2	3	0	4
PHY 101	Engineering Physics – I	S.N Bose	2	3	0	4
BIO 101	Life Science	S.N Bose	0	3	0	3
CE 101	Engineering Drawing	J.C Bose	4	0	0	2
ME 101	Engineering Mechanics	S.N Bose	0	3	0	3
ME 102	Workshop Practice	J.C Bose	4	0	0	2
EEE 101	Basic Electrical & Electronics Engineering	J.C Bose	2	3	0	4
HSS 101	Communication Skill	S.N Bose	2	0	0	1
HSS 102	NSS / NCC	J.C Bose	2	0	0	1
HSS 103	Foreign Language (French / Korean) (Audit)	J.C Bose	2	0	0	1
			20	18	1	29

**Name of the Module: Engineering Mathematics-I**

**Module Code: MAS 101**

**Semester: 1<sup>st</sup>**

**Credit Value: 4 [P=0, T=1, L=3]**

#### A. Objectives:

The course is designed to meet with the objectives of:

1. Providing high quality education in pure and applied mathematics in order to prepare students for graduate studies or professional careers in mathematical sciences and related fields.
2. Imparting theoretical knowledge and to develop computing skill to the students in the area of Science and Technology.
3. Providing teaching and learning to make the students competent to their calculating ability, logical ability and decision making ability.
4. Giving students theoretical knowledge of Calculus, Algebra and their practical applications in the various fields of Science and Engineering.
5. Apply their knowledge in modern industry or teaching, or secure acceptance in high-quality graduate programs in Mathematics and other fields such as the field of quantitative/Mathematical finance, Mathematical computing, statistics and actuarial science.

#### B. Learning Outcomes:

Students successfully completing this module will be able to:

1. Students will become more confident about their computing skill, logical skill and decision making skill.
2. Students will find various applications of Calculus and Algebra in the practical fields science and engineering.
3. Students will become more competent to analyze mathematical and statistical problems,



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- precisely define the key terms, and draw clear and reasonable conclusions.
4. Student will be able to use mathematical and statistical techniques to solve well defined problems and present their mathematical work, both in oral and written format, to various audiences (students, mathematicians, and non-mathematicians).
  5. Student will be able to understand, and construct correct mathematical and statistical proofs and use the library and electronic data-bases to locate information on mathematical problems.
  6. Student will be able to explain the importance of Mathematics and its techniques to solve real life problems and provide the limitations of such techniques and the validity of the results.
  7. Student will be able to propose new mathematical and statistical questions and suggest possible software packages and/or computer programming to find solutions to these questions.

### C. Subject Matter:

#### Unit I:

**Matrices:** Introduction to Matrices and their basic properties, Transpose of a matrix, verification of the properties of transposes, Symmetric and Skew symmetric matrices and their properties. Determinant of a square matrix, Minors and Cofactors, Laplace's method of expansion of a determinant, Product of determinants, Adjoint of a determinant, Jacobi's theorem on adjoint determinant. Singular and non-Singular matrices, Adjoint of a matrix, Inverse of a non-singular matrix and its properties, Orthogonal matrix and its properties, Trace of a matrix, Rank of a matrix and its determination using elementary row and column operations, Solution of simultaneous linear equations by matrix inversion method, Consistency and inconsistency of a system of homogeneous and non homogeneous linear simultaneous equations, Eigen values and Eigen vectors of a square matrix (of order 2 or 3), Eigen values, Caley-Hamilton theorem and its applications, Diagonalisation of a square matrix with real and distinct eigen values (up to 3rd order).

#### Unit II:

**Successive Differentiation:** Higher order derivatives of a function of single variable, Leibnitz's theorem (statement only) and its application, problems of the type of recurrence relations in derivatives of different orders.

#### Unit III:

**Mean Value Theorems & Expansion of Functions:** Rolle's theorem(statement only) and its application, Mean Value theorems – Lagrange & Cauchy (statement only) and their application, Taylor's theorem with Lagrange's and Cauchy's form of remainders (statement only) and its application, Expansions of functions by Taylor's and Maclaurin's theorem, Maclaurin's infinite series expansion of the functions.

#### Unit IV:

**Integrals:** Double and triple integrals and evaluation of area and volume. Change of order of integration.

**Reduction formula:** Reduction formulae both for indefinite and definite integrals.

### D.Teaching/ Learning/ Practice Pattern:

Teaching: 70%



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Learning: 30%

Practice: 0%

### E. Examination Pattern:

Theoretical Examination: Written

### F. Reading Lists:

#### Books:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Eastern.
2. Babu Ram, "Engineering Mathematics", Pearson Education.
3. H. K. Dass "Higher Engineering Mathematics", S. Chand & Co.
4. B.S. Grewal, "Engineering Mathematics", S. Chand & Co.
5. Pulak Kundu, "A Text book on Engineering Mathematics" Vol. I, Chhaya Prakashani.
6. Pal & Das, "Engineering Mathematics" Vol. I, U.N. Dhar.
7. John Bird, "Higher Engineering Mathematics", 4th Edition, 1st Indian Reprint 2006, Elsevier.
8. L. Rade and B. Westergren, "Mathematics Handbook: for Science and Engineering", (5th edition, Indian Edition 2009, Springer).
9. M. J. Strauss, G. L. Bradley and K. L. Smith, "Calculus", 3rd Edition, 1st Indian Edition 2007, Pearson Education.
10. S. K. Adhikari, "A text Book of Engineering Mathematics-I", Dhanpat Rai and Co. (P) Ltd.
11. S. S. Sastry, "Engineering Mathematics", PHI, 4th Edition, 2008.
12. Ravish R Singh, "Engineering Mathematics", McGraw Hill.
13. Das & Mukherjee, "Differential Calculus", U.N. Dhar & Sons Private Ltd.
14. Das & Mukherjee, "Integral Calculus", U.N. Dhar & Sons Private Ltd.

#### Magazines:

1. Current Science (Indian Academy of Science).
2. The Mathematics Student (Math Student) (Indian Mathematical Society).
3. Mathematical Spectrum (The University of Sheffield).
4. Mathematics Magazine (Mathematical Association of America).
5. +Plus magazine (University of Cambridge).
6. Mathematics Today, London Metropolitan University.

#### Journals:

1. Journal of Engineering Mathematics, Springer.
2. Journal of Computational and Applied Mathematics, London Metropolitan University.
3. The Journal of Indian academy of Sciences.
4. Bulletin of Pure and Applied Sciences.

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**Name of the Module: Engineering Chemistry**

**Module Code: CHY 101**

**Semester: 1<sup>st</sup>**

**Credit Value: 4 [P=2, T=0, L=3]**

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#### A. Objectives:



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The course is designed to meet with the objectives of:

1. Imparting theoretical and practical knowledge to the students in the area of Chemistry.
2. Providing teaching and learning to make students acquainting with advanced science and technology in Chemistry.
3. Injecting the future scope and the research direction in the discipline of Chemistry.
4. Making students competent to the research and development in advanced science and technology in Chemistry.

### B. Learning outcomes:

Students successfully completing this module will be able to:

1. Students will be adequately trained to become Chemists, Scientist and Chemical Engineers.
2. Students will be skilled both theoretically and practically to do operation, control and maintenance works in Chemistry and Chemical Engineering.
3. Students will be substantially prepared to take up prospective research assignments.

### C. Subject matter:

#### Unit I:

**Chemical Thermodynamics:** Concept of Thermodynamic System: diathermal wall, adiabatic wall, isolated system, closed system, open system, extensive property, intensive property  
Introduction to first law of thermodynamics: different statements, mathematical form; internal energy: physical significance, mathematical expression (ideal and real gas), Enthalpy: physical significance, mathematical expression. Cp and CV definition and relation; adiabatic changes; reversible and irreversible processes; application of first law of thermodynamics to chemical processes: exothermic, endothermic processes, law of Lavoisier and Laplace, Hess's law of constant heat summation, Kirchoff's law. Second law thermodynamics; Joule Thomson and throttling processes; inversion temperature; evaluation of entropy: characteristics and expression, entropy change in irreversible process, entropy change for irreversible isothermal expansion of an ideal gas, entropy change of a mixture of gases.

Work function and free energy: physical significance, mathematical expression for ideal and real gases obeying Vander Waals' equation, Gibbs Helmholtz equation.

Condition of spontaneity and equilibrium

#### UNIT II:

**Electrochemistry Conductance:** Conductance of electrolytic solutions, specific conductance, equivalent conductance, molar conductance and ion conductance, effect of temperature and concentration. Kohlrausch's law of independent migration of ions, transport numbers and hydration of ions. Conductometric titrations: SA vs SB & SA vs WB; precipitation titration KCl vs AgNO<sub>3</sub>.

**Electrochemical cell:** Cell EMF and its Thermodynamic significance, single electrode potentials and its applications; hydrogen half cell, quinhydrone half cell and calomel half cell. Storage cell, fuel cell. Application of EMF measurement. Reaction Dynamics: Reaction laws: rate and order; molecularity; zero, first and second order kinetics. Arrhenius equation. Mechanism and theories of reaction rates (Transition state theory, Collision theory). Catalysis: Homogeneous catalysis and heterogeneous catalysis.

#### UNIT III:



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**Structure and reactivity of Organic molecule:** Electronegativity, electron affinity, hybridization, Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion and free radicals. Brief study of substitution, eliminations and addition reactions.  
**Instrumental Methods of Analysis:** Introduction to instrumental methods such as IR, UV, VIS, NMR and Mass spectrometry.

### UNIT IV:

**Polymerization:** Concepts, classifications and industrial applications. Polymerization processes (addition and condensation polymerization), degree of polymerization, Copolymerization, stereo-regularity of polymer, crystallinity and amorphicity of polymer. Preparation, structure and use of some common polymers: plastic (PE, PP, PVC, bakelite), rubber (natural rubber, SBR, NBR), fibre (nylon 6.6, polyester). Conducting and semi-conducting polymers.

**Industrial Chemistry:** Solid, liquid and gases fuels; constituents of coal, carbonization of coal. Coal analysis: Proximate and ultimate analysis. Classification of coal, petroleum (LPG, CNG), gasoline, octane number, aviation fuel, diesel, cetane number. Natural gas, water gas, Coal gas, bio gas. Bio-diesel.

### D. List of practical's: (Minimum eight experiments should be conducted by students)

1. Acid-base titration : (Estimation of commercial caustic soda)
2. Red-ox titration: (Estimation of iron using permanganometry)
3. Complexometric titration: (Estimation of hardness of water using EDTA titration)
4. Chemical Kinetics : (Determination of relative rates of reaction of iodide with hydrogen peroxide at room temperature (clock reaction).)
5. Heterogeneous equilibrium (Determination of partition coefficient of acetic acid between n-butanol and water)
6. Viscosity of solutions (determination of percentage composition of sugar solution from viscosity)
7. Conductometric titration for
  - (a) Determination of the strength of a given HCl solution by titration against a standard NaOH solution.
  - (b) Analysis of a mixture of strong and weak acid by strong base.
8. Preparation of a homo-polymer by free radical initiated chain polymerization and determination of its molecular weight by viscosity average molecular weight method.
9. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH.

### E. Teaching/ Learning/ Practice pattern:

Teaching: 40%  
Learning: 10%  
Practice: 50%

### F. Examination pattern:

1. Theoretical Examination: Written.
2. Practical Examination: Conduct Practical Examination and viva-voce.

### G. Reading lists:

#### Books:



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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1. Rakshit P. C., "Physical Chemistry" Sarat Book Distributor.
2. Dutta R. L. , "Inorganic Chemistry" The New Book Stall.
3. Levine " Physical Chemistry" McGraw-Hill Education.
4. Finar I. L., "Organic Chemistry (vol. 1 & 2)." Pearson.
5. lasston Samuel, " Text Book of Physical Chemistry" New York, D. Van Nostrand company.
6. Lee J. D., "Concise Inorganic Chemistry" Wiley India.
7. Sykes,P., "Guidebook to Mechanism in Org. Chems", Orient Longman.
8. Chakraborty D.K. , "Solid State Chemistry", New Age International.
9. Gupta M.C. , "Atomic & Molecular Spectroscopy", New Age.
10. Gowarikar V.R. , "Polymer Science", New Age.
11. Mishra G.S. , "Introductory Polymer Chemistry", New Age.
12. Nasipuri D. , "Stereochemistry of Organic Compounds", New Age.
13. Kalsi P.S, "Spectroscopy of Organic Compounds", New Age.
14. Kalsi P.S. , "Organic Reactions & their Mechanism", New Age.
15. Maity and Maity , " Engingeering Chemistry",U & N Dhar Publisher.
16. Ray, Das, Biswas, "Engingeering Chemistry", New Central Book Agency.

### Magazine:

1. Chemical science
2. chemistry Today
3. chemistry For You

### Journals:

1. Journal of Organic Chemistry, ACS
  2. Journal of Physical Chemistry, ACS
  3. Material Science & Engineering B, Elsevier
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**Name of the Module: Engineering Physics - I**

**Module Code: PHY 101**

**Semester: 1<sup>st</sup>**

**Credit Value: 4 [P=2, T=0, L=3]**

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### A. Objectives:

The course is designed to meet with the objectives of:

1. Imparting theoretical & practical knowledge to the students in the area of Engineering Physics.
2. Providing teaching and learning to make students acquainting with modern state-of-art of Engineering.
3. Injecting the future scope and the research direction in the field of Physics with specific specialization.
4. Making students competent to design & development of Engineering Physics.

### B. Learning outcomes:

Students successfully completing this module will be able to:



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1. Students will be adequately trained to become Engineers.
2. Students will be substantially prepared to take up prospective research assignments.

### C. Subject matter:

#### Unit I:

**Scalar and vector:** Scalar and vector, dot and cross product, Scalar and vector fields, concept of Gradient, Divergence and Curl.

**General Properties of Matter:** Elasticity, Viscosity, Surface tension.

#### UNIT II:

**Acoustics:** Simple Harmonic Motion, Damped Vibration, Forced Vibration

**Thermal Physics:** Kinetic Theory of Gas, conductivity & Radiation

#### UNIT III:

**Physical Optics:** Introduction to Interference, Diffraction, Polarization

**Elementary Solid State Physics:** Elementary ideas of crystal structure : lattice, basis, UNIT cell, fundamental types of lattices-Bravais lattice, simple cubic, f.c.c and b.c.c lattices, Miller indices and miller planes, Co-ordination number and atomic packing factor, X-rays: Origin of characteristics and continuous X-ray, Bragg's law (no derivation), determination of lattice constant

#### UNIT IV:

**Fundamental of Quantum Physics:** Wave particle duality, Compton effect, Photo electric effect, Heisenberg's uncertainty relation, concept of wave packet.

### D. List of practical's: (Minimum five experiments should be conducted by students)

1. Determination of thermal conductivity of a good conductor by searle's method
2. Determination of thermal conductivity of a bad conductor by Lees and Chorlton's method
3. Determination the dispersive power of the material of a given prism
4. Use of carry Foster's bridge to determine unknown resistance
5. Determination of Young Modulus by flexure method and calculation of bending moment and shear force at a point on the beam
6. Determination of coefficient of Viscosity by Poiseulle's capillary flow method
7. Determination of wavelength of light by Newton's ring method

### E. Teaching/ Learning/ Practice pattern:

Teaching: 40%

Learning: 10%

Practice: 50%

### F. Examination pattern:

1. Theoretical Examination: Written.
2. Practical Examination: Conduct Practical Examination and viva-voce.



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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### G. Reading lists:

#### Books:

1. Murrat R. Spiegel, Seymour Lipschutz & Dennis Spellman, "Vector Analysis" Second Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2009.
2. Takwale and Puranic, "Classical Mechanics" Tata McGraw-Hill Publishing
3. Sengupta & Chatterjee, "A Treatise on General Properties of Matter" New Central Book Agency (P) Limited
4. D. Chattopadhyay and P. C. Rakshit, "Vibrations, Waves and Acoustics" BOOKS and Allied (P) Ltd.
5. N. K. Bajaj, "The physics of Waves and Oscillations" Tata McGraw Hill Education Private Limited, New Delhi.
6. A. Ghatak, "Optics" 4<sup>th</sup> Edition, Tata McGraw Hill Education Private Limited, New Delhi. .
7. S. O. Pillai, "Solid State Physics", Wiley Eastern Ltd.
8. Kittel, "Solid State Physics" 7<sup>th</sup> edition, Wiley India.
9. Richard P. Feynman, Robert B. Leighton and Matthew Sands, "The FEYNMAN Lectures on Physics" Vol. I to Vol. IV, Pearson
10. D. Chattopadhyay and P. C. Rakshit, "An Advanced Course in Practical Physics" New Central Book Agency (P) Ltd.

#### Magazine:

4. *Physics Reports*
5. *Quarterly Reviews of Biophysics*
6. *Resonance*
7. *American Teacher*
8. *Scientific Physics*
9. *Physics Today*
10. *Physics For You*

#### Journals:

4. *Nature*
  5. *Physical Review Letter*
  6. *Physical Review A & B*
  7. *Applied Physics Letters (APL)*
  8. *Proceedings of the National Academy of Sciences*
  9. *Chemical Physics Letters*
  10. *Journal of Physics: (Including A, B, C, D, E, F & G)*
  8. *Journal of Scientific & Industrial Research*
  11. *Indian Journal of Engineering & Material Sciences*
  12. *Indian Journal of Radio and Space Physics*
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## **SYLLABUS FOR B-TECH (BIOTECHNOLOGY)**

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**Name of the Module: Life Science**

**Module Code: BIO 101**

**Semester: 1<sup>st</sup>**

**Credit Value: 3 [P=0, T=0, L=3]**

**A. Objectives:**

The course is design to meet with the objectives of:

1. imparting knowledge on the origin of Earth and life forms on Earth, appreciating importance of biological diversity and understanding biomolecules being the main component of life.
2. understanding “Cell” – the basic UNIT in different life forms, and structure and function of different tissue systems in plants and animals.
3. imparting knowledge on water relations, nutrient uptake and assimilation, and metabolism in plants.
4. providing knowledge on Bioenergetics of plant and animal cells, different organelles involved in electron transport systems, nervous, digestive and immune systems in animals.

**B. Learning Outcomes:**

Upon completion of the subjects:

1. Students will understand the characteristics of living organisms; appreciate the importance of diversity of life and their interaction with the environment.
2. Students will be able to explain the interrelationship between biomolecules and the living system, and influences of biomolecules upon the structure and function of intracellular components.
3. Students will have a broad knowledge on Bioenergetics of plant and animal cells; and a brief on important biological systems of animal.

**C. Subject Matter:**

**Unit I:**

**Origin of Life:** History of earth, theories of origin of life and nature of the earliest organisms.

**Varieties of life:** Classification, Five kingdoms, viruses (TMV, HIV, Bacteriophage), Prokaryote (Bacteria-cellstructure, nutrition, reproduction), Protista, Fungi, Plantae and Animalia.

**Chemicals of life:** (Biomolecules)- Carbohydrates lipids, amino acids, proteins, nucleic acids and identification of biomolecules in tissues.

**Unit II:**

**Cell:** Cell concept, structure of prokaryotic and eukaryotic cells, plant cells and animal cells, cell membranes, cell organelles and their function, Structure and use of compound microscope.

**Histology:** Maritimes (apical, intercalary, lateral) and their function; simple tissue (parenchyma, collenchymas, sclerenchyma); Complex tissue (xylem and phloem); Tissue systems (epidermal, ground, vascular); primary body and growth (root, stem, leaf); Secondary growth (root, stem). Animal tissues (Epithelial, connective, muscle and nervous tissues) and their functions in the body.

**Unit III:**

**Transport:** Plant water relationships, properties of water, diffusion, osmosis, imbibition, uptake of water by roots and theories of transport of water through xylem (ascent of water in xylem, cohesion- tension theory), apoplast and symplast theory; Transpiration-structure of leaf, opening and closing mechanisms of stomata, factors affecting transpiration and significance of transpiration.



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**Nutrition:** Mineral Nutrition in plants, Heterotrophic nutrition in plants; Photosynthesis (Autotrophic- forms of nutrition), Chloroplast structure, two pigment systems, photosynthetic UNIT, light absorption by chlorophyll and transfer of energy, phosphorylation and electron transport system, Calvin-Benson Cycle (C<sub>3</sub>), Hatch Slack Pathway (C<sub>4</sub>), Crassulacian Acid Metabolism (CAM), factors affecting photosynthesis.

### Unit IV:

**Energy Utilization:** (Respiration) - Structure of mitochondria, cellular respiration, relationship of carbohydrate metabolism to other compounds, Glycolysis, fermentation, formation of acetyl co-A, Krebs cycle, Electron Transport System and Oxidative Phosphorylation, ATP, factors affecting respiration;

Elementary canal in humans, nervous and hormonal control of digestive systems, fate of absorbed food materials; Nutrition in humans, Reference values; General characteristics of blood vascular system, development of blood systems in animals, Composition of blood, circulation in blood vessels, formation of tissue fluids, the heart, functions of mammalian blood, the immune system.

### D. Teaching/ Learning/ Practice Pattern:

Teaching: 70%

Learning: 30%

Practice: 0%

### E. Examination Pattern:

Theoretical Examination: Written

### F. Reading List:

#### Books

1. J.N. Mitra, D. Mitra and S.K. Chowdhuri, "Studies in Botany" Volume I & II, Moulik Library Publisher, Kolkata,
2. M.J. Pelczar, E.C.S. Chan and N.R. Krieg, "Microbiology", Tata McGraw Hill Education, New Delhi, 1993.
3. B.P. Pandey, "Plant Anatomy", S. Chand & Company Ltd., New Delhi, 1997.
4. H.S. Srivastava, "Plant Physiology", Rastogi Publishers, Meerut, 1998.
5. B.P. Pandey, "College Botany" Volume I & II, S. Chand Publisher, New Delhi, 2012.
6. N.A. Campbell, J.B. Reece, "Biology" Person Education, Inc & Dorling Kinderley Publishing, Inc.

#### Magazines

1. National Geographic Chennel, <http://science.nationalgeographic.co.in/science/earth>
2. Wikipedia, The Free Encyclopedia, <http://www.bbc.co.uk/science/earth>
3. Wikipedia, The Free Encyclopedia, <http://en.wikipedia.org/wiki/HIV>

#### Journals

1. Journal of Biology, BioMed Central Ltd, London, England.
2. Annals of Botany, Oxford JOURNALS, USA.
3. Plant and Cell Physiology, Oxford JOURNALS, USA.

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**Name of the Module: Engineering Drawing-I**



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

**Module Code: CE 101**

**Semester: 1<sup>st</sup>**

**Credit Value: 2 [P=3, T=0, L=0]**

### A. Objectives:

The course is design to meet with the objectives of:

1. Increase ability to understand Engineering Drawing.
2. Learn to sketch and take field dimensions.
3. Learn to take data and transform it into graphic drawings.
4. Learn basic Auto Cad skills.
5. Learn basic engineering drawing formats.
6. Prepare the student for future Engineering positions.

### B. Learning Outcome:

Upon completion of the subject:

1. Student's ability to hand letter will improve.
2. Student's ability to perform basic sketching techniques will improve.
3. Students will be able to draw orthographic projections and sections.
4. Student's ability to use architectural and engineering scales will increase.
5. Students ability to produce engineered drawings will improve
6. Student's ability to convert sketches to engineered drawings will increase.
7. Students will become familiar with office practice and standards.
8. Students will become familiar with Auto Cad two dimensional drawings.
9. Students will develop good communication skills and team work.

### C. Subject Matter:

#### Unit I:

**Indian Standards:** Line symbols and line groups; Sheet Layout of Rules of printing; Preferred scales.

#### Unit II:

Theory of Orthographic Projection.

#### Unit III:

Technical sketching; Multi-planar representation: First and third angle system of projection.

#### Unit IV:

Glass box concept: Sketching of orthographic views and line.

### D. List of Practical:

1. Technical writing of various type of letters.
2. Technical sketching of Scales- Plain, Diagonal, Vanier, Comparative and chord.
3. Technical sketching of Projection of points.
4. Technical sketching of Projection of lines.
5. Technical sketching of Projection of plains.
6. Technical sketching of Projection of solids.
7. Technical sketching of orthographic Projection

### D. Teaching/ Learning/ Practice Pattern:

Teaching: 70%



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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Learning: 30%

Practice: 0%

### E.Examination Pattern:

1. Practical Drawing.
2. Assignment.

### F. Reading List:

#### Books:

1. N. D. Bhatt, "Machine Drawing". Charotar Publishing House Pvt. Ltd.
2. V. Laxminarayanan & M. L. Mathur, "A Text Book of Machine Drawing", Jain Brothers, New Delhi
3. Jolhe "Machine Drawing", Charotar Publishing House Pvt. Ltd.
4. Venugopal K and Prabhu Raja V "Engineering Graphics", New Age International Pvt. Ltd.
5. John, K C "Engineering Graphics", PHI Learning Pvt. Ltd.
6. Kulkarni, D. M., Rastogi, A. P., Sarkar, A. K. "Engineering Graphics with Autocad", PHI Learning Pvt. Ltd.
7. Natarajan, K. V "Engineering Graphics", Dhanalakshmi Publisher
8. French and Vierk "Fundamentals of Engineering Drawing", McGraw Hill
9. Venugopal K and Prabhu Raja V "Engineering Graphics", New Age International Pvt. Ltd.

#### Magazine

1. Machine Design.
2. Design to Part Magazine.

#### Journals

1. International Journal of Design Engineering

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**Name of the Module: Engineering Mechanics**

**Module Code: ME 101**

**SEMESTER: 1<sup>st</sup>**

**Credit Value: 3 [P=0, L=3, T=0]**

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### A. Objectives:

The course is design to meet with the objectives of:

1. Ability to utilise scalar and vector analytical techniques for analysing forces in statically determinate structures.
2. Ability to apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.
3. Student gets a basic idea of Centre of gravity, moment of inertia, mass moment of inertia,



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

Friction.

### B. Learning Outcome:

Upon completion of the subject:

1. Should have knowledge of different type of force resolving
2. Should have knowledge of centre of gravity of different size, shape, and solid.
3. Should have knowledge of basic idea of Centre of gravity, moment of inertia, mass moment of inertia, friction.

### C. Subject Matter:

#### UNIT I

Forces and Moments: Force, Moment and Couple, Resultant of forces, Forces in space. Equilibrium, FBD, General equations of equilibrium, Analysis of forces in perfect frames. Brief introduction to vector approach.

#### UNIT II

Friction: Introduction to dry friction. laws of friction, friction of simple machines- inclined planes, Screw jacks.

#### UNIT III

Center of gravity and moment of inertia: Center of gravity of axes, volume and composite bodies: Area moment of inertia and mass moment of inertia for plane figures and bodies

#### UNIT IV

Kinetics of rigid bodies: Plane motion, force, mass, acceleration. Work and energy, Impulse and momentum, rotational motion, centrifugal force, torque, angular motion and acceleration, angular momentum, D'Alembert's principle, Virtual work.

**D. List of Practical's:** No Practical's

### E. Teaching/ Learning/ Practice pattern:

Teaching: 60%

Learning: 40%

Practice: 0%

### F. Examination pattern:

1. Theoretical Examination.

### G. Reading lists:

#### Books:

1. *Mariam & Kraige, Engineering Mechanics (Vol-II) Dynamics, Wiley publisher*
2. *Meriam & Kraige, Engineering Mechanics, Vol-I (Statics), Wiley publisher*
3. *Timoshenko, Engineering Mechanics, McGraw Hill Publisher*
4. *Nelson, Engineering Mechanics, Tata McGraw Hill Publication*
5. *Shames and Rao, Engineering Mechanics, Pearson Publisher*
6. *Suman Chakraborty, Engineering Mechanics, Everest Publishing House*
7. *Beer and Johnson, Vector Mechanics for Engineers, Tata McGraw Hill Publication*



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### Magazines:

1. *Popular Mechanics Everyday*
2. *Engineering Magazine*

### Journals:

1. *International Journal of Applied Mechanics and Engineering*
2. *Journal of Applied Mechanics, ASME*
3. *Journal of Engineering Mechanics, ASCE.*

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**Name of the Module: Workshop Practice-I**

**Module Code: ME 102**

**Semester: 1st**

**Credit Value: 2 [P=3, T=0,L=0]**

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### A.Objectives:

The course is design to meet with the objectives of:

1. To acquire skills in basic engineering practice.
2. To identify the hand tools and instruments.
3. To acquire measuring skills.
4. To acquire practical skills in the trades.
5. To acquire practical skills in welding, carpentry, Fitting.

### B. Learning Outcome:

Upon completion of the subject:

1. Should have knowledge of workshop safety.
2. Should have knowledge of Handling workshop tools, machines.
3. Should have knowledge of different welding types.
4. Should have knowledge of different carpentry joints
5. Should have knowledge of different tools working principle

### C. Subject Matter:

#### Unit I:

**Carpentry (Wood Working):** Timber, Seasoning and Preservation, Plywood and Plyboards, Carpentry Tools, Engineering applications. Different Joints

#### Unit II:

**Metal Joining:** Definitions of welding, brazing and soldering processes, and their applications. Oxy acetylene gas welding process, equipment and techniques. Types of flames and their applications. Manual metal arc welding technique and equipment.AC and DC welding, electrodes, constituents and functions of electrodes. Welding positions. Types of weld joint. Common welding defects such as cracks, slag inclusion and porosity.

#### Unit III:



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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### **Bench work and Fitting**

Tools for laying out, chisels, files, hammers, hand hacksaw, their specifications and uses.

### **Unit IV:**

Laying out (bench work): Sawing and Finishing by Filing.

### **D. List of Practical:**

1. T-Lap joints and Bridle joint (Carpentry Shop).
2. Gas Welding practice on mild steel flat/sheet upto 3 mm thick.
3. Lap joint by Gas Welding (upto 3mm thick).
4. Manual Metal Arc Welding practice (upto 5mm thick).
5. Pattern Making. (Carpentry Shop)
6. Laying out (bench work); Sawing and Finishing by Filing.

### **E. Teaching/Learning/Practice Pattern:**

Teaching: 20%

Learning: 20 %

Practice: 60%

### **F. Examination Pattern:**

1. Job making.
2. Viva-voce.

### **G. Reading List:**

#### **Books:**

1. *M.L. Begeman and B.H. Amstead, "Manufacturing Process" John Wiley, 1968.*
1. *W.A.J. Chapman and E.Arnold, "Workshop Technology" Vol. 1, 2 & 3, CRC press Prentice Hall*
2. *B.S. Rghuwanshi, "Workshop Technology" Vol. 1 & 2 – Dhanpat Rai and Sons.*
3. *Hazra and choudhary "Workshop Technology" Vol. 1, 2, Media Promoters*
4. *VirenderNarula "Workshop Technology",S.K.Kataria& Sons*

#### **Magazines**

1. *International Metal Working News.*
2. *Industrial Distribution*

#### **Journals**

1. *International Journal of Machine Tools and Manufacture*
2. *Journal of Manufacturing Science and Engineering, Transactions of the ASME*
3. *Journal of Manufacturing Technology and Research*

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**Name of the Module: Basic Electrical & Electronics Engineering**

**Module Code: EE 101**

**Semester: 1<sup>st</sup>**

**Credit Value: 4 [P=2, T=0, L=3]**

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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

### A. Objectives:

The course is designed to meet with the objectives of:

1. To make the students familiar with the course and its importance.
2. Introduction to Basic Electrical & Electronics Engineering.
3. Basic knowledge of DC circuits, Electromagnetism, AC fundamental.
4. Introduction to DC, AC single and three phase machine, their construction and working principles.
5. Introduction to measurement of electrical quantities.
6. Making familiar with P-N Junction.
7. Briefing to Semiconductor devices and their applications

### B. Learning outcomes:

Students successfully completing this module will be able to:

1. Students will develop interest in learning the subject and be adequately trained to solve network problems.
2. Students will be skilled both theoretically and practically to utilize conventional circuit solving procedures.
3. Students will be substantially prepared to take up prospective design assignments.

### C. Subject matter:

#### Unit I:

**DC circuits:** Definition of electric circuit, network, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, Dependent source, Kirchhoff's law, Principle of superposition. Source equivalence and conversion, Thevenin's theorem, Norton Theorem, nodal analysis, mesh analysis, star-delta conversion. Maximum power transfer theorem with proof.

**Electromagnetism:** Biot-savart law, Ampere's circuital law, field calculation using Biot-savart & ampere's circuital law. Magnetic circuits, Analogous quantities in magnetic and electric circuits, Faraday's law, self and mutual inductance. Energy stored in a magnetic field, B-H curve, Hysteretic and Eddy current losses, lifting power of Electromagnet.

#### Unit II:

**Decision making:** Simple If statement, if-else statement, nested if else statement, Switch statement, nested switch, the operator, goto statement.

**Decision making & branching:** while statement, do-while statement, for statement. Array

#### Unit III:

**Transformers:** Construction, Types, emf equation, voltage, current, impedance and turns ratio; auto-transformer. DC machines (motor and generator)–Construction, types, emf equation, equivalent circuit, starting, speed control, braking, applications. Single phase motors, types; need of rotating field, starting, running, speed control and applications.

#### Unit IV:

**P-N Junction:** Energy band diagram, Formation of P-N junction, built-in-potential forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics, Zener breakdown, Avalanche breakdown and its reverse characteristics, junction capacitance and varactor diode. Simple diode circuits, load line, linear piecewise model; rectifiers: half



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wave, full wave, its PIV, DC voltage and current, ripple factor, efficiency, Clipper & Clamper Circuits.

**Introduction to Transistors:** Formation of PNP/ NPN junctions, energy band diagram; transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics: cut-off active and saturation mode, early effect. Introduction to Field Effect Transistor: Structure and characteristics of JFET and MOSFET, depletion and enhancement type, CS, CG, CD configurations.

### D. List of practicals: (Minimum eight experiments should be conducted by students)

1. To construct a series-parallel circuits and verify:  
Ohms law, Kirchoff's laws  
Verify Thevenin's theorem.  
Verify Norton's theorem.  
Verify Maximum Power Transfer theorem.
2. Constructan R-L-C circuit and verify  
Voltage across R, L and C  
Verify the phasor sum of the voltages across the combination of R-L-C.
3. Measurement of power in the circuit made in 2 above and verify:  
The power consumed by Resistance, Inductance and Capacitance and the total power consumed by the circuit.
4. How does the power factor varies in the circuit of 2 above if Resistance, Inductance and Capacitance are varied.
5. Study of VI Characteristics of Silicon Diode.
6. Study of VI Characteristics of Zener Diode.
7. Design and Analysis of a Half wave Rectifier using Diode.
8. Design and Analysis of a center-tap Full wave Rectifier using Diodes
9. Design and Analysis of a Bridge Rectifier Circuit.
10. Design and Analysis of a Clipping Circuit with one voltage source. (Different possible configurations)
11. Design and Analysis of a Clipping Circuit with two voltage source. (Different possible configurations)
12. Design and Analysis of a Clamper Circuit.
13. Analysis of the characteristics of BJT (CE and CB mode)
14. Design and Analysis of fixed bias circuit using NPN transistor (DC)
15. Design and Analysis of emitter bias circuit using NPN transistor (DC)
16. Determination of the characteristics of JFET.
17. Determination of the characteristics of MOSFET.
18. Verification of truth tables of logic gates.

### E. Teaching/ Learning/ Practice pattern:

Teaching: 40%

Learning: 10%

Practice: 50%

### F. Examination pattern:

3. Theoretical Examination: Written.
4. Practical Examination: Conduct Practical Examination and viva-voce.



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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### G. Reading lists:

#### Books:

1. Theraja, "Electrical technology, Vol 1 &2", Nirja Construction & Development Co. (P) Ltd.
2. Sen, P.C. "Principles of Electrical Machines and Power Electronics" John wileyand sons.
3. V.K.Mehta, "Basic Electrical Engineering" S.Chand and Co. Publication.
4. Guru and Hiziroglu "Electric Machinery and Transformers", Saunders College Pub. NY, 1990
5. Malvino: "Electronic Principle" Tata McGraw-Hill Publishing Co.Ltd.
6. Millman & Halkias: "Integrated Electronics" Tata McGraw-Hill Publishing Co.Ltd.
7. Boylestead and Nashelsky, *Electronic Devices and Circuits Theory*, 9/e, PHI, 2006.
8. R.P.Jain, *Modern Digital Electronics*, 3/e, TMH, 2000.

#### Magazines:

1. IEEE Industrial Electronics
2. Electrical Line, Canada.

#### Journals:

1. Electrical Engineering, Springer.

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### *Name of the Module: Communication Skill*

*Module Code: HSS 101*

*Semester: 1<sup>st</sup>*

*Credit Value: 1 [P=2, T=0, L=0]*

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### A. Objectives:

The course is design to meet with the objectives of:

1. To increase the Students ability to improve and utilize the skills necessary to be competent interpersonal communicator.
2. To Increase the student's understands of his or her own communication behavior.
3. To Increase the students understands of others communication behaviours.
4. To improve the students communication skills of both social professional contexts.
5. To improve the students ability to demonstrate effective complete resolution skills.

### B. Learning Outcomes:

Students successfully completing this module will be able to :

1. The students will be able to develop their communication skills on the specific subject.
2. After learning communication skills they will be able to direct effectively in their world place.

### C. Subject Matter:

#### Unit I:



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**General Principles of Communication and Oral Communication:** The Process of Communication, Principles of Communication (communication barriers, levels of Communication, Communication network, verbal, non-verbal) and Professional Communication. The Speech Mechanism, IPA symbols (vowel and consonant sounds), minimal pairs, word transcription, stress and intonation, active listening, types of listening, traits of a good listener, active versus passive listening,

### Unit II:

**Constituents of Effective Writing and Vocabulary:** The sentence and its parts, articles, the verb phrase, tense and aspect, the active and passive, the adjective, interrogative and negative sentences, concord, preposition. Paragraph development, summary writing and reading comprehension. Word formation processes: affixation, compounding, converting, use of words in different parts of speech, idioms and phrases.

### Unit III:

**Business Correspondence and Communication Strategies:** Characteristics of Business Letters, Drafting: Bio-data/Resume/Curriculum vitae (theory). Report Writing: Structure, Types of Reports (theory). Presentation Skills, public speaking and group discussion (theory) and Soft Skills (theory).

### D. List of Practical:

1. Issue Writing
2. Writing Resumes and Applications
3. Writing Memos
4. Reading Comprehension
5. Vocabulary
6. Presentation Skills
7. Group Discussion
8. Extempore
9. Debates

### E. Teaching/ Learning/ Practice Pattern:

Teaching: 40%  
Learning: 10%  
Practice: 50%

### F. Examination Pattern:

1. Theoretical Examination

### G. Reading List:

#### Books:

1. Nira Konar, "English Language Laboratory", Prentice Hall India
2. Jones, Daniel, Cambridge English Pronouncing Dictionary with CD, New Delhi, 2009.
3. Roach, Peter, English Phonetics and Phonology with CD, CUP, India, 1983.
4. Cambridge Learners Dictionary with CD, CUP, New Delhi, 2009.
5. Rajeevan, Dutt, Sasikumar, A course in Listening and Speaking I & II with CD, CUP, New Delhi, 2007.
6. Rajeevan and Dutt, Basic Communication Skills, CUP, New Delhi, 2007.
7. Software: Orell Digital Language Lab Software.



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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8. *R.C. Sharma and Krishna Mohan Business Correspondence and Report Writing*
10. *Meenakshi*
9. *Raman and Sangeeta Sharma Technical Communication, Oxford.*
10. *Krishna Mohan and Meera Bannerji, Development Communication Skills*

### Magazines:

1. *Communication Skill Magazine*
2. *Magazine for Communication*
3. *Communication Studies*

### Journals:

1. *Developing Effective Communication Skills.*
2. *Cooperative Communication Skills.*
3. *Improving Communication Skills.*
4. *Key Communication Skills.*
5. *Journal on Communication.*

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**Name of the Module: Foreign Language (French) (Audit)**

**Module Code: HSS 103**

**Semester: 1<sup>st</sup>**

**Credit Value: 0[P=2, T=0, L=0]**

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### A. objectives:

The course is design to meet with the objectives of:

1. The French Language course accords to a method created for Indian students who are complete beginners in French and who wish to acquire verbal communication skills in current scenario.

### B. Learning outcome:

Students successfully completing this module will be able to :

1. Develop four skills in French i.e. Reading, Writing, Speaking, Comprehension.

### C. Subject matter:

#### Unit-I:

Articles, Gender and Number of Nouns and Adjectives. Personal and Tonique Pronouns, Demonstrative and Possessive Adjectives, Preposition and Adverbs.

#### Unit-II

Pronominal Verbs Conjugation of Verbs of all the Groups in present Tense and Introduction to past and Future tense, Interrogation, Negation and Imperatives.

#### Unit-III

Name of days, seasons. Months, colours, garments body parts and numbers. Computer, Commerce & Marketing related Vocabulary & Terminology, Phonetics and Pronunciation.

### D. List of Practical:



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

1. Issue Writing
2. Writing Resumes and Applications
3. Writing Memos
4. Reading Comprehension
5. Vocabulary
6. Presentation Skills
7. Group Discussion
8. Extempore
9. Debates

### E. Teaching/ Learning/ Practice Pattern:

Teaching: 40%

Learning: 10%

Practice: 50%

### F. Examination Pattern:

1. Theoretical Examination

### G. Reading List:

#### Books:

*Suggested book-Ailes Volume-I*

## SEMESTER - II

Subject Code	Subject	Model	P	T	L	Credit
MAS 201	Engineering Mathematics II	S.N Bose	0	1	3	4
ME 201	Basic Elements of Mechanical Engineering	S.N Bose	0	0	3	3
CSE 201	Programming in C	J.C Bose	8	0	0	4
CHY 201	Environmental Science	J.C Bose	0	0	3	3
PHY 201	Engineering Physics II	S.N Bose	2	0	3	4
ECE 201	Digital Electronics & Logic Design	J.C Bose	2	0	3	4
HSS 201	Historiography of Science & Technology	J.C Bose	0	0	3	3
CE 201	Basic Civil Engineering	J.C Bose	3	0	0	2
ME 202	Workshop Practice II	J.C Bose	3	0	0	2
			18	1	18	29

Contact Hrs: 37

Credits: 29

**Name of the Module: Engineering Mathematics-II**

**Module Code: MAS 201**

**Semester: 2<sup>nd</sup>**

**Credit Value: 4 [P=0, T=1, L=3]**

### A. Objectives:

The course is design to meet with the objectives of:



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

1. Imparting theoretical knowledge to the students about three and more dimensional objects in space and to improve their capability of visualising of objects in space.
2. Making student competent enough to construct a differential equation/ mathematical modelling for every real life situation with its solution.
3. Giving students theoretical knowledge of vectors with the flavour of Calculus.
4. Introduce the concepts of Laplace and Fourier transforms and its application to the solution of differential equations (ODE & PDE) to the students.

### B. Learning Outcomes:

Upon completion of the subject:

1. Students will have strong visualising capability in their mind about any object.
2. Students are so trained that they will recognize various real life situation/ problem and able to solve them by constructing a differential equation/ mathematical model.
3. Students will be able to find the Laplace and Fourier representation as well as transforms of functions of one variable.

### C. Subject Matter:

#### Unit I:

**Coordinate Geometry Of Three Dimensions:** Equation of a sphere, plane section of a sphere, tangent plane, orthogonality of spheres, definition and equation of right circular cone and right circular cylinder.

#### Unit II:

**Vector Calculus:** Differentiation and integration of vector functions, scalar and vector fields, Gradient, Directional derivative, Divergence, Curl. Line integral, Surface integral and Volume integral, Green's, Gauss' and Stokes' theorems (without proofs) and their simple applications.

#### Unit III:

**Ordinary Differential Equations:** Formulation of Differential equations, Linear Differential Equations and reducible to linear form, Exact Equations, Reducible to exact form, Linear differential equations with constant coefficients, Second order ordinary differential equations with variable coefficients, Homogeneous form, Change of dependent variable, Change of independent variable, Normal form, Variation of Parameters, Solution in series of second order LDE with variable co-efficient (C.F. only), Bessel's and Legendre differential equations with their series solutions, Orthogonal properties, recurrence relations and generating function of Bessel functions and Legendre polynomials.

**Partial Differential Equation:** Linear and non-linear Partial Differential Equation of order one, Linear Partial Differential Equation with constant coefficient, Partial Differential Equation of order two with variable coefficients.

#### Unit IV:

**Basic Transform:** Laplace & Fourier.

### D: Teaching/ Learning/ Practice Pattern:

Teaching: 70%

Learning: 30%



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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Practice: 0%

### E: Examination Pattern:

Theoretical Examination and open book examination.

### F: Reading Lists:

#### Books:

1. Shanti Narayan, "Analytic Solid Geometry", S. Chand.
2. M. D. Raisinghania, "Vector Analysis", S. Chand.
3. R. K. Jain & S R. K Iyengar, "Advanced Engineering Mathematics", Narosa.
4. M. D. Raisinghania, "Ordinary & Partial Differential equations", S. Chand.
5. M. D. Raisinghania, "Advanced Differential equations", S. Chand.
6. H. K. Dass, "Higher Engineering Mathematics", S. Chand & Co.
7. B. S. Grewal, "Engineering Mathematics", S. Chand & Co.
8. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Eastern.
9. S. L. Ross, "Differential equations", Willey.
10. Pal & Das, "Engineering Mathematics", Vol. I, U. N. Dhar.
11. J. N. Sharma, A. R. Vasishtha, "Vector Calculus", Krinhna Prakashan Mandir, Meerut.
12. P. P. Gupta, G. S. Malik, "Vector Calculus", Kedarnath Ramnath, Meerut.
13. Brahma Nand, B. S. Tyagi, B. D. Sharma, "Co-ordinate Solid Geometry", Kedarnath Ramnath, Meerut, Delhi.
14. A. R. Vasishtha, D. C. Agarwal, "Analytical Geometry of Three Dimensions", Krinhna Prakashan Media (P) Ltd, Meerut.

#### Magazines:

1. Current Science (Indian Academy of Science).
2. The Mathematics Student (Math Student) (Indian Mathematical Society).
3. Mathematical Spectrum (The University of Sheffield).
4. Mathematics Magazine (Mathematical Association of America).
5. +Plus magazine (University of Cambridge).
6. Ganithavahini (Ramanujan Mathematical Society).
7. Mathematics Today, London Metropolitan University.

#### Journals:

1. Journal of Engineering Mathematics, Springer.
  2. Journal of Computational and Applied Mathematics, London Metropolitan University.
  3. The Journal of Indian academy of Sciences.
  4. Bulletin of Pure and Applied Sciences.
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**Name of the Module: Basic Elements of Mechanical Engineering**

**Module Code: ME 201**

**SEMESTER: 2<sup>nd</sup>**

**Credit Value: 3 [P=0, T=0, L=3]**

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#### A. Objectives:





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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

The course is design to meet with the objectives of:

1. Ability to utilise scalar and vector analytical techniques for analysing forces in statically determinate structures.
2. Ability to apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.
3. Student gets a basic idea of Engineering Mechanics, Fluid Mechanics, Strength of Material and Thermodynamics.

### B. Learning Outcome:

Upon completion of the subject:

1. Should have knowledge of different type of force resolving
2. Should have knowledge of centre of gravity of different size, shape, and solid.
3. Should have knowledge of basic idea of Engineering Mechanics, Fluid Mechanics, Strength of Material and Thermodynamics.

### C. Subject Matter:

#### Unit I:

**Thermodynamics:** Introduction to Thermodynamics, Concepts of system control volume, state, properties, equilibrium, quasi- static process, reversible & irreversible process, cycle. Zeroth Law and Temperature, Heat and Work transfer Definition, Sign convention, various P-dV work done (Isobaric ,Isochoric, Polytropic, adiabatic and isothermal processes) and related problems.

1st Laws of Thermodynamics for closed & open systems (ii) Non Flow Energy Equation (iii) Steady State, Steady Flow Energy Equation and related problems. , Equivalence of two statements, Definition of Heat Engines, Heat pumps, Refrigerators Carnot and related problems. Air Standard cycles – Otto and Diesel cycle and their efficiencies and related Problems

#### Unit II:

**Fluid Mechanics:** Properties & Classification of Fluids – ideal & real fluids, Newton's law of viscosity, Newtonian & Non Newtonian Fluids, Compressible & Incompressible fluids Pressure at a point, Pascal's law. Measurement of Pressure. Continuity equation. Bernoulli's equation and its application,

#### Unit III:

**Statics:** Particle and Rigid body concept; Types of forces (collinear, concurrent, parallel, concentrated, distributed). Vector and scalar quantities, Transmissibility of a force (sliding vector); Lamé's Theorem. Two and three dimensional force systems; Moment and Couple, Varignon's theorem, Resultants, Free body concept.

#### Centroid and Centre of Gravity:

Moments of inertia of plane figures: M.I. of plane figures : MI of plane figure with respect to an axis in its plane; MI of plane figure with respect to an axis Parallel to the plane of the figure

#### Unit IV:

**Strength Of Materials:** Concept of simple stresses and strains. Yield strength, Normal stress Shear stress, Bearing stress, Normal strain, Shearing strain, Hooke's law, poisson's ratio, Examples.

**Dynamics:** Kinematics and Kinetics; Rectilinear motion of particles; determination of



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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position velocity and acceleration – under uniform rectilinear motion (uniform and non-uniform accelerated rectilinear motion), Relative motion, construction of x-t, v-t and a-t graphs (simple problems), Projectile motion, Normal and Tangential components, Radial and Transverse components, simple problems. Equation of motion, D'Alembert's principle.

**D. List of Practical:** No practicals.

**E. Teaching/Learning/Practice Pattern:**

Teaching: 60 %

Learning : 40 %

Practice : 0%

**F. Examination Pattern:**

1. Theoretical Examination

**G. Reading List:**

**Books**

1. P.K. Nag , “Engineering Thermodynamics” 2nd Edition, Tata McGraw Hill Publisher
2. S.K. Som & G. Biswas, “Introduction to Fluid Mechanics & Fluid Machines” Tata McGraw Hill
3. Timo & Young, “Elements of Strength of Materials” D Van Nostrand Company
4. Mariam & Kraige, “Engineering Mechanics (Vol-II) Dynamics” Wiley Publisher
5. Meriam & Kraige, “Engineering Mechanics, Vol-I (Statics)” Wiley India

**Magazine**

1. Popular Mechanics. Everyday
2. Engineering Magazine

**Journals**

1. International Journal of Applied Mechanics and Engineering
2. Journal of Applied Mechanics, ASME
3. Journal of Engineering Mechanics, ASCE.

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**Name of the Module: Programming in C**

**Module Code: CSE 201**

**Semester: 2<sup>nd</sup>**

**Credit Value: 4 [P=8, T=0, L=0]**

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**A. Objectives:**

The course is designed to meet with the objectives of:

1. introducing art, science and engineering of C programming language to the students of all UG programs,
2. teaching and training of different problems in data structures,



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

3. guiding and training students to write efficient coding,
4. guiding & training students to fragment problems into different functions or units.

### B. Learning outcomes:

Students successfully completing this module will be able to:

1. understand the basic terminology used in computer programming
2. write, compile and debug programs in C language in different operating systems.
3. design programs involving decision structures, loops and functions.
4. use and apply the dynamics of memory by the use of pointers in engineering applications.
5. use and apply the differences between structure oriented and function oriented programming in programming applications.

### C. Subject matter:

#### Unit I:

**Basic concept:** Some basic concept of binary number, Octal number, hexadecimal number system and there conversion among them. Assembly language, high level language, Compiler and assembler (basic concept).

**Keyword & Identifiers:** History & Importance of C, Basic structure of C programs, C fundamentals: The C character set identifier, Constants and keywords, data types & size, variable names, declaration, statement, C token, symbolic constant.

**Operators and Expression:** Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment & Decrement operators, Condition Operators, Bitwise Operators, Special operators, precedence of arithmetic operators.

**Managing Input & output operations:** using of printf( ) & scanf( ).

#### Unit II:

**Decision making:** Simple If statement, if-else statement, nested if else statement, Switch statement, nested switch, the operator, goto statement.

**Decision making & branching:** while statement, do-while statement, for statement. Array

#### Unit III:

**String & pointer:** One-dimension array, Two-dimension array and multi dimension array. String: Operation on String without using library function and using library function. Pointer: Declaration of pointer variables, accessing the variable by using pointer, pointer increment and decrement operator, pointer and array.

**Functions:** Basic functions, function type, function with no argument & no return value, function with no argument but return value, function with argument & return value, Storage class identifier, Call by reference, Recursive function. Pointer to function.

#### Unit IV:

**Structure & Union:** Defining a structure, accessing of structure variable, structure and array, array within structure. Nested structure, structure & functions, Pointer & structure, Unions.

**File management system:** Advantage of using file, Open ,close, read. write in the files, Operation on files.

**Dynamic memory Allocation:** use of Malloc, calloc, realloc, free. Library functions, Linked list concept.

**The pre-processor:** macro statements.

### D. List of practicals: (Minimum eight experiments should be conducted by students)

1. Write a program to find the highest number of a given set of numbers and print the numbers of the set in descending order. [Minimum size of set=50]



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- Write a program to list even numbers and odd numbers separately in ascending order of a given set of minimum size of 50.
- Write a program to find roots of a given quadratic equation.
- Write a program to test whether a given number is prime or not.
- Write a program to check whether a given number is a palindrome or not ( ForEg. 121- $\rightarrow$ 121).
- Write a program to compute the following series and test it for different inputs.

a)  $2 + 4 + 6 + 8 \dots \dots \dots$

b)  $f(x) = 1! + 2! + 3! + 4! + \dots \dots \dots$

c)  $f(x) = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots \dots \dots$

d)  $f(x) = 1 + x + x^2 + x^3 + x^4 + \dots \dots \dots$

- Write a program to display the following patterns using nested for loops.

a) \*  
\*\*  
\*\*\*  
\*\*\*\*

b) ####  
###  
##  
#

c) 1010  
010  
10  
0

d) \*  
\*\*  
\*\*\*  
\*\*\*\*

e) ABCDCBA  
ABC CBA  
AB BA  
A A

f) | \* \*  
\*\* \*\*  
\*\*\* \*\*\*  
\*\*\*\*\*

- Write a C program to find the maximum element from given input array elements.
- Write a C program to sort an array elements using BUBBLE sort.
- Implement the C program for the following numbering system conversion:
  - Decimal to Binary and Vice-versa (By a single algorithm both for integer and fractional part).
  - Octal to Binary and Vice-versa.
  - Hexadecimal to Binary and Vice-versa.
- Write a program to add two given matrices each of size (nXm).
- Write a program to multiply any two given matrices.
- Write a program to check whether a given matrix is Identity matrix or not.
- Write a program to generate calendar of a given year & print both in desk and wall mode.
- Write a program to implement factorial of a given input using recursive function.
- Write a program to differentiate between call by value and call by reference.
- Write a program to pass an array to a function and find minimum value of it.
- Write a program to explain scope, visibility and the lifetime of variables.
- Write a program to explain reference variable and its implementation.
- Write a program to swap two values using pointer and function.
- Write a mini project to store all records of students and search by their name, roll number or registration number.
- Write a program the explain the concept of pointer to a structure..
- Write a program to differentiate between Enumerated data types, Union and Structures.
- Write a program to create, edit, open, delete a file and perform different operations accordingly.
- Write a program to backup one file to another file.
- Write a program to merge two files.
- Write a mini project to control mouse cursor and display whether left, right or scroll happens.

### E. Teaching/ Learning/ Practice pattern:

Teaching: 40%



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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Learning: 10%

Practice: 50%

### F. Examination pattern:

2. Theoretical Examination: Open book and on line.
3. Practical Examination: Conduct Programming test and viva voice.

### G. Reading lists:

#### Books

1. Kernighan and Ritchie, "The 'C' programming language", Prentice Hall.
2. Yashavant P. Kanetkar, "Let Us C", Infinity Science Press, 2008.
3. Herbert Schildt, "C: The Complete Reference", McGraw-Hill Education, 2000.
4. Balaguruswamy, "Programming In Ansi C, 5E", Tata McGraw-Hill Education, 2011.
5. Govil, Agrawal, Mathur & Pathak, "Computer Fundamentals and Programming in C", Jaipur Publication House (JPH)
6. M.T. Somashekara, "Programming in C", PHI Learning Pvt. Ltd., 2005.
7. Sinha & Sinha, "Foundations of Computing", BPB Publications, 2002.
8. J. B. Dixit, "Computer Fundamentals and Programming in C", Firewall Media, 2009.
9. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 2014.
10. K. N. King, "C Programming: A Modern Approach", W.W. Norton, 2010.
11. Zed Shaw, "Learn C The Hard Way", Addison Wesley Professional, 2015.
12. Steve Oualline, "Practical C Programming, 3rd Edition", O'Reilly Media, Inc., 2003.
13. Ajay Mittal, "Programming In C: A Practical Approach", Pearson Education India, 2010.
14. A.P. Godse, D.A. Godse, "Computer Concepts and Programming in C", Technical Publications, 2008.

#### Magazines:

3. C/C++ Users, CMP Media LLC publication, United States.
4. EPS Software Corp/CODE Magazine, 6605 Cypresswood Drive, Suite 300 Spring, TX 77379.

#### Journals:

2. Science of Computer Programming: Methods of Software Design: Techniques and Applications, Elsevier, ISSN: 0167-6423
3. Programming and Computer Software, Springer, ISSN: 0361-7688.
4. Dr. Dobb's Journal, United Business Media publication, United State, ISSN: 1044-789X
5. Journal of C Language, CMP Media LLC publication, United States
6. C vu Journal, ACCU, UK.

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**Name of the Module: Environmental Science**

**Module Code: CHY 201**

**Semester: 2<sup>nd</sup>**

**Credit Value: 3 [P=0, T=0, L=3]**

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### A. Objectives:

The course is designed to meet with the objectives of:



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

1. Imparting the knowledge to the students in the area of Environmental Engineering.
2. Providing teaching and learning to make students acquainting with advanced science and technology in Environmental Science.
3. Injecting the future scope and the research direction in the discipline of Environmental Engineering.
4. Making students competent to the research and development in Environmental Engineering.

### B. Learning outcomes:

1. Students successfully completing this module will be able to:
2. Students will be adequately trained to become Scientist, trainers and Chemical Engineers.
3. Students will be skilled both to control and maintenance in Environmental pollution, waste water treatment and other related activities in Environmental Engineering.
4. Students will be substantially prepared to take up prospective research assignments.

### C. Subjects Matters:

#### Unit I:

**Environment:** Concepts of Environment, Environmental gradients, Tolerance levels of environment factor, EU, US and Indian Environmental Law. Chemistry in Environmental Engineering: Chemistry of the atmosphere, combustion related air pollution, global environmental problems - ozone depletion, greenhouse effect, acid rain etc.

**Ecological Concepts:** Biotic and Abiotic components, Ecosystem Process: Energy transfer, Food Chain and Food Web, Water cycle, Oxygen cycle, Carbon cycle, Nitrogen cycle etc., Soil chemistry. Soil composition, properties, identification and classification. Noise pollution Effect of noise on people, rating systems, community noise sources and criteria, traffic noise prediction, noise control. Noise standards, measurement and control.

#### Unit II:

**Waste Water Treatment:** Water Treatment: water quality standards and parameters, Ground water. Water treatment processes, Pre-treatment of water, Conventional process, advanced water treatment process. DO and BOD of Waste water treatment process, primary and secondary treatment of waste water, Activated sludge treatment: Anaerobic digestion, Reactor configurations and methane production. Water resources, characteristics of water, water pollutants, oxygen demanding wastes, surface water quality, groundwater quality, water treatment systems, biomedical wastes treatment technologies and disposal options.

#### Unit III:

Solid waste, Definition and characteristics of industrial and hazardous wastes. Hazardous waste management, Solid Waste Management, Source classification and composition of MSW: Separation, storage and transportation, Reuse and recycling, Waste Minimization Techniques. Hazardous waste and their generation, Transportation and treatment: Incinerators, Inorganic waste treatment. E.I.A., Environmental auditing, Hazardous substances and risk analysis: Hazardous substance legislation, risk assessment, haza



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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rd deification, potential carcinogens, toxicity testing in animals, human exposure assessment.

### Unit IV:

Air quality standards, emission standards, criteria pollutants, air pollution and meteorology, atmospheric dispersion, emission controls. Air pollution and pollutants, criteria pollutants, Acid deposition, Global climate change –greenhouse gases, non-criteria pollutants, air pollution meteorology, Atmospheric dispersion. Industrial Air Emission Control. Flue gas desulphurization, NOx removal, Fugitive emissions.

### D. Reading List:

#### Books:

1. G. Kiely, "Environmental Engineering" Irwin/ McGraw Hill International Edition, 1997, ,
2. Arcadio P. Sincero & Gergoria A. Sincero, "Environmental Engineering" Prentice Hall India
3. M. L. Davis and S. J. Masen, "Principles of Environmental Engineering and Science", McGraw Hill International Edition, 2004
4. Curringham & Saigo, "Environmental Science", TMH,
5. Gilbert M. Masters & Wendell P. Ela, "An Introduction to Environmental Engineering and Science", PHI Publication.
6. Gilbert M Masters, " Introduction to Environmental Engineering and Science" Prentice Hall
7. J. G. Henry and G. W Heinke "Environmental Science and Engineering" Benjamin/Cummings Publishers
8. M.L. Davis and D.A. cornwell "Introduction to Environmental Engineering" McGraw-Hill Education

#### Magazines:

1. Applied Environmental Research Foundation
2. Environmental Science and Engineering
3. Climate Wire
4. Down to Earth
5. The Green Economist
6. Green Wire

#### Journals:

1. Journal of Environmental Science, Elsevier Publication
2. Environmental Science and Technology, ACS Publication
3. Energy and Environmental Science, RSC Publication
4. Environmental International, Elsevier Publication

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**Name of the Module: Engineering Physics - II**

**Module Code: PHY 201**

**Semester: 2<sup>nd</sup>**

**Credit Value: 4 [P=2, T=0, L=3]**

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### A. Objectives:

The course is design to meet with the objectives of:



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

1. Imparting theoretical & practical knowledge to the students in the area of Engineering Physics.
2. Providing teaching and learning to make students acquainting with modern state-of-art of Engineering
3. Injecting the future scope and the research direction in the field of Physics with specific specialization.
4. Making students competent to design & development of Engineering Physics.

### B. Learning Outcomes:

Students successfully completing this module will be able to:

1. Students will be adequately trained to become Engineers.
2. Students will be substantially prepared to take up prospective research assignments Students will be substantially prepared to take up prospective research assignments.

### C. Subject Matter:

#### Unit I:

**Electricity:** Coulombs law in vector form, Electrostatic field and its curl, Gauss's law in integral form and conversion to differential form, Electrostatic potential and field, Poisson's Eqn. Laplace's Eqn. (Application to Cartesian, Spherically and Cylindrically symmetric systems-effective 1D problems) Electric current, drift velocity, current density, continuity equation, steady state current Dielectrics- concept of polarization.

#### Unit II:

**Magnetostatics & time varying Field:** Lorentz force, force on a small current element placed in a magnetic field, Biot-Savart law and its applications, divergence of a magnetic field, vector potential, ampere's law in integral form and conversion to differential form, Faraday's law of electromagnetic induction in integral form and conversion to differential form.

**Electromagnetic theory:** conception of displacement current, Maxwell 's field equations, Maxwell's wave equation and its solution for free space, E.M wave in a charge free conducting media, skin depth, physical significance of skin depth, E.M. energy flow & poynting vector.

#### Unit III:

**Quantum Mechanics:** Wave particle duality, Compton effect, Photo electric effect, Black body radiation, Heisenberg's uncertainty relation, concept of wave packet. Conception of probability and probability density, operators, commutator, Formulation of quantum mechanics and basic postulates, Time dependent Schrodinger's equation, Formulation of Time independent Schrodinger's equation, physical interpretation of wave function, Free particle and particle in a box.

#### Unit IV:

**Statistical Mechanics:** Concept of energy levels and energy states. Microstates, macrostates and thermodynamic probability, equilibrium macrostate. MB, FD, BE statistics (No deduction





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necessary), fermions, bosons (definitions in terms of spin, examples), physical significance and application, classical limits of quantum statistics Fermi distribution at zero & non-zero temperature, Bose-Einstein statistics – Planck's law of blackbody radiation.

### D. List of practicals: (Minimum six experiments are required to be performed)

1. Determination of dielectric constant of a given dielectric material.
2. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
3. Determination of specific charge (e/m) of electron by J.J. Thomson's method.
4. Determination of Planck's constant using photocell.
5. Determination of Rydberg constant by studying Hydrogen/ Helium spectrum.
6. Determination of Stefan's radiation constant.
7. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
8. Determination of Hall co-efficient of semiconductors.
9. Determination of band gap of semiconductors
10. Use of carry Foster's bridge to determine unknown resistance

### E. Teaching/ Learning/ Practice Pattern:

Teaching : 40%

Learning : 10%

Practice : 50%

### F .Examination Pattern:

1. Theoretical Examination: Open book and on line.
2. Practical Examination: Conducting Experiment and Viva-Voce.

### G. Reading lists:

#### Books

1. Herbert Goldstein, Charles P. Poole and John Safko, " Classical Mechanics" 3<sup>rd</sup> edition, Pearson.
2. N. C. Rana and P. S. Joag, "Classical Mechanics", Tata McGraw Hill Education Private Limited, New Delhi.
3. D. Chattopadhyay and P. C. Rakshit, "Electricity and Magnetism" , New Central Book Agency (P) Ltd.
4. David J. Griffiths, "Introduction to Electrodynamics," 3rd edition, PHI Learning Private Limited.
5. W. H Hayt and J A Buck, "Engineering Electromagnetics" 7<sup>th</sup> edition, Tata McGraw Hill Education Private Limited, New Delhi.
6. Eisenberg and Resnick, "Quantum Physics", 2<sup>nd</sup> edition, Wiley India.
7. F. Reif, "Statistical Physics" Tata McGraw Hill Education Private Limited, New Delhi.
8. S. N. Ghoshal, "Atomic Physics" S. Chand



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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9. *Beiser, Mahajan and Choudhury, " Concepts of Modern Physics" Tata McGraw Hill Education Private Limited, New Delhi.*
10. *A. B. Gupta, "Modern Atomic and Nuclear Physics" BOOKS and Allied (P) Ltd.*
11. *Jeremy Bernstein, Paul M. Fishbane and Stephen G. Gasiorowicz " Modern Physics" Pearson.*
12. *Richard P. Feynman, Robert B. Leighton and Matthew Sands, " The FEYNMAN Lectures on Physics" Vol. I to Vol. IV, Pearson*
13. *D. Chattopadhyay and P. C. Rakshit, "An Advanced Course in Practical Physics" New Central Book Agency (P) Ltd.*

### Magazine:

1. *Resonance*
2. *American Teacher*
3. *Scientific Physics*
4. *Physics Today*
5. *Physics For You*

### Journals:

1. *Nature*
2. *Physical Review Letter*
3. *Physical Review A & B*
4. *Applied Physics Letters (APL)*
5. *Proceedings of the National Academy of Sciences*
6. *Chemical Physics Letters*
7. *Journal of Physics: (Including A, B, C, D, E, F & G)*
8. *Journal of Scientific & Industrial Research*
9. *Indian Journal of Engineering & Material Sciences*
10. *Indian Journal of Radio and Space Physics*

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**Name of the Module: Digital Electronics & Logic Design**

**Module Code: ECE 201**

**Semester: 2<sup>nd</sup>**

**Credit Value: 4 [P=2, T=0, L=3]**

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### A. Objectives:

The course is designed to meet the objectives of:

1. To make the students to build a solid foundation about Boolean algebra
2. To make the students to study Digital Logic Gates and Circuits
3. To provide a clear foundation of Modern Digital System



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

### B. Learning outcomes:

At the end of this module, students are expected to be able to

1. Clear understanding & utilization of logic gates
2. Design and develop of advanced TTL logic circuits
3. Utilization of Combinational and Sequential circuits, Counters, ADC and DAC

### C. Subject matter:

#### Unit I:

**Number Systems:** Decimal, Binary, Octal and Hexadecimal systems, conversion of a number from one base to another.

**Codes:** BCD, Excess- 3, Gray, Reflected, ASCII, EBCDIC.

**Algebra for logic circuits:** Logic variables; Logic constants; Logic functions- NOT, AND, OR, NAND, NOR, Ex-OR;

**Combinational circuits:** Full Adder / Subtractor, BCD Adder, LAC Adder, Comparator, Decoder, Encoder, Priority Encoder, MUX/DEMUX & there structures, Combinational logic design using ROM array, Applications of MSI designs.

#### Unit II:

**Minimization Techniques & System Design:** Basic models of sequential M/C, Analysis of Asynchronous and Synchronous circuits, Synthesis of completely and incompletely specified synchronous sequential M/Cs, Combination & Sequential Circuits. Boolean Algebra (including Shanon's expansion theorem and consensus theorem); Ven diagram representation, Canonical representations-min-term, max-term; Karnaugh map simplification, Quine Mc-clusky minimization. Minimization of Multiple Input and multiple Output system. Introduction to state machines. Classification of State Machines. State Machine Applications. Analysis of State Machine, State table, State Diagram, State Equation, State reduction and State assignment.

#### Unit III:

**Other Gates & Circuits:** Difference between combinational and sequential circuits,

**Sequential Gates:** Triggering of sequential logic circuits. Difference between flip flop and latch – Construction of RS, D, JK, JK master slave, T flip flops using basic gates, preset and clear signal,

**Shift Registers:** Serial in serial out – Serial in parallel out, Parallel in serial out, Parallel in parallel out, Universal Shift Registers & their Applications.

**Counters:** Asynchronous and synchronous counter, Ripple counter, Mod-N counter, Up-down counter, Ring counter, Johnson counter, Programmable counter – Applications. Design of Synchronous State Machine (including Counter) and Asynchronous state machine.

#### Unit IV:

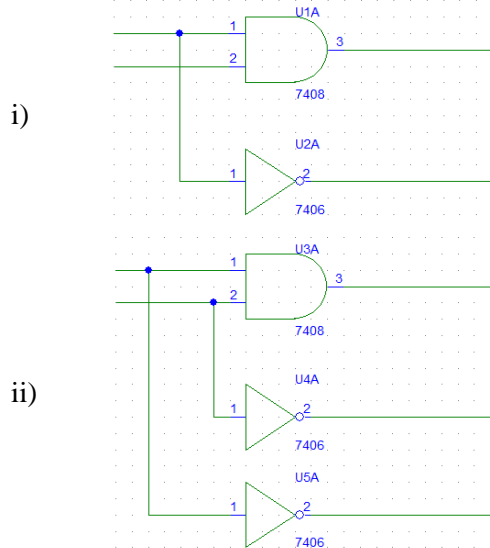
**Logic Families:** Comparative studies of different type of logic families like RTL, Diode logic, DTL, TTL, IIL, HTL, ECL, MOS & CMOS etc. with the following characteristics: (a) logic levels, (b) power dissipation, (c) fan in and fan out, (d) propagation delay, and, (e) noise immunity.

**Data Converters:** Digital to Analog Converters: Binary weighted resistor type, R-2R ladder type, Specifications and applications of DA converter. Analog to Digital Converter: Comparator type, Successive approximation type, Dual slope AD converter, Specifications and applications of AD converter.



**D. List of Experiments: (Minimum eight experiments should be conducted by students)**

1. Study Data Hand Book and list at least 5 chips for each of primary, secondary gates & flip-flops and draw their diagram with pin configuration.
2. Verify Truth Table of NOT, 2-input AND and 2-input OR gate thereby inference.
  - i) Single line definition of multiple input AND & OR gate.
  - ii) What is the primary difference between NOT gate from AND & OR gate.
3. Study the Truth Table of the following by circuits.



- iii) Compare the Truth Table of i) & ii) and that of AND gate and state inference.
4. Design Gray to Binary and Binary to Gray Converter & test
  5. Design and test byte operated even parity generator & then convert it to odd parity generator.
  6. Design and test (7,4) Hamming Code Generator and Error Correction decoder.
  7. Design a Majority Gate and use it & a XOR gate to realize Adder Circuit & Verify.
  8. With Serial Data input design a single circuit for test of >, < and = for two data.
  9. Minimize the following logic system with SOP by tabular technique & implement the circuit.
    - i)  $f_1(A,B,C,D) = m_0 + m_1 + m_2 + m_3 + m_5 + m_6 + m_{10} + m_{13} + m_{15}$
    - ii)  $f_2(A,B,C,D) = m_0 + m_1 + m_2 + m_3 + m_5 + m_7 + m_{10} + m_{13}$
    - iii)  $f_3(A,B,C,D) = m_1 + m_2 + m_4 + m_5 + m_6 + m_7$
  10. Minimize the following logic circuit defined in POS by tabular minimization technique:
    - i)  $f_1(X,Y,Z) = M_0.M_1.M_3.M_7$
    - ii)  $f_2(X,Y,Z) = M_0.M_1.M_2.M_6.M_7$
  11. Write a C program to implement Tabular Technique for minimization of system as in problem (8) & (9)
  12. Test Truth Table of
    - i) S – R flip flop
    - ii) J – K flip flop
    - iii) D – flip flop
    - iv) T – flip flop
  13. Design 1 bit Read/Write memory with flip-flop and other logic gate & test.
  14. Design Serial input & parallel output Shift register & test.
  15. Design a binary counter & test.



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16. Design one ADC & one DAC circuit & test.

### E. Teaching/Learning/Practice Pattern:

Teaching : 40%

Learning : 10%

Practice : 50%

### F. Examination Pattern:

1. Theoretical Examination: Open book/ Regular examination and on line test.
2. Practical Examination: Conducting Experiment and Viva-Voice.

### G. Reading List:

#### Books:

1. J Crowe & B. Hayes-Gill, "Introduction to Digital Electronics", Newnes.
2. T. L. Floyd, "Digital Fundamentals" (9<sup>th</sup> Edition), Prentice Hall.
3. Taylor L. Both, "Introduction to Computer Engineering", 3<sup>rd</sup> Ed., John Wiley & Sons
4. R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill.
5. R L Morris & J R Miller, "Designing with TTL integrated circuits", McGraw Hill
6. C. H. Roth (Jr.), "Fundamentals of Logic design", Cengage Engineering.
7. M. Morris Mano, "Digital Logic Design" (3<sup>rd</sup> Edition), Prentice Hall.
8. Malvino & Leach, "Digital Principles and Applications", Tata McGraw Hill.
9. Anand Kumar, "Fundamentals of Digital Circuits", Prentice Hall.

#### Magazines:

1. Planet Analog, <http://www.planetanalog.com/>
2. IEEE Spectrum, <http://spectrum.ieee.org/>
3. Electronics for you, EFY Enterprises Pvt. Ltd, New Delhi, <http://www.electronicsforu.com/>
4. Electropages, <http://www.electropages.com/>

#### Journals:

1. International Journal of Electronics Devices and Circuits.
2. IEEE Transaction on Computer-Aided Design of Integrated Circuits and System.
3. IEEE Transaction on Computer.

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**Name of the Module: History of Science & Technology**

**Module Code: HSS201**

**Semester: 2<sup>nd</sup>**

**Credit Value: 3[P=0, T=0, L=3]**

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### A. Objectives:

The course is design to meet with the objectives of:

1. Providing teaching with inclusive learning.
2. Imparting theoretical lectures with case discussion.
3. Making students aware about the importance of this subject in their future career.



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### B. Learning Outcomes:

Students successfully completing this module will be able to :

1. Students will be to work with efficiency as they had knowledge of the subject.
2. With the backup knowledge their performance will definitely be much better in their workplace.

### C. Subject Matter:

#### Unit I

**Introduction:** An overview: definitions, Different approaches to the scientific explorations, to introduce humanity's endeavour behind science and its application over the centuries, characteristics of histography of science and technology.

#### Unit II

**Motivation:** Nature of drives, needs and motives, work motives, need of hierarchy theory and two factor theory of motivation, How to motivate the workers at work, factors effecting the morale of workers.

**Lives of Eminent Scientists:** To understand the Background, Opportunities, Achievements and Qualities in their efforts to become Scientist of first order.

**Scientific Eras:** Course of Civilization and Scientific Endeavour.

**Contribution of science:** Contribution to the present day World.

#### Unit III

Answers to the Criticism that Science has created a World full of Pollutions

### D. Teaching/Learning/Practice Pattern:

Teaching : 40%

Learning : 10%

Practice : 50%

### E. Examination Pattern:

1. Theoretical Examination: Open book/ Regular examination and on line test.

### F. Reading List:

#### Books:

1. Agassi, Joseph. *Towards an Historiography of Science*, Wesleyan University Press. 1963.
2. Kragh, Helge *An Introduction to the Historiography of Science*, Cambridge University Press. 1990.
3. Kuhn, Thomas. *The Structure of Scientific Revolutions*, Chicago: University of Chicago, 1962 (third edn, 1996)
4. Gopala krishnan, K.V. *Inventors Who Revolutionised Our Lives*, National Book Trust, India. 1999.

#### Magazine:

1. *Science and Technology Magazine*
2. *Histography of contemporary Science and Technology*
3. *Science News Letter*

#### Journal:



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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1. *Historiography in Graduate Technology*
  2. *Innovation, Technology or History*
  3. *Historiography of the Sciences*
- 

**Name of the Module: Basic Civil Engineering**

**Module Code: CE 202**

**Semester: 2nd**

**Credit Value: 22 [P=3, T=0, L=0]**

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### **A. Objectives:**

The course is design to meet with the objectives of:

1. Increase ability to understand Engineering Drawing.
2. Learn to sketch and take field dimensions.
3. Learn to take data and transform it into graphic drawings.
4. Learn basic engineering drawing formats.
5. Prepare the student for future Engineering positions.

### **B. Learning Outcome:**

Upon completion of the subject:

1. Student's ability to perform basic sketching techniques will improve.
2. Students will be able to draw orthographic projections and sections.
3. Student's ability to use architectural and engineering scales will increase.
4. Students ability to produce engineered drawings will improve
5. Student's ability to convert sketches to engineered drawings will increase.
6. Students will become familiar with office practice and standards.

### **C. Subject Matter:**

#### **Unit I:**

Traditional Materials: stones, bricks, lime, cement, timber. Mortar: sand, cement mortar, mud mortar, special mortar, test on mortar Concrete: plain concrete, reinforced cement concrete, reinforced brick concrete

#### **Unit II:**

Metals as Building materials: Ferrous metals, aluminum, copper. Miscellaneous Building materials: Glass, plastics, bitumen, asbestos, paints, distempers, varnishes, solid and hollow concrete Blocks, Roofing and flooring tile

#### **Unit III:**

Superstructures: Types of superstructure based on the method of load transfer, walls, stone masonry, brick masonry, plastering, pointing, flooring, roof, doors and lintels, stairs.

#### **Unit IV:**



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Surveying: Introduction to surveying-Object and uses of surveying, primary divisions of surveying, fundamental principles of surveying, classification of surveying, plans and maps, scales.

### D. Teaching/Learning/Practice Pattern:

Teaching : 40%

Learning : 10%

Practice : 50%

### E. Examination Pattern:

1. Theoretical Examination: Open book/ Regular examination and on line test.

### F. Reading List:

#### Books

1. Rakesh Roshan Beohar, "Basic Civil Engineering", Laxmi Publications.
2. Ramamurtham, "Basic Civil Engineering", Dhanpat Rai and sons
3. S S Bhavikatti "Basic Civil Engineering" New Age international Publishers,

#### Magazine

1. Civil Engineering and construction Review.

#### Journals

1. ASCE
2. Springer.

## ***Name of the Module: Workshop Practice-II***

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***Module Code: ME 202***

***Semester: 2<sup>nd</sup>***

***Credit Value: 2 [P=3, T=0,L=0]***

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### **A.Objectives:**

The course is design to meet with the objectives of:

1. To acquire skills in basic engineering practice.
2. To identify the hand tools and instruments.
3. To acquire measuring skills.
4. To acquire practical skills in the trades.
5. To acquire practical skills in welding, carpentry, fitting.

### **B. Learning Outcome:**

Upon completion of the subject:

1. Should have knowledge of workshop safety.
2. Should have knowledge of Handling workshop tools, machines.
3. Should have knowledge of different welding types.





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4. Should have knowledge of different carpentry joints.
5. Should have knowledge of different tools working principle.

### C. Subject Matter:

#### Unit I:

**Bench work and Fitting:** Tools for laying out, chisels, files, hammers, hand hacksaw, their specifications and uses, plumbing, Sheet metal Work.

#### Unit II:

**Metal Joining:** Definitions of welding, brazing and soldering processes, and their applications. Oxy acetylene gas welding process, equipment and techniques. Types of flames and their applications. Manual metal arc welding technique and equipment. AC and DC welding, electrodes, constituents and functions of electrodes. Welding positions. Types of weld joint. Common welding defects such as cracks, slag inclusion and porosity.

#### Unit III:

**Machine Shop:** Introduction, Basic Principles of Lathe, Shaper, Milling, Drilling, Grinding, Power Hacksaw, etc.

### D. List of Practicals:

1. To practice Gas welding using a 3mm thick mild steel plate. (Welding Shop)
2. To prepare a Lap joint and Butt joint by Gas Welding from 3mm thick mild steel plate (Welding Shop).
3. To practice Manual metal arc welding using a 5mm thick mild steel plate (Welding Shop).
4. To prepare various patterns using wood as a pattern material with the help of specific tools. (Carpentry Shop)
5. To perform various bench working operations like sawing, filling and finishing on a 5mm thick mild steel plate using specific tools (Fitting Shop).
6. To prepare jobs (Square, Angular and Semi Circular grooves) using 5mm mild steel plate using specific tools (Fitting Shop)
7. T-Lap joint and Bridle joint (Carpentry Shop).
8. Gas Welding practice on mild steel flat/sheet upto 3 mm thick.
9. Lap joint by Gas Welding (upto 3mm thick).
10. Manual Metal Arc Welding practice (upto 5mm thick).
11. Pattern Making. (Carpentry Shop)
12. Laying out (bench work); Sawing and Finishing by Filing.

### E. Teaching/Learning/Practice Pattern:

Teaching: 20%  
Learning: 20 %  
Practice: 60%

### F. Examination Pattern:

1. Job making.
2. Viva-voce.

### G. Reading List:



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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### Books:

2. *M.L. Begeman and B.H. Amstead, "Manufacturing Process" John Wiley, 1968.*
3. *W.A.J. Chapman and E.Arnold, "Workshop Technology" Vol. 1, 2 & 3, CRC press Prentice Hall*
4. *B.S. Rghuwanshi, "Workshop Technology" Vol. 1 & 2 – Dhanpat Rai and Sons.*
5. *Hazra and choudhary "Workshop Technology" Vol. 1, 2, Media Promoters*
6. *VirenderNarula "Workshop Technology", S.K. Kataria & Sons*
7. *Anderson "Shop Theory" Mc Graw Hill.*
8. *H.S.Bawa, "Carpentry: A complete guide", Tata McGraw Hill.*
9. *R.Little, "Welding & Welding Technology", Tata McGraw Hill.*
10. *L.M.Gourd, "Principles of welding technology", Edward Arnold Publishers.*
11. *R.S.Parmer, "Welding processes and technology" Khanna publication.*

### Magazines

1. *International Metal Working News.*
2. *Industrial Distribution*

### Journals

1. *International Journal of Machine Tools and Manufacture*
2. *Journal of Manufacturing Science and Engineering, Transactions of the ASME*
3. *Journal of Manufacturing Technology and Research*

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**Name of the Module: Foreign Language (German/Chinese) (Audit)**

**Module Code: HSS202**

**Semester: 2<sup>nd</sup>**

**Credit Value: 2 [P=2, T=0,L=0]**

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### A. Objectives:

The course is design to meet with the objectives of:

1. The French Language course accords to a method created for Indian students who are complete beginners in French and who wish to acquire verbal communication skills in current scenario.

### B. Learning outcome:

Students successfully completing this module will be able to :

2. Develop four skills in French i.e. Reading, Writing, Speaking, Comprehension

### C. Subject matter:

#### Unit-I:

Self Introduction, Introducing Friends, Family & persons Topical writing, Essays Description of persons Place, Things, Class, City, Country, House, Plan a Week-End, Excursion,

#### Unit-II:



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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Making Resume , Interviews Letter Writing , Rejecting or accepting proposals. Invitation, Dialogues, Tastes & Preferences

### Unit-III:

Conversational French between Known & Unknown people, Telephonic Conversation with Friends & Client

### D. List of Practical:

1. Issue Writing
2. Writing Resumes and Applications
3. Writing Memos
4. Reading Comprehension
5. Vocabulary
6. Presentation Skills
7. Group Discussion
8. Extempore
9. Debates

### E. Teaching/ Learning/ Practice Pattern:

Teaching: 40%

Learning: 10%

Practice: 50%

### F. Examination Pattern:

1. Theoretical Examination

### G. Reading List:

#### Books:

*Suggested book-Ailes Volume-II*



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

### SEMESTER - III

Subject Code	Subject	Model	P	T	L	Credit
BT 301	Biochemistry 1	J. C. Bose	2	0	3	4
BT302	Principle and Chemistry of Food Preservation Or Material Science and Engineering	S. N. Bose	0	0	3	3
ME 302						
BT 303	Genetics	J. C. Bose	2	0	3	4
BT 304	Microbiology 1	J. C. Bose	2	0	3	4
CSE 302	Data Structure and Algorithm	J. C. Bose	2	0	3	4
BT 305	Enzyme Engineering	S. N. Bose	0	0	3	3
HSS 301	Behavioral Science	S. N. Bose	0	0	2	2
			8		20	24

**Name of the Module: Biochemistry 1**

**Module Code: BT-301**

**Semester: 3<sup>rd</sup>**

**Credit Value: 4 [P = 2, T = 0, L = 3]**

#### A. Objectives:

1. To study the structure and properties of carbohydrates.
2. Discuss the structure, properties and reactions of proteins and amino acids
3. Discuss the structure, properties of fats and lipids
4. To study the composition, structure and functions of nucleic acids

#### B. Learning Outcome:

Biochemistry has its roots in medicine, nutrition, agriculture, and natural products. It covers many other areas as well, but today it is mostly is concerned with the chemistry of molecules found in and associated with living systems, especially the chemistry of these molecules. Biochemists are always trying to break processes down in order to understand how these work, how molecules are created or destroyed and how they relate and affect each other. With the advent of modern computing and technology, the students also study intact systems and how each system functions and the other structures or processes that may be affected.

#### C. Subject Matter

##### Unit I:

What is Biochemistry? Metabolic Processes – Catabolism and Anabolism. Amino Acids – Biochemical Nomenclature. Amino Acid Properties, concept of oxidation- reduction in biological systems;

##### Unit II:

pH and buffers; spectrophotometry (UV, visible, infrared) and spectrofluorometry; ultracentrifugation; chromatographic techniques-basics, TLC; electrophoretic techniques for protein and nucleic acid separation-PAGE, SDS-PAGE.

##### Unit III:



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Protein function: Protein Structure – Primary Structure, Secondary Structure, Tertiary Structure, Quaternary Structure. Fibrous, Globular Proteins. Cofactors and Protein Conformation-Protein Denaturation, Protein Degradation, Protein Folding. Heat Shock Proteins, Structural Evolution of Proteins.

### Unit IV:

Saccharides – Classification of Monosaccharides Oligosaccharides and Polysaccharides with examples, Polysaccharide Bonds. Polysaccharide Function –Complex Sugars. Lipids –structure and classification of lipids, Enzymes – Coenzymes. Vitamins – Vitamin Classification, Hormones– Plant Hormones, Animal hormones, Neurotransmitters.

### D. Reading List

#### Books

1. *Biochemistry by Jeremy M. Berg, John L. Tymoczko, Lubert Stryer, Fifth edition, W.H. Freeman and Company, 1514 pages.*
2. *Lehninger Principles of Biochemistry Edition 4, Nelson, David L. Cox, Michael M. Lehninger, Albert L. W H Freeman & Co.*
3. *Student Companion to Accompany Biochemistry, Richard I. Gumport, Jeremy M. Berg, Nancy Counts Gerber, Frank H. Deis, Jeremy Berg, W H Freeman & Co.*

#### Journals

1. *Bio-Organic Medicinal Chemistry-Science Direct*
2. *Journal of medicinal Chemistry-ACS publication*

### E. List of Practical:

1. Preparation of buffers
2. Separation of amino acids by TLC
3. Separation of proteins by SDS-PAGE
4. Estimation of proteins
5. Estimation of sugar
6. Estimation of vitamins
7. Extraction of lipids and their separation on TLC
8. Estimation of oils
9. Nitrogen estimation by different methods

### E. Teaching/ Learning/ Practice pattern:

1. Teaching: 40%
2. Learning: 10%
3. Practice: 50%

### F. Examination pattern

1. Theoretical examination
2. Practical examination

### G. Reading List

#### Books

1. *Conn, E.E., Stumpf, P.K., Bruening, G. and Doi, R.H. 1997. Outlines of Biochemistry, John. Wiley & Sons Inc., New York and Toronto.*
2. *Fingar, I.L. 1993. Organic Chemistry, Vol. I, II, 6th edn. Longman, London and New York.*



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

3. Nelson, D.L. and Cox, M.M. 2000. *Lehninger Principles of Biochemistry*, 3rd edn. Printed in India by Replika Press Pvt. Ltd., New Delhi for Worth Publishers, New York.
4. Stenesh, J. 1998. *Biochemistry*, Vol. I (Foundation of Biochemistry), Vol. II (Biomolecules), Vol. III (Metabolism), Plenum Press, New York and London.
5. Stryer, L. 1995. *Biochemistry*, 4th edn. W.H. Freeman and Company, New York.
6. Voet, D., Voet, J.G. and Pratt, C.W. 1999. *Fundamentals of Biochemistry*
7. Voet, D., Voet, J.G. and Pratt, C.W. 1999. *Fundamentals of Biochemistry*, John Wiley and Sons Inc., New York and Toronto.
8. Zubay, G.L. 1998. *Biochemistry*, 4th edn. W.C. Brown Publishers.

### Journals:

1. *Journal of Medicinal Chemistry*, ACS publication
2. *Bioorganic & Medicinal Chemistry Letters* – ScienceDirect

### Magazines:

1. *Biochemist e-volution: The Biochemist magazine*

## **Name of the Module: Principle and Chemistry of Food Preservation**

**Module Code: BT-302**

**Semester: 3<sup>rd</sup>**

**Credit Value: 4 [P = 0, T = 0, L = 3]**

### **A. Objectives:**

1. To impart thorough knowledge on the technical skills in various aspects of food processing and preservation.
2. To inculcate the students to work in a hygienic way.
3. To provide an employment potential in food processing and preservation /self-employment.

### **B. Learning Outcome:**

Upon completion of this subject, students will be able to:

1. gain appreciation of the fundamental principles of food spoilage and deterioration and the methods to control spoilage and deterioration;
2. understand the principles that make a food product safe for consumption;
3. assess the storage stability of food products;
4. apply the principles of food preservation in practical, real-world problems;
5. demonstrate abilities in critical and analytical thinking as well as life-long learning and communication skills;

### **C. Subject Matter**

#### **Unit I**

#### **Principles underlying Food Spoilage and Food Preservation**

Important parameters of foods that affect their stability; causes of food spoilage; microorganisms and food spoilage; enzymatic reactions in foods; chemical changes in foods; the aim of food preservation; principles of food preservation; methods of food preservation.

Post-harvest changes in fruits and vegetables; methods to reduce spoilage in fruits and vegetables; controlled atmosphere storage and modified atmosphere storage; storage of cereal grains; storage of fruits and vegetables; storage of meat, milk and eggs.



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

### Unit II:

#### The Control of pH

Effect of pH on the growth of food-borne pathogens and spoilage organisms; the use of pH control to preserve food products: dairy, meat and fish products; cereal, fruits and vegetable products; sauces.

Heat resistance of microbial cells and bacteria spores; kinetics of microbial death; Thermal-Death-Time curves; commercial sterility and 12D concept; heat penetration; heat treatments employed in processing foods.

### Unit III:

#### Food Preservation by Use of Low Temperatures

Effect of low temperature on microbial activity, enzymatic activity and rate of chemical changes; lethal effects of freezing; freezing points of foods and freezing curves; slow freezing and quick freezing. Water activity and food preservation: free and bound water in foods; water activity and microbial spoilage; water activity and enzymatic reactions; effects of water activity on the chemical deterioration of foods; food concentrates: sweetened condensed milk, fruit jellies and preserves; principles of semi-moist foods. Stability of vitamins.

### Unit IV:

#### Other Methods of Food Preservation

Chemical preservation; pickling of fruits and vegetables; meat curing and processing; concept of hurdle technology; examples of food preservation via fermentation processes.

### E. Teaching/ Learning/ Practice pattern:

1. Teaching: 40%
2. Learning: 10%
3. Practice: 50%

### F. Examination pattern

1. Theoretical examination
2. Practical examination

### G. Reading List

#### Books:

1. *Fellows, P.J. Food Processing Technology: Principles and Practice (2nd ed) Woodhead 2000*
2. *Zeuthen, P. (Ed.) Food Preservation Technique Woodhead 2003*
3. *Rahman, M.S. (Ed.) Handbook of Food Preservation Marcel Dekker 1999*

#### Journals:

1. *Bioorganic & Medicinal Chemistry Letters - ScienceDirect*
2. *Bioorganic & Medicinal Chemistry - ScienceDirect*
3. *Organic and Medicinal Chemistry Letters-Springer*

**Name of the Module: Material Sciences & Engineering**

**Module Code: ME 302**

**Semester: 3<sup>rd</sup>**

**Credit Value: 3 [P=0, T=1, L=3]**

**Module Leader:**



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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### A. Objectives:

The course is designed to meet with the following objectives:

1. Know the fundamental science and engineering principles relevant to materials.
2. Understand the relationship between nano/microstructure, characterization, properties and processing and design of materials.
3. Have the experimental and computational skills for a professional career or graduate study in materials.
4. Possess knowledge of the significance of research, the value of continued learning and environmental/social issues surrounding materials.
5. Be able to communicate effectively, to work in teams and to assume positions as leaders.

### B. Learning Outcome:

Upon completion of the subject, the students should be:

1. Able to apply general math, science and engineering skills to the solution of engineering problems.
2. Aware of the social, safety and environmental consequences of their work, and be able to engage in public debate regarding these issues.
3. Capable to apply core concepts in Materials Science to solve engineering problems.
4. Knowledgeable of contemporary issues relevant to Materials Science and Engineering.
5. Able to select materials for design and construction.
6. Able to design and conduct experiments, and to analyse data.
7. Able to understand the professional and ethical responsibilities of a materials scientist and engineer.
8. Capable to work both independently and as part of a team.
9. Able to communicate effectively while speaking, employing graphics and writing.
10. Possessing the skills and techniques necessary for modern materials engineering practice

### C. Subject Matter:

#### Unit I:

**Crystal Structure:** Unit cells, the face centred cubic crystal structure, the body centred cubic crystal structure, and the hexagonal close packed structure, Crystallographic directions and planes, Determination of crystal structures, Crystal defects.

#### Unit II:

**Mechanical Properties of Metal:** Concepts of stress and strain, Tension tests, Compression and Shear tests, Elastic deformation- Stress-Strain behaviour, Plastic deformation, Tensile properties, Yielding and yield strength, Ductility, Toughness, True stress and strain, Elastic recovery during plastic deformation, Creep, Fatigue, Proof stress.

#### Unit III:

**Stability of Phases and Equilibrium:** Liquid solid transition, Phase equilibrium diagrams, Cooling curves, The lever rule, Iron-Iron carbide equilibrium diagram, TTT diagram. Crystallization, Nucleation, Homogeneous nucleation, Heterogeneous nucleation, Crystal growth, Full annealing, Spheroidizing, Normalizing, the isothermal transformation diagram, Continuous cooling transformation diagram, Tempering, Hardenability, application of heat treatment for gear, thread etc.

#### Unit-IV:





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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

**Cast Iron:** Classification of CI, production of various types of cast iron and their applications, brief introduction of alloys, their uses and application, Composite materials, ceramic materials, polymer, and corrosion.

### D. Teaching/Learning/Practice Pattern:

Teaching: 60 %

Learning: 40%

Practice: 0%

(Teacher is to divide components for T/R/P)

### E. Examination Pattern:

1. Theoretical Examination.

### F. Reading List:

#### Books:

1. Y. Lakhtia, "Engineering Physical Metallurgy" 1<sup>st</sup> edition, Mir Publishers, Moscow.
2. A. G. Guy, "Physical Metallurgy Principle", 2<sup>nd</sup> edition, MGH.
3. S. H. Avner, "Introduction to Physical Metallurgy", 2<sup>nd</sup> edition, TMGH.
4. Boothroyd, "Fundamental of Metal Machining and Machine tools" 3<sup>rd</sup> edition, TMGH.
5. P. N. Rao, "Manufacturing Technology (Vol I & II)", 2<sup>nd</sup> edition, TMGH.
6. P. C. Pandey & C. K. Singh, "Production Engineering Sciences", 1<sup>st</sup> edition, Standard Book Publishers. B. S. Raghuwanshi, "A Course in Workshop Technology", 2<sup>nd</sup> edition, Dhanpat Rai & Sons.
7. Chapman and Martin, "Workshop Technology", Viva Book Pvt. Ltd.
8. M. L. Begeman and B.H. Amstead, "Manufacturing Process", 1<sup>st</sup> edition, John Wiley.

#### Magazine:

1. Material Today.
2. Discover.

#### Journals:

1. Journal of Materials Science.
2. Advanced Composite Materials.
3. [Applied Materials & Interfaces](#).
4. Materials Science and Engineering.
5. Journal of Tribology.

**Name of the Module: Genetics**

**Module Code: BT-303**

**Semester: 3<sup>rd</sup>**

**Credit Value: 4 [P = 2, T = 0, L = 3]**

### A. Objectives:



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By doing this course, the students will be able to:

1. relate the structure and function of the DNA molecule to its functional role in encoding genetic material;
2. apply the principles of inheritance as formulated by Mendel;
3. apply the principles of extensions to Mendelian inheritance, including multiple allelism, lethal alleles, gene interactions, and sex-linked transmission;
4. analyze genetic data using statistical procedures;
5. describe normal chromosome number, structure, and behaviour in human cells, and understand the cause and effect of alterations in chromosome number and/or structure;

### B. Learning Outcome:

On satisfying the requirements of this course, students will have the knowledge and skills to:

1. explain the key concepts in population, evolutionary and quantitative genetics including: the basis of genetic variation; heritability; Hardy-Weinberg Equilibrium; roles of selection, migration, mutation and genetic drift in evolution;
2. understand the range of molecular laboratory techniques used routinely in human forensic analysis and population genetic analysis including sex typing, DNA profiling and DNA sequencing;
3. perform by hand, calculator and computer software the statistical analysis of genetic data relevant to forensic, conservation and evolutionary genetics, and summarise and interpret the outcomes;
4. search the literature to identify papers relevant to the genetic data sets provided for statistical analysis and integrate and evaluate the findings in written form;

### C. Subject Matter

#### Unit I:

##### Cell and Organism Reproduction

Describe cellular and chromosomal events that occur during the eukaryotic cell cycle and gamete formation, describe chromosome behavior and changes in chromosome structure and number as a cell progresses through a cell cycle, meiosis I and meiosis II Explain how meiosis and random fertilization contribute to genetic variation in sexually reproducing organisms.

#### Unit II

**Principles of Heredity:** Explain Mendel's principles of inheritance and apply these to problems of inheritance. Describe the different forms of inheritance patterns and identify these in genetic data. Use and interpret probabilities and statistics in the gathering, predicting, and analysis of genetic data. Describe various types of genetic crosses and indicate when/why they would be used by a geneticist. Explain more complex modes of inheritance and how sex influences the inheritance and expression of genes (e.g. sex-influenced traits, cytoplasmic inheritance, genomic imprinting) Use this information in predicting genetic outcomes and the analysis of genetic data

#### Unit III:

##### Pedigrees

Apply principles of heredity in assessment of pedigrees to identify genotypes of family members, conclude the mode of inheritance for a trait, and predict mating outcomes.

**Eukaryotic Gene Mapping:** Compare the effect of linkage and independent assortment on genetic outcomes and assess data to determine if genes are linked or on separate chromosomes. Explain how crossing over produces recombination and use recombination frequencies to construct a genetic map. Use genetic maps to predict gametic and mating outcomes. Describe some of the methods that can be used to place a gene on a particular chromosome (e.g. FISH)

#### Unit IV:



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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### Chromosome Variation and Structure

Describe and recognize a variety of abnormalities in chromosome structure and number and explain how these anomalies arise and are detected. Explain the molecular structure of chromosomes as it relates to storage, gene expression, and sequence function. **Nucleic Acid Structure:** Describe early studies that led to DNA as the genetic material. Describe the molecular structure of DNA and RNA and indicate similarities and differences

### D. List of Practical:

1. Mitosis in onion root tip
2. Barr body preparation and staining
3. Agarose gel electrophoresis
4. Preparation of Karyogram
5. Study of polytene chromosomes of Diptera
6. Preparation of chromosome spreads

### E. Teaching/ Learning/ Practice pattern:

1. Teaching: 40%
2. Learning: 10%
3. Practice: 50%

### F. Examination pattern

1. Theoretical examination
2. Practical examination

### G. Reading List

#### Books

1. *Principles of Genetics* by Gardner, Simmons, Snustad, 8th edition – John Wiley and Sons, Inc., 2003.

#### Journals

1. *Bioorganic & Medicinal Chemistry Letters - ScienceDirect*
2. *Bioorganic & Medicinal Chemistry - ScienceDirect*
3. *Organic and Medicinal Chemistry Letters-Springer*



***Name of the Module: Microbiology 1***

***Module Code: BT-304***

***Semester: 3<sup>rd</sup>***

***Credit Value: 4 [P = 2, T = 0, L = 3]***

**A. Objectives:**

The course is designed to meet with the objectives of:

The goal of this course is to provide an understanding of microorganism and the role they play in health and disease

**B. Learning outcomes:**

Students successfully completing this module will be able to:

1. compare the theories of spontaneous generation and biogenesis,
2. describe the germ theory of disease and Koch's postulate,
3. list the major groups of organisms studied in microbiology,
4. explain the basic principles of biological chemistry and their relevance to living things,
5. compare and contrast prokaryotic and eukaryotic cells in terms of structures, functions and chemistry,
6. explain the principle mechanisms of metabolism including aerobic and anaerobic respiration, fermentation as well as the synthesis of macromolecules,
7. compare aerobic and anaerobic respiration,
8. describe the difference between Gram + and Gram - cells,
9. describe the mechanisms of enzyme action and inhibition,
10. list the chemical and physical requirements for microbial growth and explain how these are used to classify microorganisms,
11. describe the actions of antimicrobial agents,
12. identify physical and chemical methods of microbial control,
13. describe the processes of DNA replication and protein synthesis,
14. explain the role of plasmids and genetic transfer in antibiotic and chemical resistance,
15. identify medically important groups of microorganisms,
16. identify the methods of disease transmission,
17. explain the importance of epidemiology and the use of DNA fingerprinting to identify sources of contamination,
18. explain the role of normal flora,
19. describe the principles of disease and mechanisms of pathogenicity,
20. identify and discuss the roles of specific and non specific host defences,
21. identify major diseases caused by microorganisms, □
22. explain the role of microorganisms in the environment.

**C. Subject matter:**



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

### Unit I:

**Introduction to Microbiology:** Characterization, Classification and Identification of microorganisms, Microscopic examination of Micro organisms morphology and fine structure of bacteria, cultivation of bacteria, reproduction & growth, pure cultures and cultural characteristics.

**Microbial Physiology and Genetics:** Microbial enzymes and their regulation, Microbial metabolism energy production, utilization of energy & biosynthesis, bacterial genetics

### Unit II:

**Microbial Physiology and Genetics:** Fungi– importance, characteristics, morphology, reproduction, physiology cultivation & classification of fungi, molds & repair association with other organisms. **Algae** – importance of algae, characteristics of algae. Classification protozoa- Ecology, importance, morphology, reproduction and classification of protozoa, control of micro organisms

### Unit III

**Virus evolution and classification,** properties of viruses, virus structure. Diversity, classification, characteristics and applications and general account on algal, fungal and protozoan viruses. Bacteriophages- General characteristic - Morphology and structure, Classification and Nomenclature. Bacteriophages of *E.coli*. Viruses of plants and animals- Structure- Replication- Classification- isolation and identification, ICTV modern classification and cryptograms of various virus groups.

### Unit IV:

**Symptoms caused by viruses and viroids** in diseased economically important trees and agricultural crops, transmission and their control including development of virus disease resistant transgenetics. **Environmental and industrial microbiology:** Microbiology of soil – aquatic microbiology, Microbiology of domestic water and waste water. Microbiology of fuel and Industrial microbiology

### D. List of practicals: (Minimum eight experiments should be conducted by students)

1. Sterilization techniques
2. Media preparation
3. Microscopy and Micrometry
4. Isolation, size and shape of microbes from a given sample
5. Staining Techniques (Simple, Gram staining, spore staining )
6. Motility test by Hanging drop method
7. Biochemical Characterization of Bacteria
8. Oxidation/Fermentation Test
9. Catalase, Oxidase and Urease Tests
10. IMViC test

### E. Teaching/ Learning/ Practice pattern:

Teaching: 40%  
Learning: 10%  
Practice: 50%



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

### F. Reading lists:

#### Books:

1. *Microbiology by Pelczar, JR E.C.S Chan and noel R.Krieg. Fifth edition Tata Mc GrawHill - 2006*
2. *Thomas D. Brock, Michael T. Madigan, John M. Martinko. 12<sup>th</sup> edition Pearson*

#### Journals:

1. *Medicinal Chemistry Letters-ACS publication*
2. *Trends in Microbiology - Elsevier*
3. *FEBS Lettes- Elsevier*
4. *Medicinal Chemistry Letters-ACS publication*
5. *Cell – ScienceDirect and Cell Press*
6. *Nature – Nature Publishing Group*
7. *PLOS ONE –Public Library of Science*

### **Name of the Module: Data Structure & Algorithm**

**Module Code: CSE 302**

**Semester: 3<sup>rd</sup>**

**Credit Value: 4 [P = 2, T = 0, L = 3]**

#### A. Objectives:

The course is designed to meet with the objectives of:

1. design principles of algorithms and data structures,
2. efficiency and scaling of algorithms,
3. essential algorithms in computing,
4. generic data structures for common problem.

#### B. Learning outcomes:

Students successfully completing this module will be able to:

1. assess performance efficiency of sequential algorithms,
2. design data structures to enable algorithms and design sequential algorithms for performance,
3. implement designed algorithms and corresponding data structures using object oriented programming languages,
4. demonstrate informed deployment of essential data structures such as lists, stacks, queues, and trees,
5. demonstrate use of algorithm design methods such as divide and conquer.

#### C. Subject matter:

##### Unit I:



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

**Introduction:** Basic concept of data, structures and pointers. **Arrays:** Representation, implementation, polynomial representation, limitations. **Strings:** Representation, String operations, Implementing String.h library functions.

### Unit II:

**Recursion** - Design of recursive algorithms, Tail Recursion, When not to use recursion, Removal of recursion. **Linked List:** Static and dynamic implementation. Single, double, circular, multiple linked lists. **Stacks:** Recursion and Stacks. Static and dynamic implementation. Expression evaluation. Infix, postfix expressions, multiple stacks. **Queues:** Static and dynamic implementation, circular queues, and implementation.

### Unit III:

**Hash Tables:** Hash tables implementation. Hashing techniques, single, double. Storage Management: Memory Management techniques, garbage collection. **Trees:** Binary trees, binary search trees, static and dynamic implementation. AVL tree, B+ tree, B tree, tree operations, insert, delete, and search. **Heaps:** Implementation, sorting etc. Sorting and Searching: Different sorting techniques. Insertion sort, selection sort, bubble sort, radix sort, quick sort, merge sort, heap sort.

### Unit IV:

**File Structures** - Sequential and Direct Access. Relative Files, Indexed Files - B+ tree as index, Multi-indexed Files, Inverted Files, Hashed Files. **Graphs:** Representation of graphs, BFS, DFS sort.

### D. List of practicals: (Minimum eight experiments should be conducted by students)

1. experiments should include but not limited to: Implementation of array operations,
2. stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements Merging Problem : Evaluation of expressions operations on Multiple stacks & queues,
3. implementation of linked lists: inserting, deleting, and inverting a linked list. Implementation of stacks & queues using linked lists. Eg, Railway ticketing system, CD's in the case wearing bangles,
4. polynomial addition, Polynomial multiplication Sparse Matrices: Multiplication, addition. Recursive and Non recursive traversal of Trees,
5. threaded binary tree traversal,
6. application of Trees. Application of sorting,
7. implementation of different types of searching like linear search, binary search with real life analysis,
8. hash tables implementation: searching, inserting and deleting, searching & sorting techniques,
9. implementation of recursive function using Tower of Hanoi,
10. implementation of External memory data structure using B tree,
11. implementation of AVL tree.

### E. Teaching/ Learning/ Practice pattern:



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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Teaching: 40%

Learning: 10%

Practice: 50%

### F. Examination pattern:

5. Theoretical Examination: Open book and on line.
6. Practical Examination: Conduct Programming test and viva voice.

### G. Reading lists:

#### Books:

1. Seymour Lipschutz, G A Vijayalalashmi Pai, "Data Structure", Schaum's Outlines, TMH
2. Data Structures and Algorithms O.G. Kakde & U.A. Deshpandey, ISTE/EXCEL BOOKS
3. Aho Alfred V., Hopperoft John E., Ullman Jeffrey D., "Data Structures and Algorithms", Addison Wesley
4. Drozdek- Data Structures and Algorithms, Vikas
5. Heileman: data structure algorithms & Oop Tata McGraw Hill
6. Data Structures Using C – M.Radhakrishnan and V.Srinivasan, ISTE/EXCEL BOOKS
7. Weiss Mark Allen, "Algorithms, Data Structures, and Problem Solving with C++", Addison Wesley.
8. Horowitz Ellis & Sartaj Sahni, "Fundamentals of Data Structures", Galgotria Pub.
9. Tanenbaum A. S. "Data Structures using C", Pearson Education
10. Ajay Agarwal: Data structure Through, C.Cybertech

#### Journals:

1. IEEE Transactions on Computers, IEEE, Computer Society, United State
2. ACM Transactions on Embedded Computing Systems (TECS), ACM, United State
3. Journal of Systems Architecture, Elsevier, Netherlands
4. Journal of Discrete Algorithms (JDA), Elsevier, Netherlands

#### Magazines:

1. MSDN Magazine, Microsoft and 1105 Media, USA
2. IBM system Magazine, IBM, USA





**Name of the Module: Enzyme Engineering**

**Module Code: BT 305**

**Semester: 3<sup>rd</sup>**

**Credit Value: [P = 0, T = 0, L = 3]**

**A. Objectives:**

The course is designed to meet with the objectives of:

1. to provide students with an advanced understanding of enzyme engineering,
2. make students efficient in properties of bioproducts as relevant to food, pharmaceuticals, bioactive product development, processing and stability control.

**B. Subject matter:**

**Unit I:**

Structure, properties and mechanism of action of enzymes. Kinetics of the enzymatic reactions using Michaelis-Menten equation; Introduction and historical perspective; classification and nomenclature; isolation and purification of enzymes; cofactors - structures and biological functions.

**Unit II**

Theory of enzymatic catalysis, specificity, concept of active site and enzyme substrate complex, active site mapping, covalent and acid base catalysis, factors associated with catalytic efficiency, proximity, orientation, distortion and strain, induced fit hypothesis.

Kinetics, chemical kinetics a brief review, enzymatic kinetics; effect of substrate concentration, derivation of Michaelis-Menten equation,  $K_s$ ,  $K_m$ ,  $V_{max}$ , and  $K_{cat}$  and their significance, methods to determine  $K_m$  and  $V_{max}$  with their merits and demerit

**Unit III**

Briggs- Haldane steady state approach, King-Altman patterns, computer simulation of Michaelis-Menten equation; effect of different factors affecting enzyme activities; transition state theory; Arrhenius equation; determination of energy of activation; optimum temperature and thermal stability of enzyme;

**Unit IV:**

Stabilization of enzymes; Enzymes and their applications in biotechnology; Enzymes and enzyme processes in science, medicine, technology and industry; Biocatalysis in chemical synthesis, in electrochemical systems, in microanalysis (Biosensor). Enzymes as drugs; Immobilization of enzymes; Kinetics of immobilized enzymatic reaction.

**C. Teaching/ Learning/ Practice pattern:**

Lecture:	3
hours/week	
Tutorial:	0
hours/week	
Laboratory Practical:	2 hours/week
Self study:	



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

### D. Examination pattern:

1. Theoretical examination

### E. Reading lists:

#### Books:

1. *Biochemical Engineering Fundamentals*, James E Bailey and David F Ollis, Tata McGraw-Hill Education Pvt. Ltd, New Delhi.
2. *Principles of Biochemistry*, Lehninger, Fourth edition by David L. Nelson and Michael M. Cox University of Wisconsin-Madison, USA
3. *Bioprocess Engineering: Basic Concepts*, Michael L Shuler and Fikret Kargi, Prentice Hall of India, New Delhi

#### Journals:

1. *Process Biochemistry*, Elsevier
2. *Journal of Biotechnology*, Elsevier
3. *Bioresource Technology*, Elsevier
4. *Applied Biochemistry and Biotechnology*, Springer

**Name of the Module: Behavioral Science**

**Module Code: HSS 301**

**Semester: 3<sup>rd</sup>**

**Credit Value: 2 [P=0, T=0, L=2]**

### A. Objectives:

The course is designed to meet with the objectives of:

1. imparting theoretical lectures with case discussion,
2. providing teaching with inclusive learning,
3. making students aware about the importance of this subject in their future career.

### B. Learning outcomes:

Students successfully completing this module will be able to:

1. work with efficiency as they had knowledge of the subject,
2. backup knowledge their performance will definitely be much better in their workplace.

### C. Subject matter:

#### Unit I:

**Behavioral Science:** An overview: definitions, Man the critical factor, Behavioral science and its historical development. **Motivation:** Nature of drives, needs and motives, work



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motives, need hierarchy theory and two factor theory of motivation, how to motivate the workers at work, factors effecting the morale of workers.

### Unit II:

**Industrial Sociology:** Concept and Definitions; Importance for Engineers; Growth; Criticism of the Hawthorne Studies; Nature and scope of Industrial sociology, Industry and Community, Industry and Tradition in India. **Society and Technical Change:** Concept of social change, meaning and definitions of social change, nature of social change. Factors such as Natural, Cultural, Economic, Planning, Technological, Indian Information Technology Scenario, Effect of Technology on Social Institutions. **Society and Environment:** Meaning and Definitions, Characteristics, Classification of Environment, Physical Environment and its Influence, Social Environment and its some basic elements, Environment in Industry, Illumination, Noise, Atmospheric Conditions, Music and Colour.

### Unit III:

**Groups:** Meaning and Definitions, types of Groups, characteristics, functions of formal and informal groups, merits and demerits of informal groups.

### Unit IV:

**Human relations:** Historical overview, definitions, early and later approaches to human relations, strategies for establishing healthy human relations. **Labour management relations:** Industrial relations; meaning, objectives and definitions, Dunlop's theory of industrial relations, Psychological and Gandhian approach to industrial relations, industrial relations in Japan and India, industrial relation in coming years, challenges of coming years, new dimensions of industrial relations, the ways of industrial peace. Trade unions; meaning and definitions, functions of Indian trade Unions, recent emerging trends in Indian trade unions.

### D. Teaching/ Learning/ Practice pattern:

1. Teaching	: 50%
2. Learning/ case presentation	: 30%
3. Assignment	: 10%
4. Attendance	: 10%

### F. Examination pattern:

1. Theoretical Examination	: 50
2. Class test	: 30
3. Assignment	: 20

### G. Reading lists:

#### Books:

1. *Wendell L. French, Human Resource Management (4<sup>th</sup> ed.) Proston: Honshto Mittin, 1998.*
2. *H.Fayol, Industrial and General administration, Paris: Dunod, 1916.*



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3. Mintzberg, *the Nature of Managerial Works: Upper Saddle River, N.J Printice Hall,1973.*
4. Fred N.Ker Linger, *Behavioral Research: A conceptual Approach, New York:Holt Rinehart and Winston,1979*
5. Milter William R. And Stephen Rollnick, *Motivational Interviews, (3<sup>rd</sup> ed.), Sept 7,2012.*
6. Daniel Kahnmen, *Thinking Fast and Slow, April 2, 2013.*
7. Elizabeth, D. Hutchison. *Essentials of Human Behaviour, September 3,2013.*
8. Susan P.Robbins, Pranal Chatterjee, Edward R.Canda, *Contemporary Human Behaviour Theory, 2013.*

### Magazine:

1. *Leadership Quarterly*
2. *HBR Magazine*

### Journal:

1. *Journal of Behavioral Sciences*
2. *Behavioral and Brain Sciences*
3. *Journal of Contextual Behavioral Sciences*
4. *Harvard Business Review*



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

### SEMESTER – IV

Subject Code	Subject	Model	P	T	L	Credit
BT 401	Biochemistry II	S. N. Bose	0	0	3	3
BT 402	Microbiology II	S. N. Bose	0	0	3	3
BT 403	Plants Cell and Tissue Culture	J. C. Bose	2	0	3	4
BT 404 Or EE 404	Cell Biology or Introduction to Microprocessors and microcontrollers	J. C. Bose	2	0	3	4
BT 405	Molecular Biology	S. N. Bose	0	0	3	3
HSS 401	Entrepreneurship and innovation	S. N. Bose	0	1	3	4
			4	1	18	21

**Name of the Module: Biochemistry II**

**Module Code: BT-401**

**Semester: 4<sup>th</sup>**

**Credit Value: 4 [P = 0, T = 0, L = 3]**

#### **A. Objectives:**

The course aims to provide an advanced understanding of the core principles and topics of Biochemistry and their experimental basis, and to enable students to acquire a specialized knowledge

and understanding of selected aspects by means of a stem/branch lecture series and a research project.

#### **B. Learning Outcome:**

The study of the structures, functions, and interactions between biological molecules forms the focus of the work of biochemists. Biochemistry majors will build and expand their capacity to think, work, and communicate as scientists. Majors will use biochemical knowledge for experimental design, data analysis and interpretation, scientific reports and presentations, and exposure to the research literature. Mastery in these essential areas will prepare biochemistry graduates for graduate study in the health professions or natural sciences, as well as for work in a research environment.

#### **C. Subject Matter**

##### **Unit I:**

Scope and importance of biochemistry in agriculture; fundamental principles governing life; structure of water; acid base concept and buffers; pH; hydrogen bonding; hydrophobic, electrostatic and Van der Waal forces; general introduction to physical techniques for determination of structure of biopolymers; fundamentals of thermodynamics applicable to biological processes;

##### **Unit II:**

**Solute Transport:** Primary and Secondary transport: Introduction, Kinetics, ABC transporters, Phosphotransferase system, Drug export systems, amino acid transport.



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**Central Metabolic Pathways and Regulation:** Glycolysis, PPP, ED pathway, Citric acid cycle: Branched TCA and Reverse TCA, glyoxylate cycle. Utilization of sugars other than glucose and complex polysaccharides.

**Nitrogen metabolism:** Metabolism of amino acids: Amino acid biosynthesis and utilisation, lysine and glutamine overproduction, stringent response, polyamine biosynthesis and regulation.

### Unit III

**Metabolism of fats, proteins, and carbohydrates;**

**Metabolism of lipids and hydrocarbons:** Biosynthesis and degradation of lipids, hydrocarbon utilization, PHA synthesis and degradation.

**Metabolism of nucleotides:** Purine and pyrimidine biosynthesis, regulation of purine and pyrimidine biosynthesis, inhibitors of nucleotide synthesis.

**Inborn errors of metabolism: a) Disorders of amino acid metabolism** - Phenylalanemia, homocystinuria, tyrosinemia, MSUD, phenylketonuria, alkaptonuria, albinism and aminoacidurias.

**b) Disorders of nucleic acid metabolism** - Disorders in purine/ pyrimidine metabolism

### Unit IV

**Disorders of carbohydrate metabolism:** Diabetes mellitus, glycohemoglobins, hypoglycemia, galactosemia and ketone bodies. Various types of glucose tolerance tests. Glycogen storage diseases.

Physiology of lipids/lipoproteins. Lipidosis. Clinical inter-relationships of lipids (sphingolipidosis and multiple sclerosis), lipoproteins and apolipoproteins. Diagnostic tests for HDL-cholesterol, LDL-cholesterol and triglyceride disorders.

### D. Teaching/ Learning/ Practice pattern:

4. Teaching: 40%
5. Learning: 10%
6. Practice: 50%

### E. Examination pattern

1. Theoretical examination

### F. Reading List

#### Books

9. Conn, E.E., Stumpf, P.K., Bruening, G. and Doi, R.H. 1997. *Outlines of Biochemistry*, John Wiley & Sons Inc., New York and Toronto.
10. Finar, I.L. 1993. *Organic Chemistry, Vol. I, II, 6th edn.* Longman, London and New York.
11. Nelson, D.L. and Cox, M.M. 2000. *Lehninger Principles of Biochemistry*, 3rd edn. Printed in India by Replika Press Pvt. Ltd., New Delhi for Worth Publishers, New York.
12. Stenesh, J. 1998. *Biochemistry, Vol. I (Foundation of Biochemistry), Vol. II (Biomolecules), Vol. III (Metabolism)*, Plenum Press, New York and London.
13. Stryer, L. 1995. *Biochemistry, 4th edn.* W.H. Freeman and Company, New York.
14. Voet, D., Voet, J.G. and Pratt, C.W. 1999. *Fundamentals of Biochemistry*



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

15. Voet, D., Voet, J.G. and Pratt, C.W. 1999. *Fundamentals of Biochemistry*, John Wiley and Sons Inc., New York and Toronto.
16. Zubay, G.L. 1998. *Biochemistry*, 4th edn. W.C. Brown Publishers.
17. *Textbook of Medical Biochemistry* By MN Chatterjea and Rana Shinde, Jaypee Brothers.
- 18.

### Journals:

3. *Journal of Medicinal Chemistry*, ACS publication
4. *Bioorganic & Medicinal Chemistry Letters – ScienceDirect*

### Magazines:

2. *Biochemist e-volution: The Biochemist magazine*

## **Name of the Module: Microbiology II**

**Module Code: BT-402**

**Semester 4<sup>th</sup>**

**Credit Value: 4 [P = 0, T = 0, L = 3]**

### **A. Objectives:**

1. To highlight the roles and characteristics of microorganisms
2. To impart knowledge on the basic concept of replication in microorganisms
3. To study in detail the growth of microorganisms and impact of environment on their growth
4. To evaluate explicitly, the metabolic pathways, role of microbes in public health; insight into the physical and chemical control of microorganisms.

### **B. Learning Outcome:**

By introducing the fundamentals of microbiology through the study of the characteristics of microorganisms, multiplication, growth in different media, metabolic pathways, effects of microbe and their control the students will be more enriched.

### **C. Subject Matter**

#### **Unit I:**

**Growth and cell division:** Measurement of growth, growth physiology, cell division, growth yields, growth kinetics, steady state growth and continuous growth.

**Animal Viruses:** Techniques for visualisation and enumeration of viral particles, measuring biological activity of viruses, assays for virus estimation and manipulation, characterization of viral products expressed in infected cells, Diagnostic virology, Physical and chemical manipulation of viruses.

**Virus replication Strategies:** Principal events involved in replication: Adsorption, penetration, uncoating nucleic acid and protein synthesis, intracellular trafficking, assembly, maturation and release, viral-host interaction, Host response to viral infection.

#### **Unit II**



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Details on important viruses namely Herpesvirus, Poliovirus, Influenza virus, VSV, SV40 and Adeno Virus, Poxviruses, Hepatitis Viruses, coronaviruses, Retroviruses. **Subviral pathogens:** HDV, Prions, Viroids

**Pathogenesis of viral infection:** Stages of infection, Patterns of some viral diseases-epidemiology, transmission, infection, symptoms, risk, transformation and oncogenesis, emerging viruses. **Anti-viral strategies-prevention and control of viral diseases:** Host specific and nonspecific defense mechanisms involved in resistance to and recovery from virus infections. Role of interferon in viral infections. Contributions of various host defense mechanisms in viral infections; Viral Chemotherapy: Nucleoside analogs, reverse transcriptase inhibitors, protease inhibitors, History of vaccines especially smallpox and polio. New methods: subunit vaccines, anti-idiotype and DNA vaccines.

### Unit III:

**Propagation, purification, characterization and identification and genomics of plant viruses:** General methods of propagation of plant viruses; purification of plant viruses using centrifugation, chromatography and electrophoresis techniques, their assay and comparison of the sensitivity of assay methods; methods employed in identification of plant viruses and structural and functional genomics.

**Classical view of microbial pathogenicity:** Define pathogenicity and virulence; Quantitative measures of virulence: minimal lethal dose (MLD), LD50, ID50, TCID50. Virulence determinants: colonization, toxins, enzymes and invasiveness. Facultative / obligate intracellular pathogens.

### Unit IV

**Emerging and re-emerging pathogens:** Illustrate emerging and re-emerging pathogens using *V. cholerae* O: 139, X-MDR *M. tuberculosis*, *Helicobacter pylori*, Enterohaemorrhagic *E. coli* (EHEC), *Cryptosporidium parvum*, Lyme disease, SARS virus, Bird flu, prions, AIDS, Dengue Hemorrhagic Fever, and *Chlamydiae*, opportunistic fungal pathogens. Mechanisms of emergence of new pathogens: microbial change and adaptation, horizontal gene transfer (HGT), pathogenicity islands (PAI), role of integrons.

### E. Reading List:

#### Books

1. *Biochemistry* by Geoffrey L. Zubay. Fourth Edition, Addison-Wesley educational publishers Inc., 2008
2. *Lehninger Principles of Biochemistry* by David L. Nelson and Michael M. Cox. Fifth Edition, W.H. Freeman and Company; 2008.
3. *Microbial lipids* edited by C. Ratledge and SG Wilkinson, second edition, Academic Press; 1988.
4. *Microbial Physiology* by Albert G. Moat and John W. Foster. Third edition, John Wiley and Sons; 2002
5. *The Physiology and Biochemistry of Prokaryotes* by David White. Second Edition, Oxford University Press; 2000.
6. *Principles of Virology: Molecular Biology, Pathogenesis and Control of Animal Viruses* by S.J. Flint,
7. *L.W. Enquist, V.R. Racaniello, and A.M. Skalka* 2nd edition, ASM Press, Washington, DC, 2004.





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8. *Introduction to Modern Virology EPZ* by Nigel Dimmock, Andrew Easton and Keith Leppard, 5<sup>th</sup> edition, Blackwell Publishing, 2005
9. *Basic Virology* by Edward K. Wanger, Martinez Hewiett, David Bloom and David Camerini, 3rd edition, Blackwell Publishing, 2007.
10. *Principles of Molecular Virology* by Alan J. Cann, 3rd edition, Elsevier Academic Press, 2001.
11. *Plant Virology* by Roger Hull, 4th edition, Academic press, 2002. *Jawetz, Melnick, & Adelberg's Medical Microbiology* by Brooks GF, Butel JS, Morse SA, Melnick JL, Jawetz E, Adelberg EA . 23rd edition. Lange Publication. 2004.
12. *Cellular Microbiology* by Cossart P, Boquet P, Normark S, Rappuoli R eds. 2nd edition. American Society for Microbiology Press. 2005.
13. *Bacterial Pathogenesis: A molecular approach* by Salyers AA and Whitt DD eds. American Society for Microbiology Press, Washington, DC USA. 2002.
14. *Pathogenomics: Genome analysis of pathogenic microbes* by Hacker J and Dorbindt U. ed. Wiley-VCH. 2006.
15. *Molecular Microbiology: Diagnostic Principles and Practice* by Persing DH, Tenover FC, Versalovic J, Tang Y, Unger ER, Relman DA, White TJ eds. American Society for Microbiology Press, 2004.
16. *Infectious Disease Epidemiology: Theory and Practice* by Nelson KE, Williams CM, Graham NMH eds. An Aspen Publication. 2001.
17. *Molecular Genetics of Bacteria* by Larry Snyder and Wendy Champness, 3rd edition; ASM press; 2007.
18. *Fundamental Bacterial Genetics* by Nancy Trun and Janine Trempy, 1st edition; Blackwell Science Publishers; 2004.
19. *Modern Microbial Genetics* by U.N. Streips and R.E. Yasbin, 2nd edition; Wiley Publishers; 2002.

### Journals

1. *Indian Journal of Microbiology*. Springer
2. *International Journal of Microbiology*. Hindawi

**Name of the Module: Plants Cell and Tissue Culture**

**Module Code: BT-403**

**Semester: 4<sup>th</sup>**

**Credit Value: 4 [P = 2, T = 0, L = 3]**

### A. Objectives:

1. To impart knowledge on production of transgenic plants
2. To make the students to understand the concepts and applications

### B. Learning Outcome:

This course deals with the DNA isolation and transfer to plants and production of transgenic plants.

### C. Subject Matter:

#### Unit I:

**Plant genomes and plant tissue culture**



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Introduction-gene structure and gene expression-regulation, implication for plant transformation,-Protein targeting, heterologous promoters, genome size and organization, Arabidopsis and new technologies. Plant tissue culture plasticity and totipotency, culture environment, growth regulators, media regulators, culture types, plant regeneration.

### Unit II:

#### Plant transformation techniques

Introduction- *Agrobacterium* mediated gene transfer –Ti-plasmid-process of T-DNA transfer and integration, transformation in plant, direct gene transfer methods. Binary vectors- basic features of vectors-optimization-clean gene technology.

### Unit III:

#### Transgenic plants-herbicide and pest resistance

Herbicide resistance-use of herbicide in modern agriculture-strategies for engineering herbicide-Resistance environment impact, pest resistance-nature and scale of insect / pest damage to crop-GM strategies-Bt approach to insect resistance-copy nature strategy-insect resistant crops and food safety.

### Unit IV:

#### Plant disease resistance and stress tolerance

Introduction-plant-pathogen interactions-natural disease resistance pathways-biotechnological - Approaches to disease resistance. Plant viruses- types-entry and replication-transgenic approach-PDR Stress tolerance-abiotic stress-water deficit stress and various approaches for tolerance. Introduction-carbohydrates and lipids production-molecular farming of proteins-economic considerations for molecular farming.GM crops-current status-concerns about GM crops-regulations of GM crops and products-Greener genetic engineering.

### D. List of Practical:

1. Sterilizing technique in plant tissue culture
2. Preparation of culture media
3. Callus induction
4. Micro propagation with shoot tip culture
5. Isolation of protoplast

### E. Reading List:

#### Books

1. *Plant Biotechnology-The genetic manipulation of plants.* Adrian Slater, Nigel W.Scott and Mark R.Fowler. Oxford university press, pg-341.

#### Journals

1. *Plant Cell, Tissue and Organ Culture (PCTOC) Springer*



**Name of the Module: Cell Biology**

**Module Code: BT-404**

**Semester: 4<sup>th</sup>**

**Credit Value: 4 [P = 2, T = 0, L = 3]**

**A. Objectives:**

1. To study cell structure and functions of organelle functions
2. Exposure on transportations through cell membrane
3. To focus on different receptors and model of signalling
4. To introduce the concept of cell signalling

**B. Learning Outcome:**

The course is aimed to make the student understand the basic concept of cell structure, membrane, cellular functions of different types of cell, modes of cellular signaling and signal amplification.

**C. Subject Matter:**

**Unit I:**

**An overview of cells and cell research**

Origin and evolution of cells, cells as experimental models, tools of cell biology – chemistry of cells – molecular composition of cells, central role of enzymes, metabolic energy, biosynthesis of cell constituents, cell membrane. Nucleus, Endoplasmic reticulum, Golgi apparatus and Lysosomes, Bioenergetics and Metabolism – Mitochondria, chloroplasts, Peroxisomes.

**Unit II:**

**Cell structure and function**

Cell cycle, the cytoskeleton and cell movement, cell surface – transport of small molecules, Endocytosis, cell –cell interactions- Adhesion junctions-Tight junctions-Gap junctions-Plasmodesmata

**Unit III:**

**Cell signaling – cell regulation**

Signaling molecules and their receptors, functions, pathways of intracellular signal transduction– the Cell Cycle – Mitosis and Meiosis –Cell death and cell renewal-Programmed cell death-Stem cells- Embryonic stem cells and therapeutic cloning.

**Unit IV:**

**Cancer**

The Development and causes of cancer, tumour viruses, oncogenes, prevention and treatment.

**D. List of Practical:**

1. Microscopic study of cell and cell organelles
2. Cell fractionation
3. Fixation, Dehydration, embedding and sectioning of tissues
4. Histology of extracellular matrix
5. Quantitative analysis of lipid classes by TLC
6. Isolation of microtubules
7. Isolation of actin and Myosin filaments
8. Isolation of Mitochondria
9. Nuclear staining
10. Stages of cell cycle.



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

### E. Reading List

#### Books

1. *The Cell: A molecular approach* by Geoffrey M. Cooper. ASM Press, Pages:673
2. *Molecular Biology of the Cell* Edition 4, Roberts, Keith Alberts, Bruce Johnson, Alexander Raff, Martin Walter, Peter Lewis, Julian, Garland
3. *Molecular Cell Biology*, Lodish, Harvey Krieger, Monty Kaiser, Chris A. Berk, Arnold, W H Freeman & C

### ***Name of the Module: Introduction to Microprocessors and Microcontrollers***

***Module Code: EE 404***

***Semester: 4<sup>th</sup>***

***Credit Value: 4 [P=2, T=0, L=3]***

***Module Leader:***

#### **A. Objective:**

The course is design to meet with the objectives of:

1. to study the Architecture of microprocessor and microcontroller,
2. to study the Interrupts and DMA,
3. to study the synchronous, asynchronous, interrupt driven using 8255.

#### **B. Learning Outcomes:**

Upon completion of the subject, the students will be able to:

1. design a microprocessor,
2. configure or design a microprocessor-based system,
3. understand efficiency of microprocessor-based systems,
4. write code or a compiler for a microprocessor which takes advantage of the advanced architectural techniques.

#### **C. Subject Matter:**

##### **UNIT I:**

8086 Architecture, Introduction to 8086 Microprocessor, 8086 Architecture-Functional diagram. Register Organization, Memory Segmentation. Programming Mode!. Memory addresses. Physical memory organization. Architecture of 8086, signal descriptions of 8086- common function signals. Minimum and Maximum mode signals. Timing diagrams. Interrupts of 8086. Instruction Set and Assembly Language Programming of 8086:Instruction formats, addressing modes, instruction set, assembler directives, macros, simple programs involving logical, branch and call instructions, sorting, evaluating arithmetic expressions, string manipulations.

##### **UNIT II:**

I/O Interface: 8255 PPL various modes of operation and interfacing to 8086. Interfacing keyboard, display, stepper motor interfacing, D/A and A/D converter.



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Interfacing with advanced devices: Memory interfacing to 8086, Interrupt structure of 8086, Vector interrupt table, Interrupt service routine. Introduction to DOS and BIOS interrupts, Interfacing Interrupt Controller 8259 DMA Controller 8257 to 8086.

### UNIT III:

Communication Interface: Serial communication standards, Serial data transfer schemes. 8251 USART architecture and interfacing. RS- 232. IEEE-488, Prototyping and trouble shooting.

Introduction to Microcontrollers: Overview of 8051 microcontroller. Architecture. I/O Ports. Memory organization, addressing modes and instruction set of 8051, simple program

### UNIT IV:

8051 Real Time Control: Interrupts, timer/ Counter and serial communication, programming Timer Interrupts, programming external hardware interrupts, programming the serial communication interrupts, programming 8051 timers and counters.

The AVR RISC microcontroller architecture: Introduction, AVR Family architecture, Register File, The ALU. Memory access and Instruction execution. I/O memory. EEPROM. I/O ports. Timers. UART. Interrupt Structure.

### D. List of Practicals:

1. Assembly language program (ALP) to add array of N hexadecimal numbers stored in the memory. Accept input from the user.
2. 8086 ALP to perform non-overlapped and overlapped block transfer (with and without string specific instructions). Block containing data can be defined in the data segment.
3. 8086 ALP to convert 4-digit Hex number into its equivalent BCD number and 5-digit BCD number into its equivalent HEX number. Make your program user friendly to accept the choice from user for: (a)HEX to BCD (b) BCD to HEX (c) EXIT. Displaying proper strings to prompt the user while accepting the input and displaying the result.
4. 8086 ALP for the following operations on the string entered by the user.
  - a) Calculate Length of the string
  - b) Reverse the string
  - c) Check whether the string is palindromeDisplaying appropriate messages to prompt the user while accepting the input and displaying the result.
5. 8086 ALP to perform string manipulation. The strings to be accepted from the user is to be stored in data segment of program-1 and write FAR PROCEDURES in code segment program\_2 for following operations on the string:
  - (a) Concatenation of two strings
  - (b) Number of occurrences of a sub-string in the given stringUsing PUBLIC and EXTRN directive. Create .OBJ files of both the modules and link them to create an EXE file.



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

6. 8086 ALP to perform multiplication of two 8-bit hexadecimal numbers. Use successive addition and add and shift method. Accepting input from the user.
7. 8087ALP to obtain:
  - i) Mean ii) Variance iii) Standard DeviationFor a given set of data elements defined in data segment. Also displaying result.
8. 8086 ALP to convert an analog signal in the range of 0V to 5V to its corresponding digital signal using successive approximation ADC and dual slope ADC. Finding resolution used in both the ADC's and compare the results.

### E. Books:

1. D. V. Hall. *Micro processors and Interfacing*, TMGH. 2<sup>nd</sup> edition 2006.
2. Kenneth. J. Ayala. *The 8051 microcontroller*, 3rd edition, Cengage learning, 2010
3. *Advanced Microprocessors and Peripherals* - A. K. Ray and K.M. Bhurchandani, TMH, 2nd edition 2006.
4. *The 8051 Microcontrollers, Architecture and programming and Applications* -K.Uma Rao, Andhe Pallavi,,Pearson, 2009.
5. *Micro Computer System 8086/8088 Family Architecture. Programming and Design* - By Liu and GA Gibson, PHI, 2nd Ed.,
6. *Microcontrollers and application*, Ajay. V. Deshmukh, TMGH, 2005

### F. Magazines:

1. *IEEE Microcontrollers and Microprocessors Magazine*.
2. *Electronics Business Magazine*.
3. *IEE ASSP Magazine*

### G. Journals:

1. *IEEE journal on selected Areas in communication*.
2. *Springer*
3. *IEEE Spectrum*
4. *Bell Systems Technical Journal*
5. *AT&T Bell Laboratory Technical Journal*
6. *Electronics Letter*
7. *International Journal of wireless Information Networks*.
8. *British Telecom Technological Journal*
9. *AT&T Technical Journals*



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

**Name of the Module: Molecular Biology**

**Module Code: BT-405**

**Semester: 4<sup>th</sup>**

**Credit Value: 4 [P = 0, T = 0, L = 3]**

### A. Objectives:

To impart knowledge on Nucleic acids and their characteristics, transcription, translation, protein sorting, regulation of gene expression.

### B. Learning Outcome:

This subject discusses the fundamentals concepts and basic principles such as structure of DNA / RNA, transcription, translation gene regulation, and RNA splicing.

### C. Subject Matter:

#### Unit I:

**Introduction to molecular biology - dna and rna:** Scope and History. Structure of DNA- Nucleoside, Nucleotide, Base pairing, Base stacking, Double Helix, features of Watson and Crick model, major and minor groove, Supercoiling- twist, writhe and linking number. Forms of DNA- A, B, Z. Structure and function of mRNA, rRNA, tRNA. Secondary structures in RNA.

#### Unit II:

**Replication and repair:** Types and functions of DNA polymerases in Prokaryote and Eukaryote. Replication in prokaryote and Eukaryote. Proof reading activity, 5' → 3' exonuclease activity, topoisomerase activity, Telomeric DNA replication and Plasmid Replication-theta model, strand displacement model and rolling circle model. DNA Repair- Nucleotide excision repair, base excision repair, mismatch repair, photo-reactivation, recombination repair and SOS repair.

#### Unit III:

**Transcription and post transcriptional modifications:** Fine structure of prokaryotic and eukaryotic gene, structure and function of the promoters in mRNA, rRNA, tRNA genes. RNA polymerases in prokaryote and eukaryote, types and function. Transcription of mRNA, rRNA, and tRNA genes in Prokaryote and eukaryote. Post transcriptional processing of mRNA – 5' capping, splicing (including different types), polyadenylation and RNA editing.

#### Unit IV:

**Translation and post translational processing:** Genetic code and Wobble hypothesis. Translation in prokaryote and eukaryote. Post translational modifications. Principles protein sorting and targeting into endoplasmic reticulum, mitochondria, chloroplast, and nucleus.

**Gene regulation:** Principles of gene regulation- Transcriptional and post transcriptional gene regulation-activators, co-activators, suppressors, co-suppressors, moderators, silencers, insulators, enhancers. Operon-*lac* operon, *trp* operon, *ara* operon and *gal* operon.

### D. Reading List:

#### Books:

1. *Molecular Biology of Gene* - Watson
2. *Molecular and Cellular Biology*- Stefen Wolfe



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### Journals:

1. *Bio-Organic Medicinal Chemistry Letter-Science Direct*
2. *Bio-Organic Medicinal Chemistry-Science Direct*
3. *Nature – Nature publishing House*
4. *Cell -*

### **Name of the Module: Entrepreneurship and Innovation:**

**Module Code: HSS 401**

**Semester: 4<sup>th</sup>**

**Credit Value: 3 [P=0, T=0, L=3]**

### **A. Objectives:**

### **B. Learning Outcomes:**

Upon completion of the subject:

1. Students will be able to start their venture more scientifically.
2. Students will be able to start their venture by linking with the financial institutions.

### **C. Subject Matter:**

#### **Unit I:**

**Introduction to Entrepreneurship:** Meaning, Role of Entrepreneur, Entrepreneur Process: different approaches, Motivation for becoming an Entrepreneur.

SME Concept, its role, status, prospects and policies for promotion of SMEs.

Importance of Entrepreneurship: innovations, Qualities of successful Entrepreneur, Functions of an Entrepreneur, Types of Entrepreneur, Issues & Problems Entrepreneurial Practices,

#### **Unit II:**

**Importance of Entrepreneurship:** innovations: Converting Innovation to Economic Value which includes, Growth Strategies, value position, Market Segments, Value Chain Structure, Revenue Model etc., Qualities of successful Entrepreneur, Functions of an Entrepreneur, Types of Entrepreneur, Issues & Problems Entrepreneurial Practices. Contribution of Entrepreneurs: Towards R&D, creates Wealth of Nation & Self prospect with Challenge.

Entrepreneur Carrier: Different Stages, Entrepreneur Development Programmers (EDPs).

#### **Unit III:**

**Characteristics of Entrepreneurship:** Risk taker, Perceptive, Curious, Imaginative, Persistent, Goal setting, and Hardworking, Research & Management Skill, Organising & Controlling, Soft skills and Feasibility. Women Entrepreneurship: Opportunities, promotion Hurdles and Prospects of women Entrepreneurs.

Factors & Models of Entrepreneurial Development. Social Entrepreneurial Initiative: Solving social Problems, Business plan, Strategic Plan vs Business Plan

#### **Unit IV:**

**Forest based Industries:** Mobilization of resources from NTFP products, Processing units, Technical and Financial Feasibility study and analysis of projects under self employment scheme including small entrepreneur. Farm based enterprises for production and post production of Agri-produce: Crops: Cereals, Legumes, Oilseeds; Horticulture crops: Fruits and vegetables Livestock production : Poultry, Fishery, Medicinal and Aromatic plants. Handlooms & Sericulture;





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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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Handicraft, coir, jute & leather Micro entrepreneurial skills development and good production practices.

### D. Teaching/ Learning/ Practice Pattern:

Teaching: 70%

Learning: 30%

Practice: 0%

### E. Examination Pattern:

1. Theoretical Examination

### F. Reading List:

#### Books:

1. *Management and Entrepreneurship* N. V. R. Naidu, Naidu I. K. International Pvt Ltd, 01-Jan-2008
2. *Social Enterprise Developing Sustainable Businesses* Frank Martin and Marcus Thompson Palgrave Macmillan
3. *Small Business Management and Entrepreneurship* David R. Stokes, Nicholas Wilson Cengage Learning EMEA, 2006 - Business & Economics
4. *Entrepreneurship: Theory, Process, Practice* Donald F. Kuratko Cengage Learning, 14-Nov-2008 Business & Economics
5. *Essentials of entrepreneurship and small business management* Thomas Zimmerer, Norman M. Scarborough, Doug Wilson Pearson/Prentice Hall, 2008 - Business & Economics
6. *Entrepreneurship 6/E* Robert D. Hisrich Tata McGraw-Hill Education, 2011 - Entrepreneurship

#### Journals:

1. *International Journal of Entrepreneurship*
2. *International Journal of Innovation Management*
3. *Journal of Small business and Entrepreneurship*
4. *Journal of Human Values.*

*Journal of Management Research*



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

### SEMESTER – V

Subject Code	Subject	Model	P	T	L	Credit
BT 501	Immunology	J. C. Bose	2	0	3	4
BT 502	Bioinformatics	J. C. Bose	2	0	3	4
BT 503 Or CSE 503	Enzyme Technology Or Database Management System	J. C. Bose	2	0	3	4
BT 504	Secondary Metabolites in Plants	S. N. Bose	0	0	3	3
CHE 504 (IC)	Chemical Process Calculations	J. C. Bose	0	1	3	4
HSS 501	Industrial Management	S. N. Bose	0	0	3	3
			6	1	18	22

**Name of the Module: Immunology**

**Module Code: BT-501**

**Semester: 5<sup>th</sup>**

**Credit Value: 4 [P = 2, T = 0, L = 3]**

#### A. Objectives:

1. The immune system, their structure and classification, genetic control of antibody production
2. Cellular immunology
3. Mechanism of activation in hypersensitive immune reaction.

#### B. Learning Outcome:

Aimed at introducing the science of immunology and detail study various types of immune systems their classification structure and mechanism of immune activation.

#### C. Subject Matter:

##### Unit I:

##### Overview of the immune system:

Innate Immunity, adaptive immunity, comparative immunity cells and organs the immune system – Antigens.

##### Unit II:

##### Immunoglobulin structure and functions

Basic structures of Immunoglobulins – Ig classes and biological activities, Antigenic determinants on Ig, B Cell receptor, Monoclonal antibodies – cytokines – complement system

##### Unit III:

##### Antigen – antibody interactions

Antibody Affinity and activity – Precipitation reactions- agglutination reactions- Radio immunoassay-ELISA-Western blotting, Immunoprecipitation, Immunofluorescence, immunoelectron microscopes, flow cytometers-MHC Antigen processing & presentations.

##### Unit 4:

##### Cell & b cell maturation, activation & differentiation

T Cell receptor, T Cell maturation, activation and differentiation B Cell generation, activation and differentiation cell mediated effectors responses. **Immune system in health & disease:**



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Leukocyte migration and inflammation, hypersensitive reactions, immune response to infection diseases vaccines.

### D. List of Practical:

1. Blood grouping
2. Leukocyte count
3. PBMC preparation and their enumeration
4. Production of polyclonal antibodies – preparation of antigen – protocol for immunization in rabbits
5. Methods of bleeding-purification of polyclonal antibodies
6. Antigen-antibody reaction-Haemagglutination, precipitation-Widal and VDRL
7. Immunodiffusion, Immunoelectrophoresis.
8. Affinity chromatography for antibody purification.
9. ELISA-DOT and plate ELISA
10. Western blotting

### E. Reading List

#### Books:

1. *Kuby Immunology* by Richard A. Golds by Tharmas J. kindt fourth edition 2000 and Barbara Osborne. W.H.freeman and company
2. *Immunobiology 6th Edition*, Janeway, Travers, Walport, Shlomchik, Garland, 2005.

#### Journals:

1. *Molecular Immunology-Science Direct*
2. *Human Immunology - ScienceDirect*

**Name of the Module: Bio-Informatics**

**Module Code: BT-502**

**Semester: 5<sup>th</sup>**

**Credit Value: 3[P=2,T=0 L=3]**

### A. Objectives:

The course is design to meet with the objectives of:

1. to introduce the fundamental concepts of Bioinformatics;
2. to equip students with the software of Bioinformatics;
3. to explore the different paradigms in Data mining, HMM, Biocomputing.

### B. Learning outcomes:

Upon Completion of the subjects, students will be able to:

1. learn concepts of genomics and proteomics;
2. describe bioinformatics algorithms such as dynamic programming, hidden markov models and monte carlo;
3. utilize bioinformatics tools such as Pymol, Blast, and ClustalW;
4. code solutions to bioinformatics problems utilizing tools such as R, biopython, bioperl;
5. explore research areas in bioinformatics;

### C. Subject Matter:

#### Unit I:



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

**Introduction to Bioinformatics:** Definition and History of Bioinformatics, Internet and Bioinformatics, Introduction to Data Mining, Applications of Data Mining to Bioinformatics Problems and Applications of Bioinformatics

### Unit II:

**Bioinformatics Softwares:** Clustal V, Clustal W 1.7, RasMol, Oligo, Molscrip, Treeview, Alscript, Genetic Analysis Software, Phylip

### Unit III:

**Biocomputing:** Introduction to String Matching Algorithms, Database Search Techniques, Sequence Comparison and Alignment Techniques, Use of Biochemical Scoring Matrices, Introduction to Graph Matching Algorithms, Automated Genome Comparison and its Implication, Automated Gene Prediction, Automated Identification of Bacterial Operons and Pathways; Introduction to Signalling Pathways and Pathway Regulation. Gene Arrays, Analysis of Gene Arrays.

### Unit IV:

**Markov chains and applications:** Systems Biology-an introduction  
Machine Learning Methods, Hidden Markov models, Applications of HMM in gene identification and Profiles HMMs, Neural Networks and Support Vector machines.

### D. Teaching/ Learning/ Practice Pattern:

1. Teaching: 40%
2. Learning: 10%
3. Practice: 50%

### B. List of Practical:

1. Handling of different databases (primary and secondary database)
2. Processing, storing and analyzing of DNA sequences from chromatogram
  - a. Open the chromatogram
  - b. Obtain the sequence in FASTA format
  - c. Annotate the sequence
  - d. Conversion of sequence in different format
3. Alignment of gene sequences for predicting similarities
  - a. Pair wise alignment using BLAST and ClustalW
  - b. Multiple sequence alignment using ClustalW
4. Phylogenetic analysis
5. Functional gene identification from genomic database
  - a. Find ORF and six frame translation product
  - b. Find out the conserved domain
6. Protein structure prediction
7. Drug designing and molecular docking
8. Basic of Perl Language

### F. Examination Pattern:

1. Theoretical Examination: Regular Examination.
2. Practical Examination: Conducting experiment and viva voice

### G. Reading List :



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

### Books:

1. Claverie, J.M. and Notredame C. 2003 *Bioinformatics for Dummies*. Wiley Editor.
2. Letovsky, S.I. 1999 *Bioinformatics*. Kluwer Academic Publishers.
3. Baldi, P. and Brunak, S. 1998 *Bioinformatics*. The MIT Press.
4. Setubal, J. and Meidanis, J. 1996 *Introduction to Computational Molecular Biology*. PWS Publishing Co., Boston.
5. Lesk, A.M. 2002 *Introduction to Bioinformatics*. Oxford University. Press.
6. Rastogi, S.C., Mendiratta, N. and Rastogi, P. 2004 *Bioinformatics: Concepts, Skills & Applications*. CBS Publishers & Distributors, New Delhi.
7. Vyas, S.P. and Kohli, D.V., *Methods in Biotechnology and Bioengineering*.
8. Singer, M. and Barg, P. *Exploring Genetic Mechanism*.
9. Fogel, G.B. and Corne, D.W., *Evolutionary Computation in Bioinformatics*.
10. *Genetic Library Construction and Screening: Advanced Techniques and Applications: Lab Manual*
11. Patterson, B.K., *Techniques in Quantification and Localization of Gene Expression*.
12. Mont, D.W., *Bioinformatics: Sequence and Genome Analysis*.
13. Evens, W.J. and Grant, G.R., *Statistical Methods in Bioinformatics: An Introduction*.
14. Liu, B.H., *Statistical Genomics: Linkage Mapping and QTL Analysis*
15. Bowtell, D. and Sambrook, J. *DNA Microarrays*.
16. Pierre Baldi and Soren Brunak, *Bioinformatics: The Machine Learning Approach*.
17. Jae K. Lee, *Statistical Bioinformatics*, John Wiley & Sons Inc.

### Journal:

1. *International Journal of Bioinformatics Research and Applications*, inderscience publication, Switzerland
2. *Journal of Bioinformatics and Computational Biology*, world scientific publishing Co., Singapore.
3. *Journal of Bio technology*, Elsevier.

### **Name of the Module: Enzyme Technology**

**Module Code: BT-503**

**Semester: 5<sup>th</sup>**

**Credit Value: 4 [P = 2, T = 0, L = 3]**

### **A. Objectives:**

The course is designed to meet with the objectives:

1. to provide students with knowledge on enzyme technologies applied in industrial biotransformation.
2. to understand enzyme classes and enzymatic reactions, enzyme discovery and high-throughput screening and detection methods, enzyme purification and characterization, protein engineering, directed enzyme evolution, cell engineering, biotransformation with isolated enzymes and microbial cells, reaction engineering, enzyme in organic solvent, two-liquid phase system, enzyme stabilization, cofactor regeneration, product recovery, and bioprocess economics.

### **B. Learning outcomes:**



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Students successfully completing this module will be able to:

1. understand different types of enzyme-catalysed transformations,
2. use suitable methods for enzyme discovery, engineering, and purification,
3. calculate enzyme activity, enzyme kinetics, enzyme enantioselectivity, and bioproduct cost,
4. optimize biotransformations with isolated enzyme or whole cells as catalysts,
5. solve problems on biocatalytic process development

### C. Teaching/ Learning/ Practice pattern:

- |                          |   |
|--------------------------|---|
| 1. Lecture:              | 3 |
| hours/week               |   |
| 2. Tutorial:             | 0 |
| hours/week               |   |
| 3. Laboratory Practical: | 0 |
| hours/week               |   |
| 4. Self study:           |   |

### D. Subject matter:

#### Unit I:

Introduction to enzyme technology; Industrial enzymes – present status and opportunities with special reference to food industries; Catalytic properties of enzymes. Intracellular and extra cellular enzymes.

#### Unit II:

Enzyme production technology; Enzyme reactors and process design; Application of recombinant DNA technique to enzyme technology.

#### Unit III:

Cell disintegration by physical, chemical and biological methods; Enzyme purification methods.

#### Unit IV:

Application of enzymes for production of biochemicals and in food processing industries; Application of immobilized enzymes and cells.

### D. List of Practical:

1. Characterization of the enzymes;
2. Substrate inhibition of enzymatic reaction;
3. Optimization of different physic-chemical parameters on the enzymatic reaction;
4. Immobilization of enzyme;
5. Operation of CSTR and PFR.

### E. Reading lists:

#### Books:

1. Alba S., Humphrey E and Milli N.R., "Bio Chemical Engineering" Academic Press, 1973.
2. (ii) Scragg A.H "Bioreactors in Biotechnology"- A Practical approach
3. (iii) Bailey and Ollis, "Biochemical Engineering Fundamentals", McGraw Hill (2nd Ed.). 1986.
4. (iv) Peter F. Stanbury, Allan Whitaker, "Principles of Fermentation Technology"



***Name of the Module: Database Management System***

***Module Code: CSE-503***

***Semester: 5<sup>th</sup>***

***Credit Value: 4 [P = 2, T = 0, L = 3]***

Refer to CSE B.Tech syllabus...

***Name of the Module: Secondary Metabolites in Plants***

***Module Code: BT-504***

***Semester: 5<sup>th</sup>***

***Credit Value: 4 [P = 0, T = 0, L = 3]***

**A. Objectives:**

In this course, students will learn about important secondary plant metabolites, their synthesis and possibilities of their biotechnological production.

**B. Learning Outcome:**

Deeper insight into chemistry and reactions of secondary metabolites of dietary plant.

**C. Subject Matter:**

**Unit I:**

Primary and secondary metabolism: Interrelationships, Precursors. Secondary metabolites derived from shikimic acid.

**Unit II:**

Secondary metabolites derived from mevalonic acid . Secondary metabolites derived from mevalonic acid

**Unit III:**

Secondary metabolites derived from amino acids

**Unit IV:**

Biological activities of selected secondary metabolites

**D. Reading List**

**Books**

1. Suchý, V. *Farmakognosie, část všeobecná. Bratislava: UK, 1994.*
2. (ii) Kindl, H. – Streibl, M. – Wöber, G. *Biochemie rostlin. 1. vyd. Praha: Academia, 1981. 392 p.*
3. (iii) Bruneton, J. – Hatton, C K. *Pharmacognosy : phytochemistry medicinal plants [Investice do rozvoje vzdělávání, reg.č.: CZ1.07/2.2.00/15.0084]. 2. vyd. Paris: Technique & Documentation, 1999. 1119 p. ISBN 2-7430-0316-22.*

***Name of the Module: Chemical Process Calculations***



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

**Module Code: CH.E 504**

**Semester: 5th**

**Credit Value: 4 [P = 0, T = 1, L = 3]**

### A. Objectives:

After completion this course the students will understand: Composition of mixtures, Basic principles of stoichiometry and material balance, Formulation of material balance with and without reactions and Energy balance calculations.

### B. Subject Matter:

#### Unit I:

Units and dimensions, temperature, concept of mole. Composition of mixture, basis of calculations. Fuels, types of fuel, flue gas, Orsat analysis, theoretical air, excess air Partial saturation and humidity, types of humidity. Predicting P-V-T properties of gases using ideal gas equation, composition of gases based on mole, mass, volume and partial pressure, calculation of density. Solutions and their concentrations.

#### Unit II:

Basic concepts involved in material balance calculations, material balance problems without chemical reactions: mixing, drying, crystallization, membrane separation, distillation and extraction. Material balances involved in two-phase gas-liquid systems as in humidification and dehumidification. Basic concepts of recycle, bypass and purge streams. Material balances for non reactive systems with recycle stream.

#### Unit III:

Chemical equation and stoichiometry, limiting reactant, excess reactant, conversion, selectivity, yield. Material balances for processes with reactions. Combustion as special case of material balance with reactions. Analysis of products of combustion, calculation of excess air.

#### Unit IV:

Heat capacity, empirical equations for heat capacities, mean heat capacities of gases, Kopp's rule, sensible heat and latent heats, calculation of enthalpy. Heat of formation, standard heat of combustion, law of Hess, calculation of the standard heat of reaction from heats of formation or combustion Enthalpy changes in reactions with different temperatures, calculation of theoretical flame temperature.

### D. Reading List

#### Books

1. David. M, Himmelblau, James. B .Riggs "Basic Principles and Calculations in Chemical Engineering", 7<sup>th</sup> Edn., Prentice-Hall of India, New Delhi, 2004.
2. Richard. M, Felder, Ronald W. Rousseau, "Elementary Principles of Chemical Processes", 3<sup>rd</sup> Edition by John Wiley & Sons, Inc. Singapore, 2000.
3. Bhatt. B. I. and Thakore.. S. B "Stoichiometry", 5<sup>th</sup> Edn., Tata McGraw-Hill Publishing Company, New Delhi, 2010.

#### Journals:





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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

1. *Chemical Engineering and Processing: Process Intensification, Sciencedirect*
2. *Journal of Engineering Research and Studies*

### Magazines:

1. *Chemical Engineering World (CEW)*
2. *Chemical Process Safety*

### **Name of the Module: Industrial Management**

**Module Code: HSS 501**

**Semester: 5<sup>th</sup>**

**Credit Value: 3 [P=0, T=0, L=3]**

### **A. Objectives:**

The course is design to meet with the objectives of:

1. imparting theoretical lectures with case discussion;
2. providing teaching with inclusive learning;
3. making students aware about the importance of this subject in their future career;

### **B. Learning Outcomes:**

Upon completion of the subject:

1. Students will be work with efficiency as they had knowledge of the subject.
2. With the backup knowledge their performance will definitely much better in their workplace.

### **C. Subject Matter:**

#### **Unit I:**

**Concept of Management:** Various Approaches to Management, Management as – an art, a Science, and a Profession, Managerial skills, Process of management, Planning-Mission, Goals, Strategy, Program and Procedure; Decision making-process, decision making under risk and uncertainty, Models of decision making.

#### **Unit II:**

**Principles of Organization:** Organizational Structure, span of control, Staffing function with emphasis on, Performance Appraisal, Training and Development.

#### **Unit III:**

**Direction and coordination:** Motivation and Leadership, control function-Process and Techniques.

#### **Unit IV:**

**Production Management:** Types of Production, Locational Decisions, Plant layout and design, Production. **Planning scheduling and control:** work study, method Study, and Wage Payment Schemes and Bonus, Productivity – concept and measurement.

**Material Management:** Inventory Planning, Procurement-functions, procedures and control, storing-planning procedure and control, issue and pricing, Inventory control Techniques, Value analysis and Engineering.

### **D. Teaching/ Learning Pattern:**



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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- |                                |       |
|--------------------------------|-------|
| 1. Teaching                    | : 50% |
| 2. Learning/ case presentation | : 30% |
| 3. Assignment                  | : 10% |
| 4. Attendance                  | : 10% |

### E. Examination pattern:

- |                            |       |
|----------------------------|-------|
| 1. Theoretical Examination | : 50% |
| 2. Class test              | : 30% |
| 3. Assignment              | : 20% |

### F. Reading List:

#### Books:

1. *Badiru, A (ed), 2005, Hand Book of Industrial and System Engineers, CRC press.*
2. *Blanchard, B& Fabrycky, W. 2005. System Engineering Analysis (4<sup>th</sup> Ed.). Prentice Hall.*
3. *Salvendy, G.(Ed.) 2001. Hand Book Of Industrial Engineering: Technology & Operations Management, Wiley-Inter service.*
4. *Turner, W.et.al. 1992 Introduction to Industrial and System Engineering (3<sup>rd</sup> ed.) Prentice Hall.*

#### Journals:

1. *Group and Organization Management*
2. *Journal of Organizational Behavior*
3. *Journal of Management.*



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

### SEMESTER – VI

Subject Code	Subject	Model	P	T	L	Credit
BT 601	Environmental Biotechnology	S. N. Bose	0	0	3	3
BT 602(IC)	Bio-separation Technology	J. C. Bose	2	0	3	4
BT 603	Recombinant DNA Technology	J. C. Bose	2	0	3	4
BT 604 Or ECE 601	Herbal Technology Or Fiber Optics Communication	S. N. Bose	0	0	3	3
HSS 601	Engineering Ethics & IPR	S. N. Bose	0	0	3	3
HSS 602	Disaster Management	S. N. Bose	0	0	2	2
			4	0	17	19

**Name of the Module: Environmental Biotechnology**

**Module Code: BT 601**

**Semester: 6<sup>th</sup>**

**Credit Value: 3 [P=0, T=0, L=3]**

#### A. Objectives

#### B. Learning outcome

#### C. Subject matter

##### Unit I:

**Introduction to Environment Biotechnology:** Definition of environmental biotechnology and its importance; Overview of microbial transformations; Metagenomics/environmental genomics. Microbial Reactors, genetically modified microbes & their uses in Environmental management recycling & up gradation technologies, Production of products, energy from waste.

##### Unit II:

**Application of applied technology for bioremediation:** Bioprospecting. Biomicroelectronics and Nanobiotechnology; Bioremediation of inorganic (metal, radionuclide, nitrate, phosphate) and organic pollutants; In situ and ex situ remediation strategies.

##### Unit III:

**Characteristics of pollutants:** Oxygen and ozone chemistry, Chemistry of air pollutants, Photochemical Smog, Chemistry of water, concept of D.O., B.O.D., and C.O.D, water treatment : Sedimentation, Coagulation, Filtration, tertiary and advanced treatment, redox potential, Inorganic and organic components of soil, nitrogen pathways and NPK in soils. Ethical issues in environmental biotechnology.

##### Unit IV

**Treatment process for bioremediation:** Biotransformation, bioconversion, bioremediation, phytoremediation technology, fermentation technology, development of stress tolerant plants, Environmental problems & Environmental monitoring through microorganism, microbiology of water, air and soil, microbes as pathological agent in plant, animal and man. Biogas technology,



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

plant design, construction, operation, biogas form organic wastes, water weeds, land fills, microbiology of anaerobic fermentation.

### D. Reading List:

#### Books:

1. *Wastewater Engineering: Treatment, Disposal and Reuse*, Metcalf & Eddy, Inc., Tata McGraw-Hill Pub. Co. Ltd., New Delhi.
2. *Environmental Microbiology*, Raina M. Maier, Ian L Pepper, Charles P Gerba, Academic Press, California, USA.
3. *Environmental Biotechnology*, B C Bhattacharyya and R Banerjee, Oxford University Press, New Delhi
4. *Textbook of Environmental Biotechnology* by PK Mohapatr. Publisher I. K. International Pvt Ltd
5. *Environmental Biotechnology-Recent Perspectives* by Manju Sharma, K. C. Sharma, Navneet Joshi. Publisher Lambert Academic Publishing.
6. *Text Book of Environmental Biotechnology* by V. Soni. Publisher Pointer Publishers
- 7.

#### Journals:

1. *Water Research*, Elsevier
2. *Environmental Pollution*, Elsevier
1. *Bioresource Technology*, Elsevier, , Netherlands
2. *Journal of Envioment Biotechnology*, Springer, USA
3. *Environmental Sciences and Technology*, ACS, USA
4. *Journal of Petroleum and Environmental Biotechnology*, OMIC International  
*Journal of Environmental and Analytical Toxicology*, OMIC International

**Name of the Module: Bio-separation Technology**

**Module Code: BT-602**

**Semester: 6<sup>th</sup>**

**Credit Value: 4 [P = 2, T = 0, L = 3]**

#### A. Objectives:

1. To make the student understand the importance of Bioseparation processes
2. Cell disruption
3. Filtration, sedimentation and extraction
4. Product resolution
5. Product crystallization and drying and process economics

#### B. Learning Outcome:



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The course provides an opportunity to understand the importance of the Bioseparation process, economics and process design criteria for various classes of bio products.

### C. Subject Matter:

#### Unit I:

**Introduction to bioseparation process:** Role and importance of Bioseparation process in biotechnological processes. Problems and requirements of bioproduct purification. Cost-cutting strategies Characteristics of biological mixtures – Process of Classification of Bioproducts - Biological activity Analysis of purity-Process economics-Capital and operating cost analysis.

#### Unit II:

**Cell disruption and sedimentation:** Cell disruption methods for intracellular products, removal of insolubles, biomass (and particulate debris) separation techniques, flocculation and sedimentation, centrifugation and filtration methods. FPLC, HPLC, GLC, GC, LCMS.

#### Unit III:

**Filtration, precipitation and extraction:** Membrane based separations micro and ultra filtration theory, design and configuration of membrane separation equipment, applications, precipitation methods (with salts, organic solvents, and polymers, extractive separations, aqueous two-phase extraction, supercritical extraction), *in situ* product removal.

#### Unit IV:

**Chromatography and electrophoresis:** Adsorptive chromatographic separation processes, gel permeation chromatography, all electrophoresis techniques including capillary electrophoresis, hybrid separation technologies-membrane chromatography, electro chromatography. –HPLC  
**Product crystallisation and drying:** Crystallisation.-Principles-Nucleation-Crystal growth-Kinetics-Batch crystallizers-Process crystallizers of proteins- Scale-up and design- Drying – Principles-Water in biological solids-Heat and mass transfer-Dryer description and operation-Vacuum shelf and rotary dryer-Freeze dryer-Spray dryer-Scale-up and design-spreadsheet and simulators.

### C. List of Practical

1. Fast protein purification
2. Gel Chromatography
3. Ion exchange chromatography
4. Affinity chromatography
5. Separation of cell organelles by different centrifugation parameters
6. Ammonium sulphate precipitation

### E. Reading List:

#### Books

1. Roger G Harrison et al “Bioseparation Science and Engineering” Oxford University Press, 2003
2. Belter PA and Cussler E, “ Bioseparations ”, Wiley 1985
3. Wankat P.C, “ Rate controlled separations ”, Elsevier, 1990
4. Asenjo J.M., “ Separation processes in Biotechnology ” Marcel Dekker Inc. 1993.



**Name of the Module: Recombinant DNA Technology**

**Module Code: BT-603**

**Semester: 6<sup>th</sup>**

**Credit Value: 4 [P = 2, T = 0, L = 3]**

**A. Objectives:**

1. to obtain a large number of copies of specific DNA fragments;
2. to recover large quantities of the protein produced by the concerned gene;
3. to integrate the gene in question into the chromosomes of a target organism where it expresses itself;

**B. Learning Outcome:**

1. to understand the concept of recombinant DNA technology or genetic engineering
2. to describe DNA fingerprinting, and restriction fragment length polymorphism (RFLP) analysis and their applications

**C. Subject Matter:**

**Unit I:**

**Basics of DNA cloning:** Simple cloning and cloning using linkers and adaptors. Cloning into various kinds of vectors – plasmids, phages lambda and M13, phagemids, cosmids, P1 phage, PACs, BACs and YACs. Selection and screening of clones.

**Methods of DNA and protein analysis:** Agarose, polyacrylamide and pulsed field gel electrophoresis of DNA. Southern and Northern Blotting. Radiolabelling probes. Isolation and purification of DNA. RFLP analysis. DNA fingerprinting and its application in forensics, in disease diagnosis and in identification of strains. Native PAGE, SDS-PAGE and two-dimensional PAGE analysis of proteins. Western Blotting analysis.

**Unit II:**

**Polymerase Chain Reaction:** Concept of PCR and various thermophilic enzymes used in PCR. Gradient PCR versus Touchdown PCR. Designing primers. Cloning PCR products. Long PCR, Inverse PCR, Vectors PCR, RT-PCR, 5' and 3' RACE, qPCR, Real Time PCR using SYBR Green, Scorpion primers and TaqMan probes, MOPAC, Multiplex PCR, Differential Display PCR, RAPD fingerprinting of micro-organisms, Ligation Chain Reaction, Overlap PCR, Rolling Circle Amplification Technology.

**Unit III:**

**Construction of cDNA and genomic DNA libraries:** Vectors used in the construction of cDNA versus genomic DNA libraries. Steps and enzymes involved in the construction of cDNA versus genomic DNA libraries. Screening libraries by colony hybridization and colony PCR. Screening expression libraries. Enriching for clones in cDNA libraries by positive selection and subtractive hybridization. Identifying genes in complex genomes by direct selection of cDNA and exon trapping. DNA sequencing by Sanger's method – traditional and cycle sequencing. Physical mapping by restriction fragment fingerprinting of BAC clones and STS mapping. E-PCR. Whole genome shotgun sequencing. Clone-by-clone shotgun sequencing of genome – preparation of BAC/YAC library, map construction, clone selection, subclone library construction, random shotgun phase, finishing phase and sequence authentication. Genome annotation at the nucleotide level, protein level and process level. Comparative genome sequencing of micro-organisms to identify and categorize SNPs. Array CGH.

**Unit IV:**



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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**Overexpression of recombinant proteins:** Overexpression and tagging of recombinant proteins in *E.coli*, driven by lac, T7 and Tet-regulatable promoters. Mammalian cell overexpression system. **Analysis of protein-DNA and protein-protein interactions:** Gel retardation assay, DNA footprinting by DNase I and chemical methods, yeast one-hybrid assay, CHIP- chips. Yeast two hybrids, three-hybrids, split hybrids and reverse hybrids. Co-immunoprecipitations, pull-downs and Far-Westerns. GFP and FRET. Phage display.

### D. List of practical:

1. Plasmid isolation
2. Genomic DNA isolation
3. Preparation of competent cells from bacteria
4. Restriction digestion
5. Ligation of recombinant gene into plasmid
6. Transformation
7. Screening of colonies

### E. Reading List:

#### Books

1. *Molecular Biology* by David P. Clarke, 1st edition; Elsevier Academic Press; 2005.
2. *Molecular Cloning: A laboratory manual* by Joseph Sambrook & David Russell, 3rd edition; CSHL press; 2001.
3. *DNA Technology : The Awesome Skill* by I. Edward Alcamo, 2nd edition; Hardcourt Academic Press; 2001.
4. *Molecular Biology of the Gene* by James Watson, Tania Baker, Stephen Bell, Alexander Gann, Michael Levine & Richard Losick , 6th Edition; CSHL Press; 2007.



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**Name of the Module: Herbal Technology**

**Module Code: BT-604**

**Semester: 6<sup>th</sup>**

**Credit Value: 3 [P = 0, T = 0, L = 3]**

### UNIT-I

1. General Introduction to Pharmacognosy and its importance in herbal drug industry.
2. The classification and vegetable drug with special reference to chemotaxonomy.
3. WHO Guidelines for cultivation and collection of Herbal Drugs.
4. Factors affecting cultivation of crop including Plant Growth Regulators.
5. Comparative phytochemistry, Phytochemical classification of plants, relationship between phytochemistry and taxonomy, variations, novel and unpredicted compounds.

### UNIT-2

1. Commercial sources, method of isolation and separation, chemical properties, characterization (excluding synthesis) and therapeutic uses of some medicinally important class of plant Phenolics, Alkaloids, Glycosides, Terpenoides, Steroids and Resinous substances.
2. Phytomics and metabolomics.

### UNIT-3

1. Plantibodies (immunoglobins) from plants.
2. Edible dyes, plant sweeteners, perfumery and cosmetic agents.
3. Dietary anti-oxidants in disease prevention.

### UNIT-4

1. Preclinical drug evaluation of its biological activity, potency and toxicity-Toxicity test in animals including acute, sub-acute and chronic toxicity, ED50 and LD50 determination, special toxicity test like teratogenicity and mutagenicity. Various guidelines for toxicity studies.
2. Herbal drugs used in Peptic Ulcer, Respiratory disorders, Hormone and Endocrine disorders. Anti fertility agents and diuretics.
3. Various models for Cataract, glaucoma, inflammatory bowel disease

**Name of the Module: Fiber Optics Communication**





**Module Code: ECE 601**

**Semester: 6<sup>th</sup>**

**Credit Value: 3 [P=0, T=0, L=3]**

**Module Leader:**

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**A. Objectives:**

The course is designed to meet the objectives of:

1. To make students to learn about art and technology of fiber optical communication, mainly Transmitter, Receiver and Links
2. To make the students knowledgeable of different types of techniques for measuring fiber optics communication parameters
3. To know about techniques of optical coupling, amplification and oscillation
4. To study techniques, devices, measurement and coupling of optical fiber communication

**B. Learning outcomes:**

At the end of this module, students are expected to be able to

1. Design optical transmitters, receivers and couple them through links for installing fiber communication
2. To know about different techniques of measurement of parameters of optical communication

**C. Subject matter:**

**UNIT I:**

**Introduction to optical fiber:** Ray diagram, different types of optical fiber, step index, graded index.

**Optical Fiber Communication:** Principles and systems, Single-mode Fiber: Mode Cut-Off wavelength, Mode-field Diameter, Equivalent Step-Index (ESI) Profile, Measurement, Dispersion Measurements: Time-Domain method & Frequency-Domain Method, Geometrical Measurements: diameter, deformation, eccentricity, elasticity, Mechanical Strength of Optical Fiber

**UNIT II:**

**Transmitters and Receivers:** Physics of semiconductor, LED, Laser Diodes, Solar cell, Lasers, Bias & stabilization, Driver circuits for analog & digital modulation, Modulation bandwidth, PIN, APD photodiodes, photo diode amplifiers, Signal to noise ratio in PIN and APD receivers, Receiver sensitivity, Eye diagram, Coupling mechanism, Transmission Characteristics of fibers, short haul, long haul and high speed links, optical power budget calculations

**UNIT III:**

**Optical Interconnecting Devices:** Optical isolators, polarizer, circulators, attenuators, amplifiers, oscillators, filters, add/drop multiplexers, optical modulators

**Other optical device used in fiber optics communication:** Wave division multiplexing and demultiplexing, optical switching, optical amplifier (Raman, EDFA)

**UNIT IV:**

**Measurement:** Lock-in-Amplifier, Monochromator, Infrared viewer, Optical spectrum Analyzer, Multi-mode-fiber: Parameters for characterization, Steady-State Power



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

distribution, mode stripper, Measurement of Attenuation: Loss Mechanisms in Fiber, Calorimetric Method, Absorption & Scattering I/O attenuation, Cut-Back method, OTDR techniques; Numerical Aperture-trigonometric & Scanning method, International Standards for Measurements

### D. List of Experiments: NIL

### E. Teaching/Learning/Practice Pattern:

Teaching : 40%

Learning : 10%

Practice : 50%

### F. Examination Pattern:

1. Theoretical Examination: Open book/ Regular examination and on line test.

### G. Reading List:

#### BOOKS:

1. Ghatak, "Fiber Optics Communication", Tata McGraw Hill, New Delhi
2. J M Senior, "Optical Fiber Communication", Prentice Hall of India, New Delhi
3. G Keiser, "Optical Fiber Communication", McGraw Hill
4. D K Myabaev & L LScheiner, "Fiber Optic Communication Technology", Pearson Ltd
5. Dietrich Marcuse, "Principles of Optical Fiber Measurements", Academic Press Inc NY
6. Giovanni Cancellieri & Umberto Ravaoli, "Measurements of Optical Fibers & Devices – Theory & Experiments", Artech House Inc. Dedham, USA
7. Bishnu Pal, "Fundamentals of Fiber Optics in Telecommunication & Sensor Systems", Wiley Eastern Limited
8. Giovanni Cancellieri (Editor), "Single-Mode Optical Fiber Measurements, Characterization & Sensing", Artech House Inc. Boston

#### MAGAZINES:

1. IEEE Spectrum
2. Electronics for you
3. Electropages

#### JOURNALS:

1. IEEE Xplore
2. Journal of Optical and Fiber Communications Research - Springer
3. Journal of Optical Communications - Walter de Gruyter
4. Fiber optics and optical communications - Optics InfoBase

**Name of the Module: Engineering Ethics & IPR**

**Module Code: HSS 601**

**Semester: 6<sup>th</sup>**



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**Credit Value: 3 [P=0, T=0, L=3]**

### A. Objectives:

The course is design to meet with the objectives of:

1. Imparting theoretical lectures with case discussion.
2. Providing teaching with inclusive learning.
3. Making students aware about the importance of this subject in their future

### B. Learning outcomes:

Upon completion of the subject:

1. Students will be able to work with efficiency as they had knowledge of the subject.
2. With the backup knowledge their performance will definitely be much better in their workplace.

### C. Subject Matter:

#### Unit I:

Engineering as a profession, historical and social context, Ethics in Engineering, Codes of Engineering Ethics, history and purpose, consequentialism and utilitarianism, Deontological approaches, duties, rights and respect for a person, responsibility, virtue Ethics, honesty, moral autonomy, obligations of Engineering profession and moral propriety.

#### Unit II:

Engineer's moral responsibility for safety and human right, risk assessment and communication, product liability, development ethics, engineers and employer relationship, whistle blowing and its moral justifications.

#### Unit III:

Computer Ethics: Social impact of computers, Computer and gender issues, n privacy, cyber crime, ethical use of software's, intrinsic value of nature.

#### Unit IV:

IPR I: Intellectual property, definition, types, rights and functions, patents, trademark, software design, industrial designs, semi-conductor and integrated circuits layout design, grant of patent in India, authority and procedure, patent forms, surrender and revocation of patents and compulsory licensing, acquisition of inventions by the Government.

IPR II: Contents of draft application for patents, Drafting patent specification and claims, WTO and drafting patent specification and claims, IPR in fringement and piracy under Indian Laws.

### D. Teaching/ Learning:

- |                                |       |
|--------------------------------|-------|
| 1. Teaching                    | : 50% |
| 2. Learning/ case presentation | : 30% |
| 3. Assignment                  | : 10% |
| 4. Attendance                  | : 10% |

### E. Examination pattern:

- |                            |      |
|----------------------------|------|
| 1. Theoretical Examination | : 50 |
| 2. Class test              | : 30 |
| 3. Assignment              | : 20 |

### F. Reading list:



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### Books:

1. Chowdhury, Subir, *Blending the best of the East & West*, , EXCEL
2. Ghosh, Vikas, *Ethics and Mgmt. & Indian Ethos*,
3. Pherwani, *Business Ethics*, EPH
4. Balachandran Raja, Nair, *Ethics, Indian Ethos and Mgmt.*, Shroff Publishers
5. Velasquez, *Business Ethics: concept and cases*, Pearson

### Magazine:

1. *Industry Week*

### Journals:

1. *Journal of Business Ethics*
2. *The Journal of Ethics*
3. *Ethics, University of Chicago Press*
4. *Kennedy Institute of Ethics Journal*
5. *Journal of Global Ethics*

### **Name of the Module: Disaster Management**

**Module Code: HSS 602**

**Semester: 6<sup>th</sup>**

**Credit Value: 2 [P=0, T=0, L=2]**

**Module Leader:**

### **A. Objectives:**

The course is design to meet with the objectives of:

1. Imparting theoretical lectures with case discussion.
2. Providing teaching with inclusive learning.
3. Making students aware about the importance of this subject in the future prospect

### **B. Learning outcomes:**

Upon completion of the subject:

1. Students will be able to work with efficiency as they had knowledge of the subject.
2. With the backup knowledge their performance will definitely be much better in their workplace.

### **C. Subject matter:**

#### **Unit I:**

**Introduction:** Disaster preparedness, Goals and objectives of ISDR Programme, Risk identification, Risk sharing.

**Disaster and development:** Development plans and disaster management. Alternative to dominant approach, disaster-development linkages, Principle of risk partnership

#### **Unit II:**

**Disaster management and risk reduction in garment industry:** Types of disasters and disaster plans: Processing machines and utilities. Sustainable livelihoods and their Protection –



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

Recovery from disaster –fire, boiler mishap. Garment Industry health monitoring and Disaster aids.

### Unit III:

**Awareness of risk reduction:** Trigger mechanism, constitution of trigger mechanism, risk reduction by education, disaster information network, risk reduction by public awareness.

### Unit III:

**Development planning on disaster:** Implication of development planning, financial arrangements, areas of improvement, disaster preparedness, community based disaster management, emergency response. **Seismicity:** Seismic waves, Earthquakes and faults, measures of an earthquake, magnitude and intensity ground damage, Tsunamis and earthquakes

### D. Teaching/ Learning/Practice Pattern:

- |                                |       |
|--------------------------------|-------|
| 1. Teaching                    | : 50% |
| 2. Learning/ case presentation | : 30% |
| 3. Assignment                  | : 10% |
| 4. Attendance                  | : 10% |

### E. Examination pattern:

- |                            |      |
|----------------------------|------|
| 1. Theoretical Examination | : 50 |
| 2. Class test              | : 30 |
| 3. Assignment              | : 20 |

### F. Reading List:

#### Books:

1. Pardeep Sahni, Madhavi Malalgoda and Aariyabandu, *Disaster risk reduction in south Asia*, PHI, 2009
2. Amita Sinval, *Understanding Earthquake Disasters*, TMH, 2010.
3. MHA, GOI-UNDP, *Disaster Management in India*, 2009
4. NDMA, 'Incident Response Guidelines', 2009
5. *Disaster Management Act*, 2005.

#### Journals:

1. *Asian Journal of Environment and Disaster Management*
2. *International Journal of Disaster management*
3. *IDRIM Journal*
4. *Journal of Disaster Risk Studies Emergency Management Review*



# NATIONAL INSTITUTE OF TECHNOLOGY, ARUNACHAL PRADESH

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Yupia, District Papum Pare, Arunachal Pradesh - 791112

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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

### SEMESTER – VII

Subject Code	Subject	Model	P	T	L	Credit
BT 701	Nano Biotechnology	S. N. Bose	0	0	3	3
BT 702 (IC)	Bioreactor Analysis and Design	S. N. Bose	0	0	3	3
BT 7XX	Elective I	S. N. Bose	0	0	3	3
BT 7XX	Elective II	S. N. Bose	0	0	3	3
XXX 701	Research Paper Communication	S. N. Bose	2	0	0	1
HSS 701	Mass Communication for Technology	S. N. Bose	2	0	0	1
			4	0	12	<b>18</b>

### List of Electives I and II

Subject Code	Subject	Model	P	T	L	Credit
BT 701(A)	Food Technology	S. N. Bose	0	0	3	3
BT 702(A)	Molecular Genetics	S. N. Bose	0	0	3	3
BT 703(A)	Protein Engineering	S. N. Bose	0	0	3	3
BT 704(B)	Immunotechnology	S. N. Bose	0	0	3	3
BT 705(B)	Metabolic Engineering	S. N. Bose	0	0	3	3
BT 706(B)	Development Biology	S. N. Bose	0	0	3	3

**Name of the Module: Nanobiotechnology**

**Module Code: BT 701**

**Semester: 7<sup>th</sup>**

**Credit Value: 3 [P=0, T=0, L=3]**

#### **A. Learning outcomes:**

On completion of the module, the student should be able to:

1. know the structures and processes of biomolecules for novel functional materials, biosensors, and bioelectronics,
2. understand Protein-based Nanostructures and DNA-based Nanostructures,
3. know Drug Carriers & Delivery System.

#### **B. Subject matter:**



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### Unit I:

Dimensions of nanoscience, Size of bulk versus nanomaterials, Nanoparticle synthesis techniques, Speciality of nanomaterials, Quantum dots and size effect, Classification and properties of nanomaterials, Nanocrystalline phase, Electronic structure of nanoparticles, Physics of small systems & theoretical principles, Effects of surface functionalisation and optical properties, Role of surfaces in nanotechnology devices, Micelles, Colloids Surface active agents, Critical micellar concentration (CMC).

### Unit II:

Physical characterization of nanoparticles using UV-Visible, Fluorescence Spectrophotometers X-ray diffraction, DLS, Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM), Transmission Electron Microscope (TEM), EDAX analysis.

### Unit III:

Applications of nanoparticles, Interaction between biomolecules and nanoparticle surface Natural Biomaterials, Biopolymers & Ceramics, Some nanocomposite biomaterials, teeth and bone substitution, Natural nanocomposite systems as spider silk, bones, shells; Metallic, Ceramic and Polymeric implant materials, Bio-nanosensors and Orthopaedic Biomaterials, Biomaterials in Tissue Engineering, Nanoparticles to cross biology barriers, Biomaterials and device retrieval and analysis, Biomaterials and central nervous system, Biosensors, semi-conductor nanoparticle, CNT.

### Unit IV:

Current status of nanobiotechnology, Nanotechnology in Diagnostics applications, Materials used in Diagnostics and Therapeutic application, Anti bacterial activity, Developing of Nanomedicines, Drug Carriers & Delivery System, Cancer treatment, Photodynamic therapy, Probes for bioimaging, Cardiovascular medical devices. Toxicological health effects caused by nanoparticles.

### C. Reading List:

#### Books:

1. Lindsay, S.M., *Introduction to Nanoscience*, Oxford University Press (2010).
2. Niemeyer C.M. and Mirkin, C.A., *Nanobiotechnology: Concepts, Applications and Perspectives*, Wiley-VCH (2004).
3. Balaji, S., *Nanobiotechnology*, MJP Publishers (2010).
4. Wang, Z.L., *Characterization of Nanophase Materials*, Wiley-VCH (2000).
5. Rao, C.N.R., Muller, A. and Cheetham, A.K., *The Chemistry of Nanomaterials: Synthesis, Properties and Applications Vol. 1&2*, Wiley-VCH (2004).
6. Kumar, C.S.S.R., Hormes, J. and Carola, L., *Nanofabrication towards biomedical applications*, Wiley-VCH (2005).
7. Christof M. Niemeyer, Chad A. Mirkin *Nanobiotechnology: Concepts, Applications and Perspectives*, Wiley 2004.

#### Magazines:

Nanomagazine

#### Journals:



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1. *Journals of Nanotechnology*
2. *American Journal of Nanoscience and Nanoengineering*
3. *International Journal of Pharmaceutical science Invention*

**Name of the Module: Bioreactor Analysis and Design**

**Module Code: BT 702**

**Semester: 7<sup>th</sup>**

**Credit Value: 3 [P=3, T=0, L=3]**

### A. Objectives:

The course imparts advanced knowledge on bioreactor design for efficient utilization of the principles in bioprocess technology.

### B. Learning outcomes:

Students successfully completing this module will be able to:

1. utilize basic concepts of bioreactor design,
2. utilize bioreactor instrumentation and control ,
3. carry on methods and strategies for fermentation control.

### C. Subject matter:

#### Unit I:

Stoichiometry of bioprocessing, Types of Bioreactor. Scale up of Bioreactor, biological concept, Scale down

#### Unit II:

Microbial growth and kinetics, substrate inhibition, product inhibition, Pirt equation, Leudeking-Piret model

#### Unit III:

Introduction, Mass transfer, Theory of mixing, Rheological properties, Bioreactor sensor characterizes, Temperature measurement control, principles of dissolved oxygen measurement and control, principles of PH / redox measurement and control, deduction and prevention of foam, determination of biomass and application of biosensors.

#### Unit IV:

Airlift Bioreactors, Introduction, Design and construction of the airlift-loop reactor, Hydrodynamics, Three - phase flow, Mixing, Oxygen transfer.

### D. List of Practical:

1. To determine the specific growth rate and generation time of a bacterium during submerged fermentations.





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2. To grow yeast (*S. cerevisiae*) and fungus (*Rhizopus* sp.) in artificial medium and to calculate the yield and productivity of the biomass produced.
3. To make wine from different juices by fermentation.
4. To study microbiology of vegetables, fruits, milk and milk products.
5. To test the quality of milk.
6. To demonstrate production of curd and cheese.
7. To study production of wine from grape juice.

### E. Reading lists:

#### Books:

1. *Bailey & Ollis: Biochemical Engineering fundamentals*
2. *Kargi and Shular: Bioprocess engineering*
3. *Aiba, Humphrey & Millis: Biochemical Engineering*
4. *Duran: Biochemical Engineering Principles*

#### Magazine:

*Process burners*

#### Journals:

1. *Journal of Food Engineering, ELSEVIER*
2. *Journal of Bioscience and Bioengineering, ELSEVIER*

**Name of the Module: Mass Communication for Technology**

**Module Code: HSS 701**

**Semester: 7<sup>th</sup>**

**Credit Value: 3 [P=0, T=0, L=3]**

### A. Objectives:

The course is designed to meet with the objectives:

1. Imparting theoretical lectures with case discussion.
2. Teaching with inclusive learning.
3. Making students aware about the importance of this subject in their future career.

### B. Learning outcomes:

On completion of this course the students will be able to:

1. Students will be able to work with efficiency as they had knowledge of the subject.
2. With the backup knowledge their performance will definitely much better in their workplace.

### C. Subject matter:

Fourth, Dissemination of Scientific & Technical knowledge (DSTK): Difficulties with distribution of scientific and technical information is rapid increasing with unprecedented



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spade of science and technology. Further, engineers are made to meet with this challenge. The subject should cover the knowledge so as to establish adequate and effective distribution of information. Lack of information cannot make a sound engineer. Engineers should be specialists in information dissemination for which a course on DSTK is of paramount importance. Engineers should be made to write articles and research papers fluently and confidently. They should be taught to organize seminar and conferences deliver talks as well in the seminars and conferences. They should also be taught the technique of publishing magazines and journals. DSTK should be a subject of 4th year.

### D. Teaching/ Learning/ Practice Pattern:

- |                                |       |
|--------------------------------|-------|
| 5. Teaching                    | : 50% |
| 6. Learning/ case presentation | : 30% |
| 7. Assignment                  | : 10% |
| 8. Attendance                  | : 10% |

### E. Examination pattern:

- |                            |      |
|----------------------------|------|
| 4. Theoretical Examination | : 50 |
| 5. Class test              | : 30 |
| 6. Assignment              | : 20 |

### F. Reading List:

#### Books:

1. Murthy, D.V.R. *Development of Journalism, Dominant Publishers, 2001*
2. Naarula, Uma. *Development Communication Theory and Practice, Har-Anand Publication Ltd New Delhi; 1990.*
3. Sharma, Suresh Chandra, *Media Communication and Development, Rawat Publication, 1987.*
4. UNESCO, 'Different Theories and Practice', 1982.

#### Journals:

1. *Mass Review*
2. *Journal of Communication Studies*
3. *Mass Communication and Society*
4. *Journal of Mass Communication*
5. *Communicator*
6. *Journal of Communication*

## List of Electives I and II

**Name of Module: Food Technology**

**Module Code: BT 701(A)**



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

**Semester: 7<sup>th</sup>**

**Credit Value: 3 [P=0, T=0, L=3]**

### A. Objectives:

The course is designed to meet with the objectives to:

1. have an in depth understanding of the supply chain for fish, meat and poultry, from slaughter/capture to retail,
2. discern the key regulatory and animal welfare considerations around fish and meat production,
3. gain a full understanding of the slaughter process, carcass classification and dressing, and the quality and safety management issues related to these processes,
4. distinguish the important biochemical and ultra-structural changes that take place post-mortem in the conversion of muscle to meat,
5. compare the endogenous and exogenous factors that affect the safety and quality of eat products,
6. critically evaluate the technological and commercial issues related to the processing of meat and fish,
7. evaluate the manufacture, handling and storage of fish and meat and products thereof,
8. appraise changing trends, attitudes and demands for fish and meat products.

### B. Learning outcomes:

On completion of the module, the student should be able to:

1. demonstrate a knowledge of the technological and commercial principles underpinning the manufacture and processing of high quality meat products and liquid milks,
2. work hygienically and safely in a meat industry environment,
3. to assess safety and quality requirements for meat and meat products,
4. work effectively in a team to solve technological problems,
5. demonstrate an in-depth knowledge of quality assurance techniques commonly used.

### C. Teaching/ Learning/ Practice pattern:

a. Lecture:	3
hours/week	
b. Tutorial:	0
hours/week	
c. Laboratory Practical:	2
hours/week	
d. Self study:	

### D. Subject matter:

#### Unit I:



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

Classification of fresh water fish and marine fish; Commercial handling, storage and transport of raw fish; Average composition of fish; Freshness criteria and quality assessment of fish; Spoilage of Fish; Methods of Preservation of fish: Canning, Freezing, Drying, Salting, Smoking and Curing.

### Unit II:

Fish products - production of fish meal, fish protein concentrate, fish liver oil and fish sauce and other important byproducts; Quality control of processed fish; Fish processing industries in India.

### Unit III:

Slaughtering technique of animal; Meat cuts and portions of meat, muscle; Color of meat; Post mortem changes of meat; Meat processing - curing and smoking; Fermented meat products (meat sausages & sauces); Frozen meat & meat storage; By-products from meat industries and their utilization; Meat industries in India.

### Unit IV:

Cheese making technology, Brewing Industry, Storage of vegetables, Baker's yeast fermentation.

## E. Reading List:

### Books:

1. *Processed Meats*; Pearson AM & Gillett TA; 1996, CBS Publishers.
2. *Meat*; Cole DJA & Lawrie RA; 1975, AVI Pub.
3. *Egg and poultry meat processing*; Stadelman WJ, Olson VM, Shemwell GA & Pasch S; 1988, Elliswood Ltd.
4. *Developments in Meat Science – I & II*, Lawrie R; Applied Science Pub. Ltd.
5. *Egg Science & Technology*; Stadelman WJ & Cotterill OJ; 1973, AVI Pub.
6. *Fish as Food*; Vol 1 & 2; Bremner HA; 2002, CRC Press.
7. *Fish & Fisheries of India*; Jhingram VG; 1983, Hindustan Pub Corp.

**Name of the Module: Molecular Genetics**

**Module Code: BT 702(A)**

**Semester: 7<sup>th</sup>**

**Credit Value: 3 [P=0, T=0, L=3]**

### A. Objectives:

The course is designed to meet with the objectives to:

1. to understand the molecular basis for transcription, translation, replication and gene regulation and other topics in molecular genetics,
2. to understand the underlying theoretical principles of the scientific methods and approaches of molecular genetics,
3. to learn critically interpretation of experimental designs related to molecular genetics.

### B. Learning outcomes:



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On completion of the module, the student should be able to:

1. students will learn mathematical and scientific models for genetics mechanism,
2. they will also learn sufficient theoretical knowledge so that can carry out their research in molecular genetics.

### C. Subject matter:

#### Unit I:

Genes and DNA, Genes code for distinct proteins, Alleles, mutations Genetic variation and mapping, Gene cloning strategies, positional cloning, transposons.

#### Unit II:

Background of bacterial genomes, Animal genomes, human genome, Human genome variation, globin gene and functional genomics.

#### Unit III:

Prokaryotic transcription, Prokaryotic gene regulation, Euk transcription: activation, chromatin, negative regulation, Epigenetic controls.

#### Unit IV:

RNA processing, alternate splicing, translational control, RNA stability, RNA mediated gene regulation. Methodology-Genetic Engineering of Plants: Applications-Transgenic animals and plants..

### D. Reading List:

#### Books:

1. *Molecular Biotechnology: Principles and Applications of Recombinant DNA* by Bernard R. Glick and Jack J. Pasternak.
2. *Molecular Biology* by Robert F. Weaver.
3. *Behavioral Genetics* by R. Plomin, J. C. DeFries, G. E. McClearn and P. McGuffin.

**Name of the Module: Protein Engineering**

**Module Code: BT-703(A)**

**Semester: 7<sup>th</sup>**

**Credit Value: 4 [P = 0, T = 0, L = 3]**

### A. Objectives:

1. To focus and learn advanced knowledge on primary secondary structure of protein and their determined.
2. To learn protein design principles and database analysis.

### B. Learning Outcome:

The course imparts advanced knowledge on proteins through a detailed study of protein Structure, its characteristics property and significance in biological systems.

### C. Subject Matter:



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

### Unit I:

**Introduction to protein engineering:** Primary structure, secondary structure, tertiary structure, quaternary structure, Ramachandran plots.

### Unit II:

**Protein structure prediction:** Strategies for design of novel proteins-strategies for the design of structure and function, computer methods in protein modelling. Proteomics and Proteomes, Various tools used in proteomics. Mining proteomes, protein expression profiling, identifying protein – protein Interactions and protein complexes, mapping- protein identification, new directions in proteomics.

### Unit III:

**Production of novel proteins:** : Site and strategies for heterologous expressions, methods for expressing recombinant proteins in yeast. Insertional and deletion mutagenesis. Site directed mutagenesis by conventional and PCR-based methods. Proteome analysis by 2D gel electrophoresis coupled to mass spectrometric analysis. Protein arrays and their applications.

### Unit IV:

**Characterization of proteins:** NMR spectroscopy, crystallography, spectroscopic and calorimetric methods. **Applications of protein engineering:** Design of polymeric biomaterials, nicotinic acetylcholine receptors as a model for a super family of ligand - gated ion channel proteins.

### D. Reading List:

#### Books:

1. *Protein engineering and design* by Paul R. Carey, academic press, 1996, 361 pages.

### *Name of the Module: Immunotechnology*

**Module Code: BT 704(B)**

**Semester: 7<sup>th</sup>**

**Credit Value: 3 [P=0, T=0, L=3]**

#### A. Objectives:

The course is designed to meet with the objectives to:

1. to impart knowledge on the immune system,
2. to impart knowledge on immunity to infection and molecular immunology,
3. to impart knowledge on application of immunology in food and medicine.

#### B. Subject matter:

##### Unit I:

Characteristics of animal cells; Nutritional requirements and serum free culture of mammalian cells; Kinetics of cell growth and product formation; Scale-up problems of mass propagation of animal cells;

##### Unit II:



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

Production of Polyclonal antibodies with different types of antigens; Collection of sera, purification of antibodies; Hybridoma technology – production and applications of monoclonal antibodies for diagnosis and therapy; Production of virus vaccines, specific vaccines;

### Unit III:

Production of cellular chemicals like Interferons, Interleukin etc.; Immunoassay procedures.

### C. Pattern of examination

1. Theoretical examination

### D. Reading List:

#### Books:

1. *Immunotechnology: Principles, Concepts and Applications*, Anthony Moran, Wiley-Blackwell.
2. *Immunology & Immunotechnology*, Ashim K Chakravarty, Oxford University Press, New Delhi
3. *Monoclonal Antibodies in Biotechnology: Theoretical and Practical Aspects*, Kenneth C. McCullough, Cambridge University Press

#### Journals

1. *Journal of Vaccine and Immunotechnology*, Avens Publishing Group
2. *Immunotechnology*, Elsevier
3. *Trends in Immunology*, Cell Press.

**Name of the Module: Metabolic Engineering**

**Module Code: BT 705(B)**

**Semester: 7<sup>th</sup>**

**Credit Value: 3 [P=0, T=0, L=3]**

#### A. Objectives:

The course is designed to meet with the objectives to:

1. to introduce the basic concepts about enzymology followed by primary and secondary metabolites biosynthesis,
2. to emphasize the importance of bioconversions of substances and the regulation of enzyme production.

#### B. Learning outcomes:

On completion of the module, the student should be able to:

empower the students with the knowledge on metabolic engineering.

#### C. Subject matter:



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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### Unit I:

Induction-Jacob Monod Model, catabolite regulation, glucose effect, camp deficiency, feed back regulation, regulation in branched pathways, differential regulation by isoenzymes, concerted feed back regulation, cumulative feed back regulation, amino acid regulation of RNA synthesis, energy charge, permeability control passive diffusion, facilitated diffusion, active transport group transportation.

### Unit II:

Alteration of feed back regulation, limiting accumulation of end products, feed back, resistant mutants, alteration of permeability. Precursor effects, prophophase, idiophase relationships, enzyme induction, feed back regulation, catabolite regulation by passing control of secondary metabolism, producers of secondary metabolites.

### Unit III:

Advantages of Bioconversions, specificity, yields, factors important to bioconversions, regulation of enzyme synthesis, mutation, permeability, co-metabolism, avoidance of product inhibition, mixed or sequential bioconversions, conversion of insoluble substances.

### Unit IV:

Strain selection, improving fermentation, recognizing growth cycle peak, induction, feed back repression, catabolite repression, mutants resistant to repression, gene dosage.

## D. Reading List:

### Books:

1. Wang D. I. C., Cooney C. L., Demain A. L., Dunnill P., Humphrey A. E., Lilly M. D., *Fermentation and enzyme Technology*, John Wiles and Sons., 1980.
2. Stanbury P. F. and Whitaker A., *Principles of Fermentation Technology*, Pergamon Press, 1984.
3. Zubay G., *Biochemistry*, Macmillan Publishers, 1989.





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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

**Name of the Module: Development Biology**

**Module Code: BT 706(B)**

**Semester: 7<sup>th</sup>**

**Credit Value: 3 [P=0, T=0, L=3]**

### A. Objectives:

The course is designed to meet with the objectives to:

1. to understand basic concepts and definitions of modern developmental biology, and then apply these concepts and definitions in new areas of developmental biology,
2. to develop critical thinking and study skills,
3. as a productive and cooperative member of a study group, learn to use the Internet and other on-line resources as learning and research tools.

### B. Subject matter:

#### Unit I:

Chief events in animal development-History of thoughts and conceptual developments-Experimental embryology-The concept of differential gene activity. Origine of germ cells, Gamete formation, significance of gametogenesis.

#### Unit II:

Animal Kingdom and brief description of non-chordates and Chordate phyla, Typical features of animal life. Prokaryotes and Eukaryotes, Basic structure of plant and animal cells, Organization of plant and animal tissues, Plant morphology and anatomy.

#### Unit III:

Basics of cellular division, Processes of mitosis and meiosis, Mendel's Laws of Inheritance, Patterns of inheritance – Incomplete dominance, Multiple alleles, Co-dominance, Lethal genes, Polygenic inheritance, Sex linked inheritance. Plant Growth, Transportation of fluids, Mineral nutrition, Photosynthesis in higher plants, Plant growth, Respiration, Plant growth hormones, Reproduction in Plants.

#### Unit IV:

Digestion and absorption, Breathing and exchange of gases, Body fluids and circulation, Excretion, Neural control and coordination, Chemical coordination and integration, Animal reproduction.

### C. Reading List:

#### Books:

1. *T. Subramoniam: Development Biology, Alpha Science*
2. *Bhatia, K.N. and Tyagi, M.P., Elementary Biology, Vol.2 Trueman Book Company (2007).*
3. *Dhami, P.S., Srivastava, H.N. and Chopra, G., A Textbook of Biology, Pradeep Publications (2008).*
4. *Campbell, N.A. and Reece, J.B., Biology, Pearson Education (2007) 8<sup>th</sup> ed.*

#### Journals

1. *Developmental Biology*



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

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2. *Genesis*
3. *Cell Biology*



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

### SEMESTER – VIII

Subject Code	Subject	Model	P	T	L	Credit
BT 8XX	Elective III	S. N. Bose	0	0	3	3
BT 8XX	Elective IV	S. N. Bose	0	0	3	3
XXX 803	Industrial Training		2	0	0	1
XXX 804	Project Work		16	0	0	8
XXX 805	Seminar		2	0	0	1
XXX 806	Grand Viva		8	0	0	4
			28	0	6	20

### List of Electives III and IV

Subject Code	Subject	Model	P	T	L	Credit
BT 801(A)	Biofuel Technology	S. N. Bose	0	0	3	3
BT 802(A)	Cancer Biology	S. N. Bose	0	0	3	3
BT 803(A)	Virology and Infectious Diseases	S. N. Bose	0	0	3	3
BT 804(B)	Drug Design and Delivery	S. N. Bose	0	0	3	3
BT 805(B)	Systems Biology	S. N. Bose	0	0	3	3
BT 806(B)	Tissue Engineering and Regenerative Medicine	S. N. Bose	0	0	3	3

***Name of the Module: Biofuel Technology***

***Module Code: BT 801(A)***

***Semester: 8<sup>th</sup>***

***Credit Value: 3 [P=0, T=0, L=3]***

#### **A. Objectives**

The aim of this course is to impart knowledge to students on the production of energy or fuel from bioresources such as algae, fungi and bacteria. This will help the students in application of their knowledge in industrial purposes.

#### **C. Subject matter**

##### **Unit I:**



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

Bioenergy definition; Bioenergy resources: first generation, second generation and third generation

### Unit II:

Classification of Bioenergy: Solid, Liquid, gaseous; Bioenergetic pathways;

### Unit III:

Microorganisms involved for Bioenergy production; Bioethanol production; Biomethanation process; Biohydrogen production process; Algal fermentation processes; Microbial Fuel Cell.

### D. Reading lists

#### Books:

1. *Biohydrogen production: Fundamentals and Technology Advances*, D. Das, N and C Nag Dasgupta, CRC Press, New York
2. *Microbial Fuel Cells*, Bruce E Logan, A John Wiley & Sons, Ins., Publication, New Jersey, USA
3. *Algal Biorefinery: An Integrated Approach*, Debabrata Das, Capital Publishing Company, New Delhi and Springer, Switzerland.
4. *Biofuels Engineering Process Technology*, Caye M Drapcho, Nghiem Phu Nhuan, Terry H. Walker, McGraw Hills, New York.

#### Journals:

1. *International Journal of Hydrogen Energy*, Elsevier
2. *Bioresource Technology*, Elsevier
3. *Renewable Energy*, Elsevier

**Name of the Module: Cancer Biology**

**Module Code: BT 802(A)**

**Semester: 8<sup>th</sup>**

**Credit Value: 3 [P=0, T=0, L=3]**

### A. Objectives:

The course is designed to meet with the objectives of:

1. of understanding the principles of cancer biology,
2. to provide basic cellular and molecular mechanism that leads to cancer and major hall marks of cancer.



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## SYLLABUS FOR B-TECH (BIOTECHNOLOGY)

### B. Learning outcomes:

Students successfully completing this module will be able to:

1. to demonstrate competence hallmarks of cancer,
2. the types of gene mutations possible how these mutations can contribute to cancer formation,
3. learn cell cycle, its regulation and how cell cycle dysfunction can lead to cancer,
4. will learn the role of diet in cancer development and in its preventions.

### C. Subject matter:

#### Unit I:

To impart basic concepts of cancer biology, various stages in carcinogenesis, molecular cell biology of cancer, cancer metastasis, and cancer therapy. Regulation of Cell cycle, Mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes, Modulation of cell cycle-in cancer, Different forms of cancers, Diet and cancer, cancer stem cells.

#### Unit II:

Chemical Carcinogenesis, Metabolism of Carcinogenesis, Natural History of Carcinogenesis, Targets of Chemical Carcinogenesis, Principles of Physical Carcinogenesis, X-Ray radiation – Mechanism of radiation Carcinogenesis.

#### Unit III:

Oncogenes, Identification of Oncogenes, Retroviruses and Oncogenes, detection of Oncogenes, Growth factor and Growth factor receptors that are Oncogenes. Oncogenes / Proto Oncogenes activity, cancer and DNA repair. Growth factors related to transformations.

#### Unit IV:

Clinical significances of invasion, heterogeneity of metastatic phenotype, Metastatic cascade, Basement membrane disruption, Three step theory of invasion, Proteinases and tumour cell invasion. Different forms of therapy, Chemotherapy, Radiation Therapy, Detection of Cancers, Prediction of aggressiveness of Cancer, Advances in Cancer detection.

### D. Reading lists:

#### Books:

1. *Molecular Biology of cancer: Mechanisms, Targets and Therapeutics* by Lauren Picorino.
2. *Reading Primary literature: A practical guide to evaluating research articles in biology* by C. M. Gillen and B. Cummings.
3. *The Biology of Cancer* by Robert A. Wienberg



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**Name of the Module: Virology and Infectious diseases**

**Module Code: BT 803(A)**

**Semester: 8<sup>th</sup>**

**Credit Value: 3 [P=0, T=0, L=3]**

### A. Objectives:

The course is designed to meet with the objectives of:

1. how virus and host factors interact and how these interactions lead to disease and recovery,
2. how one can apply this knowledge to the diagnosis, prevention and management of disease,
3. to analyze general concepts of existing and emerging infectious diseases,
4. to describe specific emerging bacterial, viral, and zoonotic animal and human diseases,
5. to explain how better understanding of the emerging infectious diseases maintains and improves animal and human health in the future.

### B. Subject matter:

#### Unit I:

History and principles of virology, virus taxonomy, introduction to replication strategies. Virus structures, animal and plant viruses. Virus structure and morphology, viruses of veterinary importance and plant viruses. Principles of bio-safety, containment facilities, maintenance and handling of laboratory animals and requirements of virological laboratory

#### Unit II:

In vivo, in vitro and in ovo systems for virus growth, estimation of yields, methods for purification of viruses with special emphasis on ultracentrifugation methods. Immunodiagnosis, haemagglutination and haemagglutination-inhibition tests, Complement fixation, neutralization, Western blot, RIPA, flowcytometry and immunohistochemistry. Nucleic acid hybridization, polymerase chain reaction, microarray and nucleotide sequencing. Fluorescence, confocal and electron microscopic techniques -- principles and applications

#### Unit III:

Introduction, highlights, concepts, definition of emerging diseases, description of host, agent characteristics. Food-borne, bacterial and zoonotic diseases of animals and humans

#### Unit IV:

Viral and protozoal diseases of horses. Viral diseases of swine. Viral and bacterial diseases of poultry. Viral diseases of humans

### C. Reading lists:

#### Books:

1. B.N. Fields, D.M. Knipe, P.M. Howley, R.M. Chanock, J.L. Melnick, T.P. Monath, B. Roizman, and S.E. Straus, *Fields Virology Vol 1 and 2., 3rd Edition.* Lippincott-Raven, Philadelphia, PA.
2. S. J. Flint, V. R. Racaniello, L. W. Enquist, V. R. Rancaniello, A. M. Skalka. *Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses.* 2003, American Society Microbiology.



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3. Brian W.J. Mahy (Editor), Hillar O. Kangro (Editor). *Virology Methods Manual* 1996. Publisher: Elsevier Science & Technology Books.
4. John R. Stephenson, *Diagnostic Virology Protocols: Methods in Molecular Medicine*. 1998, Humana Press.
5. *Evolution of Infectious Disease*. Ewald PW. Oxford University Press, New York. 1994. ISBN 0-19-511139-7.
6. *Emerging Infections 1*. Scheld WM, Armstrong D and Hughes JM, Editors. ASM Press, Washinton, DC. 1998. ISBN 1-55581-123-3.
7. *Emerging Infections 2*. Scheld WM, Craig WA and Hughes JM, Editors. ASM Press, Washington, DC. 1998. ISBN 1-55581-141-8.
8. *Pathology of Emerging Infections*. Horsburgh, CR Jr and Nelson AM, Editors. ASM Press, Washington, DC. 1997. ISBN 1-55581-20-5.
9. *Dengue Viruses*. Schlesinger RW. Springer, New York. 1977. ISBN 0-387-81406-X

**Name of the Module: Drug Design and Delivery**

**Module Code: BT 804(B)**

**Semester: 8<sup>th</sup>**

**Credit Value: 3 [P=0, T=0, L=3]**

### A. Objectives:

This course is designed to provide detailed knowledge about the importance of leading compounds from natural and synthetic sources, different techniques of rational drug design and designing drugs for various biological targets.

### B. Learning outcomes:

Students successfully completing this module will be able to:

1. discover lead molecules,
2. target different compounds for drug discovery,
3. study the medicinal importance of different bioactive natural and synthetic compounds,
4. study various strategies to develop new drug like molecules,
5. design of new drug molecules,
6. isolate, purify and characterize important bioactive compounds.

### C. Subject matter:

#### Unit I:

**Analog Based Drug Design:** Bioisosteric replacement, rigid analogs, alteration of chain branching, changes in ring size, ring position isomers, design of stereo isomers and geometric isomers, fragments of a lead molecule, variation in inter atomic distance, Anticancer drugs, Cardiovascular drugs, Anti inflammatory drugs, Antiparasitic drugs, Neuromuscular blocking drugs.

#### Unit II:



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**Quantitative Structure Activity Relationship (QSAR):** SAR versus QSAR, History and development of QSAR, Types of physicochemical parameters, experimental and theoretical approaches for the determination of physicochemical parameters such as Partition coefficient, Hammett's substituent constant and Taft's steric constant. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA.

### Unit III:

**Molecular Modeling and virtual screening techniques:** Molecular Modeling: Introduction to molecular mechanics and quantum mechanics. Energy Minimization methods and Conformational Analysis, global conformational minima determination, Bioactive as global minimum conformations. **Virtual Screening techniques:** Drug likeness screening, Concept of pharmacophore mapping and pharmacophore based Screening, **Molecular docking:** Rigid docking, flexible docking, manual docking; Docking based screening. De novo drug design.

### Unit IV:

**Informatics & Methods in drug design:** Introduction to Bioinformatics, pharminformatics, cheminformatics, chemogenomics, ADME databases, chemical biochemical and pharmaceutical databases; Drug design techniques using these databases.

### Unit V:

**Design of drugs for the following biological targets:** Agent acting on enzymes: DHFR, HMG-CoA Reductase, Phosphodiesterase, ACE, Transpeptidase,  $\beta$ -lactamase. Agents acting on receptors: PPAR, protein kinases. Agents acting on Nucleic acids: Topoisomerase, DNA and RNA polymerase.

### C. Reading lists:

#### Books:

1. Robert GCK, ed., "Drug Action at the Molecular Level" University Prak Press Baltimore.
2. Martin YC. "Quantitative Drug Design" Dekker, New York.
3. Lien EJ. SAR "Side effects and Drug Design" Dekker, New York.
4. William H, Malick JB "Drug Discovery and Development" Humana Press Clifton.
5. Delgado JN, Remers WA eds "Wilson & Gisvolds's Text Book of Organic Medicinal & Pharmaceutical Chemistry" Lippincott, New York.
6. Foye WO "Principles of Medicinal chemistry 'Lea & Febiger.
7. Koro Ikovas A, Burckhalter JH. "Essentials of Medicinal Chemistry" Wiley Interscience.
8. Wolf ME, ed "The Basis of Medicinal Chemistry, Burger's Medicinal Chemistry" John Wiley & Sons, New York.
9. *Advances in Medicinal Chemistry,*
10. Ariens EJ "Drug Design" Academic Press New York.
11. Thomas, G. *Medicinal Chemistry-An Introduction* John Wiley and sons Ltd.
12. Patrick Graham, L., *An Introduction to Medicinal Chemistry,* Oxford University Press.





**Name of the Module: System Biology**

**Module Code: BT 805(B)**

**Semester: 8<sup>th</sup>**

**Credit Value: 3 [P=0, T=0, L=3]**

**A. Objectives:**

The course is designed to meet with the objectives of:

1. to understand Systems biology concepts,
2. to understand Modeling biological networks,
3. to provide basic and advanced information about phylogenetics and its analysis.

**C. Subject matter:**

**Unit I:**

Phylogenetics analysis - Introduction, Methods- the matrix, homology, character coding, choosing outgroups, weighting, the tree, multiple trees, tree statistics; models of causation-Parsimony analysis -Introduction, the legacy of Willi Hennig, methods, searching, parsimony analysis using Nona

**Unit II:**

Introduction, going down to get the tree length, going up to get ancestral states, short cuts and errors, improvements; Techniques for analyzing large data sets - Traditional techniques, Composite Optima, Ratchet, Sectorial searches, tree-fusing, tree-drifting, combined methods, minimum length, TNT

**Unit III:**

Measures of support -The bootstrap, Jackknife, Noise, Direct measures of support- Partitioning of multiple datasets in phylogenetic analysis - Statistical tests of data incongruence, Measures of character interaction in combined analysis, congruence, incongruence and phylogenetic inference

**Unit IV:**

Complex model organism genome databases - Database foundations, genome databases, homology and genome databases; Comparative phylogenomics - Genomics and systematics, genomics techniques – cloning and library construction, megabase DNA isolation, physical mapping, shotgun sequencing; Subgenomics – comparative maps and synteny, Primer batteries and multiplexing. Correlated evolution and independent contrasts, importance of topology, examining the tempo and mode of evolutionary change. Analyzing data at the population level -Sequence and Allele frequency data

**C. Reading lists:**

**Books:**

*Techniques in molecular systematics and evolution, Rob Desalle, Gonzalo Giribet, Ward Wheeler, Springer.*



**Name of the Module: Tissue Engineering and Regenerative Medicine**

**Module Code: BT 806(B)**

**Semester: 8<sup>th</sup>**

**Credit Value: 3 [P=0, T=0, L=3]**

**A. Objectives:**

The course is designed to meet with the objectives to:

1. induce tissue regeneration at damaged tissues or organs for medical therapy by making use of the self-healing potential of the living body,
2. achieve with cells and the local environment which promotes their natural process of proliferation and differentiation,
3. build up the local environment of cell-induced tissue regeneration, it is important to develop drug delivery system.

**B. Subject matter:**

**Unit I:**

The History of Tissue Engineering and Regenerative Medicine in Perspective, Control of Organogenesis: Towards Effective Tissue Engineering, Towards Genetically Designed Tissues for Regenerative Medicine. Fetal Tissue Engineering: Regenerative Capacity of Fetal Stem Cells.

**Unit II:**

Bone, muscle, Tendon and Ligament, Neural Tissue, Dental Hard, Heart Valves, Breast, Urinary Bladder Tissue Engineering.

**Unit III:**

Biomaterials, Biomaterial-Related Approaches: Surface Structuring, Mineralised Collagen as Biomaterial and Matrix for Bone Tissue Engineering.

**Unit IV:**

Laboratory Procedures – Culture of Cells and Tissues, Biophysical Stimulation of Cells and Tissues in Bioreactors, Tissue Engineered Models for In Vitro Studies, In Vivo Animal Models in Tissue Engineering. Tissue Engineering Application.

**C. Reading lists:**

**Books:**

1. Rui L. Reis, Julio San Roman, *Biodegradable Systems in Tissue Engineering and Regenerative Medicine*. CRC press, 2004.
2. Rui L. Reis, Julio San Romtyn, *Biodegradable Systems in Tissue Engineering and Regenerative Medicine*, CRS press, 2004.
3. Ulrich Meyer, Thomas Meyer, Jörg Handschel, Hans Peter Wiesmann, *Fundamentals of Tissue Engineering and Regenerative Medicine*, Springer, 2004.
4. Ketul Popat, *Nanotechnology in Tissue Engineering and Regenerative Medicine*.
5. Harold S. Bernstein, *Tissue Engineering in Regenerative Medicine (Stem Cell Biology and Regenerative Medicine)*, Humana Press, 2011.



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### *Journals:*

1. *J Tissue Eng Regen Med, John Wiley & Sons*
2. *J. Med. Chemistry, Acs*