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| Course code | BSC-BIO-201G |
| Category | Basic Science Course |
| Course title | **Biology For Engineers** |
| **Scheme and Credits** | **L** | **T** | **P** | **Credits** |  |
| **2** | **1** |  | **3** |
| Branches (B. Tech.) | **Common For All Branches** |
| Class work | 25 Marks |
| Exam | 75 Marks |
| Total | 100 Marks |
| Duration of Exam | 03 Hours |

**Note**: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

**Course Objectives**

To convey that Biology is as an important scientific discipline.

To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine

To convey that “Genetics is to biology what Newton’s laws are to Physical Sciences”

To study the biomolecules that are basis of life.

To understand the tools used in modern genetic engineering and its role.

To understand the role of biotechnology in different fields.

#### UNIT – I

**Introduction to living world:** Concept and definition of Biology; Aspect of biology. Need to study biology. Characteristic features of living organisms; Cell theory, Structure of Prokaryotic and Eukaryotic cell. Distinguish between animal and plant cell. Concept of single celled organisms, Types of microbes and their important properties. Economic importance of microbes.

**Genetics :** Mendel’s laws of inheritance, Concept of allele. Concepts of recessiveness and dominance . Gene interaction.

 Cell division- Mitosis and Meiosis. Evidence of nucleic acid as a genetic material. Concept of genetic code, Central Dogma.

#### UNIT – II

**Introduction to Biomolecules**: Definition, structure and important functions of carbohydrates (glucose, fructose, disaccharides, starch and cellulose), lipids (phospholipid, cholesterol), Amino acids

Proteins- structure and function. Primary secondary, tertiary and quaternary structure.

Nucleic acid- Structure of DNA and RNA, types of RNA, Watson and Crick model of DNA

#### UNIT – III

**Introduction to Genetic Engineering**: Concept of genetic engineering. Tools used in recombinant DNA Technology. Restriction enzymes and DNA modifying enzymes, ligases. Gene cloning; plasmid vector. Transgenic plants and animals

#### UNIT – IV

**Applications of Biotechnology:** Applications of biotechnology in Agriculture, Medicine, Environment (sewage treatment), enzyme technology.

**Course Outcomes**

Students will be able to understand about living organisms, prokaryotic cell and eukaryotic cell.

Students will be able to understand structure and function of various biomolecules

Students will be able to understand gene structure, DNA replication, genetic engineering and application for sustainable development

Students will be able to understand the scope of biotechnology in field of environment, health, agriculture and industry.

**References:**

1) Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M,

L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd

2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H.

John Wiley and Sons

3) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman

and Company

4) Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and

company, Distributed by Satish Kumar Jain for CBS Publisher

5) Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C.

Brown Publishers

6) <https://onlinecourses.nptel.ac.in/noc18_bt23> by K. Suraishkumar and Madhulika Dixit

7) Campbell, NA and Reece JB, Biology, International edition, 7th edition or later, Benjamin Cummings, New York (2007 or later)
8) Karp, G, Cell and Molecular Biology: Concepts and Experiments, 7th edition, Wiley, New York (2013)

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| --- | --- |
| Course code | ESC-BT-203G |
| Category | Engineering Science Course |
| Course title |  **Thermodynamics of Bioprocesses** |
| **Scheme and Credits** | **L** | **T** | **P** | **Credits** | **Semester-III** |
| **3** | **1** |  | **4** |
| Branches (B. Tech.) |  **Biotechnology Engineering** |
| Class work | 25 Marks |
| Exam | 75 Marks |
| Total | 100 Marks |
| Duration of Exam | 03 Hours |

**Note**: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

**Course Objectives:**

1. To have understanding of basic concepts of thermodynamics
2. To get aware of heat, enthalpy, internal energy, work, energy and power etc.
3. To gain knowledge about laws of thermodynamics
4. To have understanding of energy balances in biological systems

**UNIT-I**

Introduction and basic concepts Scope and limitations of thermodynamics, Force, pressure and energy, Equilibrium state and the phase rule, Temperature and Zeroth law of thermodynamics, Heat reservoirs and heat engines, reversible and irreversible processes.

**UNIT-II**

First and second law of Thermodynamics, activity coefficients and phase equilibrium, Biological systems as open , non-equilibrium systems, failure of classical ( closed equilibrium).

**UNIT-III**

Third law of thermodynamics : Concept of entropy production , constitutive equations, Gibbs free energy-theory Effect of solutes on boiling points and freezing points, Ionic solutions, Equilibrium constant

**UNIT-IV**

Thermodynamics of coupled Biochemical reactions , cells as non equilibrium, Thermodynamics of passive and active transport , Prigogine – Curie law , Thermo analysis of oxidative phosphorylation, Gibbs free energy- application, Biological clocks.

**Course outcomes**

1. Students will be familiar with basic concepts of thermodynamics
2. They will be able to understand and apply the laws of thermodynamics.
3. They will be able to analyze energy flows in a biological system.
4. They will be able to understand Gibbs free energy and calculate obtainable work for biological systems.

**Text and Reference Books:**

1. Kinetics & Thermodynamics in Biochemistry : Bray & White.
2. Biophysical Chemistry Vol. I : Edsall & Wyman.
3. Non equilibrium Thermodynamics in Biophysics : Katchalasky & Curran.
4. Physical Biochemistry : Van Holde .
5. Biological Thermodynamics – D.T. Haynie (Cambridge University Press)
6. A textbook of Chemical Engineering Thermodynamics – K. V. Narayanan (Prentice Hall of India)
7. Introduction to Chemical Engineering Thermodynamics – Smith, Van Ness, Abbott (TMH)
8. Chemical, Biochemical and Engineering Thermodynamics – Stanley I. and Sandler (Wiley India Edition)

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| --- | --- |
| Course code | PCC-BT-205G |
| Category | Professional Core Course |
| Course title |  **Biochemistry** |
| **Scheme and Credits** | **L** | **T** | **P** | **Credits** | **Semester-III** |
| **3** |  |  | **3** |
| Branches (B. Tech.) |  **Biotechnology Engineering** |
| Class work | 25 Marks |
| Exam | 75 Marks |
| Total | 100 Marks |
| Duration of Exam | 03 Hours |

**Note**: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

**Course Objectives**

Understanding of water and its properties, pH, pKa etc.

Understanding of amino acids proteins and carbohydrates.

Understanding of lipids, nucleic acids, vitamins and their properties.

Understanding of bioenergetics and metabolism of biomolecules.

**UNIT-I**

**Introduction to Biochemistry:** Physical properties of water and their role in biology. Concepts of pH, ionic strength and buffers . Structure of atoms, molecules and chemical bonds.

**Forces that stabilize biomolecules:** Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc. Hasselbach Hendersson equation and its implications.

**UNIT-II**

**Composition, Structure and Function of Biomolecules:** Amino acids, proteins, nucleic acids, carbohydrates, lipids and vitamins.

**Conformation of Nucleic acids:** Structural characteristics of A, B and Z-DNA. 3D

structure of t-RNA, micro-RNA ,ribozymes and riboswitches

**UNIT-III**

**Protein Structure:** Structural characteristics of alpha-helix, beta-sheet and -turn. Ramachandran plot. Protein domains and domain architecture. Quaternary structure of proteins. Protein denaturation and renaturation

**Enzymology:** Principles of catalysis, enzymes. Types of enzymatic reaction mechanisms, Michaelis-Menten kinetics. Competitive, Non-competitive and Un-competitive inhibition.

 Allostery, isozymes

**Unit-IV**

**Bioenergetics and Metabolism**: Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, and biological energy transducers.

Metabolism of lipids, synthesis of triacylglycerols, biosynthesis of fatty acids, fatty acid oxidation. Amino acids Metabolism, amino acid synthesis, biological nitrogen fixation, amino acid catabolism.

**Course Outcomes**

* Students will be able to understand physio chemical properties of water, bonds and buffers.
* Students will be able to understand structure of amino acids, proteins, carbohydrates, lipids, nucleic acids and vitamins.
* Student will be able to understand about, structure of nucleic acids and protein.
* Students will be able to understand concept of bioenergetics and metabolism of biomolecules.

List of Text / Reference Books:

1. A.L. Lehninger, D.L. Nelson, M.M. Cox, “Principles of Biochemistry”, 3rd Edn.,worth Publishers, 2000.

2. L. Stryer, J.M. Berg, J.L. Tymoezko, “Biochemistry”, 5th Edition, W.H. Freeman andCo., 2002.

3. Harper’s Biochemistry, 25th edition, by R.K. Murray, P.A Hayes, D.K. Granner, P.A.Mayes and V.W. Rodwell (2000). Prentice Hall International.

4. Fundamentals of Biochemistry by Donald Voet and Judith G Voet (1999), JohnWiley & sons, NY

5. Biochemistry, 4th edition, by G. Zubay (1998). Wm.C. Brown Publishers.

6. Biochemistry, 2nd edition, by Laurence A. Moran, K.G. Scrimgeour, H.R. Horton,R.S.Ochs and J. David Rawn (1994), Neil Patterson Publishers Prentice Hall.

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| --- | --- |
| Course code | PCC-BT-207G |
| Category | Professional Core Course |
| Course title |  **Cell Biology** |
| **Scheme and Credits** | **L** | **T** | **P** | **Credits** | **Semester-III** |
| **3** |  |  | **3** |
| Branches (B. Tech.) |  **Biotechnology Engineering** |
| Class work | 25 Marks |
| Exam | 75 Marks |
| Total | 100 Marks |
| Duration of Exam | 03 Hours |

**Note**: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

**UNIT- I**

 **Cell:** An introduction, Cell Theory, classification of organisms by cell structure, compartmentalization of eukaryotic cells, cell fractionation.

 **Cell membrane and permeability:** Chemical components of biological membranes, organization and fluidity of membrane components, the membrane as a dynamic entity and membrane transport.

**Cell Wall**: Chemical composition and structure of cell wall

**UNIT- II**

 **Cytoskeleton**: Structure and functions of microtubules, microfilaments, intermediate filaments.

**Structure and Functions of Cellular Organelles:** Endoplasmic Reticulum, Golgi complex, Lysosomes, Vacuoles and Microbodies, Ribosomes, Mitochondria, Chloroplast.

**UNIT- III**

 **Nucleus:** Structure, cell-cycle and regulation of cell cycle.

**Extracellular matrix:** Composition, molecules that mediate cell adhesion, membrane receptors for extracellular matrix macromolecules, cell signaling.

**UNIT- IV**

**Muscle contraction:** Different muscle types in the body, Structure of muscle, structural proteins of muscles, energetics and regulation of muscle contraction.

**Neurons and neurotransmission:** Resting potential, action potential, synaptic transmission, neurotransmitters, and the generation of action potential by sensory stimuli and mechanism of nerve-impulses.

**Course Outcomes :**

CO1-Students will learn basic principles of cell biology especially the structure and functions of Biological Membranes

CO2 - Students will come to know about various cellular organelles and their integrated functioning.

CO3 - This unit will enable the students to learn the concept of inhibition and activation of biological phenomenon by simple methods.

CO4 - Students will be able to gain knowledge of different factors affecting the normal functioning of muscular and nervous system.

**Text / References Books:**

1. Cell Biology: Organelle structure and function, Sadava, D E.(2004) Panima pub., New Delhi.
2. Molecular Biology of cell, 4th ed. Alberts, Bruce (*et. al)(2002)* Garland Science Publishing, New York..
3. Cell Biology- Smith and Wood by Chapman and Hall.
4. Cell and Molecular Biology, 8th ed. Robertis, EDP De and Robertis, EMF De (2002) Lippincot Williams and Wilkins Pvt. Ltd.,(International Student Edition) Philadelphia.
5. Molecular Cell Biology 4th ed. Lodish, Harvey and .Baltimore, D(2000) W.H. freeman & Co. New York

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| Course code | PCC-BT 209 G |
| Category | Professional Core Courses |
| Course title |  **Genetics** |
| **Scheme and Credits** | **L** | **T** | **P** | **Credits** | **Semester-III** |
| **3** | **0** |  **0** | **3** |
| Branches (B. Tech.) |  **Biotechnology Engineering** |
| Class work |  25 Marks |
| Exam |  75 Marks |
| Total |  100 Marks |
| Duration of Exam |  03 Hours |

**Note**: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

**Course Objectives:**

In this course, emphasis is placed on the molecular basis of heredity, chromosome structure, patterns of Mendelian and non-Mendelian inheritance, principles of population, evolutionary and quantitative genetics.

**UNIT-I**

**Classical and Non-Classical Genetics.**

Introduction, History, Classical and molecular, Genetics , Mendel’s Laws of inheritance and its applications, Monohybrid and Dihybrid Crosses, Types of dominance, Test cross and back cross, common gene interactions: Complementary genes, Supplementary genes, Cumulative genes, Duplicate genes, Inhibiting genes, Lethal genes, Penetrance Expressivity, Plieotropy, Atavism, Modifiers, Qualitative and Quantitative characters, Physical basis of heredity., genetic basis of continuous phenotypic variety, Analysis of genetic data.

**UNIT-II**

**Chromosomes:**

General Features of chromosomes: Morphology, Chemical composition, Structure and functions, Chromosomal aberrations: Structural and Numerical changes, The chromosomal theory of inheritance, Sex determination, Sex influenced characters, sex limited inheritance.

**Organization of chromosomes:**

Chromosome organization and molecular structure, The structure of bacterial chromosomes, the structure of Eukaryotic Chromosome Special chromosomes: Lampbrush Chromosomes, Polytene Chromosomes, and Accessory Chromosomes, euchromatin, heterochromatin, Repetitive and non repetitive DNA.

**Linkage, Crossing Over and Recombination:** Linkage, Crossing Over, Recombination in Chromosomes, Chromosome mapping, Genetic mapping: Gene mapping from two point and three point test cross, mapping by tetrad analysis, Complementation.

**UNIT-III**

**Cytoplasmic Inheritance**: Cytoplasmic inheritance in Eukaryotes, Maternal Inheritance, Cytoplasmic Inheritance by Cell Organelles, Cytoplasmic Inheritance by Endosymbionts, Cytoplasmic inheritance in haploids, cytoplasmic inheritance in Prokaryotes.

**Mutation:** Characteristics, Classification and Molecular basis, Physical Mutagens and Chemical Mutagens, Detections of Mutation, Directed Mutagenesis, Application of Mutation, Mechanism of DNA repair.

**UNIT-IV**

**Population Genetics:** Gene frequency, Genotype Frequency, Gene pool, Hardy- Weinberg law, Random Union of gametes, Random mating among Genotypes, Factors affecting gene frequencies : Migration, Mutation, Natural Selection, Random Drift and Founder’s Principle, Inbreeding and Outbreeding.

**Inheritance of Quantitative Characters:** Quantitative and Qualitative Character, Inheritance of Quantitative Characters, Multiple factor hypothesis, Analysis of quantitative data: Mean, Range, Variance, Standard Deviation, Coefficient of Variation, Effect of Environment on Quantitative characters. Cause of Variations.

**Genetic And Man:** Human Genetics: Introduction to human Genome, genetic Studies: Genetic Diseases, Blood Groups, Disputed Parentage, Histocompatibility, Immune response, Linkage Studies, Somatic Cell Hybridization, Antibodies and Antigens Variability, Cytogenetics, Evolutionary Genetics.

**Course Outcomes:**

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

Recognize and describe genetic phenomena and demonstrate knowledge of important genetic principles.

Describe the structure and functions of chromosomes

Understand and explain the phenomenon of cytoplasmic inheritance and mutations

Explain the key concepts in population, evolutionary and quantitative genetics including: the basis of genetic variation; heritability; Hardy-Weinberg Equilibrium; roles of migration, mutation.

**List of Text / Reference Books**:

1. Principles of Genetics by Gardner published by John Wiley & Sons.

2. Genetics: Analysis and Principles by Robert J. Brooker, 3rd Edition published by MC Graw Hill Science.

3. Genetic by M.W Strickberger Published by Prentice Hall College Division.

4. Genetic: Analysis of genes and genomes by Daniel Harti, 7th Edition published by jones and Bartlet.

5. Genetic by P.J Russel, 5th Edition published by Addison Wesley Longman, Inc. California.

6. Concept of Genetics by William S. Klug, Michael Charlotte Spencer and Michael A , Palladino, 9th Edition published by Benjamin Cumming.

7. Genetics by Benjamin Pierce, 3rd Edition Published by W.H. Freeman.

8. Essential of Genetics: A genomic perspective by Daniel L Harti and Elizabeth W.

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| Course code | **HSMC-211G** |
| Category | Humanities and Social Science Including Management Courses |
| Course title |  **ENGLISH III** |
| **Scheme and Credits** | **L** | **T** | **P** | **Credits** | **Semester- III** |
| **3** | **0** |  **0** | **3** |
| Branches (B. Tech.) | **BIO TECH** |
| Class work | 25 Marks |
| Exam | 75 Marks |
| Total | 100 Marks |
| Duration of Exam | 03 Hours |

**Note**: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

**Objective**

The course aims at developing the desired language (English) skills of students of engineering and technology so that they become proficient in communication to excel in their professional lives. The course aims at developing competence for report writing with a focus on its complex writing techniques and procedures.

**Course Content**

**Unit I**

Communication Process Types and Levels, Scopes and significance, Technical and Tools of Effective communication

**Unit II**

Speaking files and Personality Development Oral Presentation, Body Language, Voice Modulation, Negotiation, Group Discussion, Interview techniques

**Unit III**

Advanced Technical Writing Job Application, CV writing, Business Letters, Memos, Minutes, Notices, Report Writing and structure, Blog writing.

**Unit IV**

Communication and Media Recent Developments in Media, Context of Communication

**SUGGESTED READING**

1. Borowick, Jerome. N. *Technical Communication and its Applications*. New Delhi: PHI, 2000
2. Guffey, Mary Ellen. *Business Communication: Process & Product*. USA: South western College Publishing, 2000.
3. Kumar, Sanjay and Pushp Lata. *Communication Skills*. Delhi: OUP, 2011

**Environmental Sciences**

|  |  |
| --- | --- |
| Course code |  MC-106G |
| Category | Mandatory Course |
| Course title | Environmental Sciences |
| Scheme and Credits | L | T | P | Credits |  |
| 3 | 0 | 1 | 0 |
| Branches (B. Tech.) | Common For All Branches |
| Class work | 25 Marks |
| Exam | 75 Marks |
| Total | 100 Marks |
| Duration of Exam | 03 Hours |

**Unit-1** The Multidisciplinary nature of environmental studies. Definition,

 scope and importance. (2 lecture)

**Unit-2 Natural Resources :**

Renewable and non-renewable resources : Natural resources and associated problems.

a) Forest resources : Use and over-exploitation : deforestation, case studies. Timber extraction, mining dams and their effects on forests and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems.

c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources : World food problems, changes, caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Water logging, salinity, case studies.

e) Energy resources : Growing energy needs; renewable and non- renewable energy sources, use of alternate energy sources, case studies.

f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

\* Role of an individual in conservation of natural resources.

\* Equitable use of resources for sustainable lifestyles.

(8 lectures)

**Unit-3** Ecosystems :

\* Producers, consumers and decomposers.

\* Energy flow in the ecosystem.

\* Ecological succession.

\* Food chains, food webs and ecological pyramids.

\* Introduction, types, characteristic features, structure and function of the following eco-system :

a. Forest ecosystem.

b. Grassland ecosystem. c. Desert ecosystem.

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (6 lectures)

**Unit-4** Biodiversity and its conservation

\* Introduction - Definition : Genetic, Species and ecosystem diversity.

\* Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.

\* Biodiversity at global, National and local levels.

\* India as a mega-diversity nation.

\* Hot-spots of biodiversity.

\* Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.

\* Endangered and endemic species of India.

\* Conservation of biodiversity : In-situ and ex-situ conservation of biodiversity.

(8 lectures)

**Unit-5** Environmental pollution :

Definition, causes, effects and control measures of :

a) Air pollution.

b) Water pollution c) Soil pollution

d) Marine pollution e) Noise pollution

f) Thermal pollution g) Nuclear hazards

\* Solids waste management: causes, effects and control measures of urban and industrial wastes.

\* Role of an individual in prevention of pollution.

\* Pollution case studies.

\* Disaster management : floods, earthquake, cyclone and landslides.

(8 lectures)

**Unit-6** Social issues and the Environment:

\* From unsustainable to sustainable development.

\* Urban problems related to energy.

\* Water conservation, rain water harvesting, watershed management.

\* Resettlement and rehabilitation of people : its problems and concerns case studies.

\* Environmental ethics : Issues and possible solutions.

\* Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.

\* Wasteland reclamation.

\* Consumerism and waste products.

\* Environment Protection Act.

\* Air (Prevention and Control of pollution) Act.

\* Water (Prevention and Control of pollution) Act.

\* Wildlife Protection Act.

\* Forest Conservation Act.

\* Issues involved in enforcement of environmental legislation.

\* Public awareness. (7 lectures)

**Unit-7** Human population and the Environment.

Population growth, variation among nations. Population explosion- Family Welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS. Woman and Child Welfare Role of Information Technology in Environment and human health.

Case Studies. (6 lectures)

**Unit-8** Field Work :

\* Visit to a local area to document environmental assets - river/forest/grassland/hill/mountain.

\* Visit to a local polluted site-urban/Rural/ Industrial/ Agricultural.

\* Study of common plants, insects, birds.

\* Study of simple ecosystems- pond, river, hill slopes, etc. (Field work equal to 10 lecture hours).

**References**

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Pub. Ltd.

Bikaner.

2. Bharucha, Frach, The Biodiversity of India, MApin Publishing Pvt. Ltd. Ahmedabad-380013, India, E-mail : mapin@icenet.net (R).

3. Brunner R.C. 1989, Hazardous Waste Incineration, Mc. Graw

Hill Inc. 480p.

4. Clark R.S., Marine pollution, Slanderson Press Oxford (TB).

5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T.

2001, Environmental Encyclopedia, Jaico Pub. House, Mumbai

1196 p.

6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.

7. Down to Earth, Centre for Science and Environment (R).

8. Gleick, H.P., 1993. Water in crisis, Pacific Institute for Studies in Dev. Environment & Security Stockholm Env. Institute, Oxford Univ. Press, 473p.

9. Hawkins R.E. Encyclopedia of Indian Natural History, Bombay

Natural History Society, Bombay (R).

10. Heywood, V.H. & Watson, R.T. 1995. Global Biodiversity

Assessment, Cambridge Uni. Press 1140p.

11. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p.

12. Mackinney, M.L. & Schoch, RM 1996, Environmental Science systems & solutions, Web enhanced edition. 639p.

13. Mhaskar A.K., Mayyer Hazardous, Tekchno-S cience

Publications (TB).

14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing

Co. (TB).

15. Odum, E.P. 1971, Fundamentals of Ecology. W.B. Saunders

Co. USA, 574p.

16. Rao M.N. & Datta, A.K. 1987 Waste Water Treatment. Oxford

& TBH Publ. Co. Pvt. Ltd. 345p.

17. Sharma, B.K. 2001, Environmental Chemistry, Goal Publ.

House, Meerut.

18. Survey of the Environment, The Hindu (M).

19. Townsend C., Harper J. and Michael Begon. Essentials of

Ecology, Blackwell Science (TB).

20. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Comliances and Standards, Vol. I and II Enviro Media (R).

21. Tridevi R.K. and P.K. Goal, Introduction to air pollution, Techno

Science Publications (TR).

22. Wagner K.D., 1998, Environmental Management, W.B.

Saunders co. Philadelphia, USA 499p.

23. A text book environmental education G.V.S. Publishers by Dr.

J.P. Yadav.

(M) Magazine (R) Reference (TB) Textbook

The scheme of the paper will be under :

The subject of Environmental Studies will be included as a qualifying paper in all UG Courses and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded.

The duration of the course will be 40 lectures. The examination will be conducted along with the semester examinations.

Exam. Pattern : In case of awarding the marks, the paper will carry 100 marks. Theory : 75 marks, Practical/ Field visit : 25 marks. The structure of the question paper will be :

Part- A : Short Answer Pattern : 15 marks Part- B : Essay Type with inbuilt choice : 60 marks Part-C : Field Work (Practical) : 25 marks Instructions for Examiners :

Part- A : Question No. 1 is compulsory and will contain five short- answer type question of 3 marks each covering the entire syllabus.

Part-B : Eight essay type questions (with inbuilt choice) will be set from the entire syllabus and the candidate will be required to answer any four of them. Each essay type question will be of 15 marks.

The examination of the regular students will be conducted by the concerned college/Institute. Each student will be required to score minimum 40% marks separately in theory and practical/Field visit. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.

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| --- | --- |
| Course code | LC-BT-213G |
| Category | Professional Core Course |
| Course title |  **Biochemistry Lab** |
| **Scheme and Credits** | **L** | **T** | **P** | **Credits** | **Semester-III** |
|  |  | **3** | **1.5** |
| Branches (B. Tech.) |  **Biotechnology Engineering** |
| Class work | 25 Marks |
| Exam | 25 Marks |
| Total | 50 Marks |
| Duration of Exam | 03 Hours |

**LIST OF EXPERIMENTS/PRACTICALS**

1. To adjust the pH of solution.
2. To prepare buffer solution using Hasselbach Hendersson equation.
3. Biochemical test for proteins.
4. Biochemical test for carbohydrates.
5. Biochemical test for lipids.
6. To check the activity of enzyme.
7. Chromatographic analysis of biomolecules (Column/TLC/Paper).
8. HPLC analysis of biomolecules.
9. Separation of biomolecules by size exclusion chromatography.

**Course Outcome**

Students will be able to

Prepare different type of buffers.

Carry out biochemical tests for different biomolecules

Learn about separation techniques or biomolecules

 Learn about characterization of enzymes.

**TEXT / REFERENCES BOOKS**

1. Principles and Techniques of Biochemistry and Molecular Biology by K.Wilson and J.Walker Cambridge University Press
2. Introductory Practical Biochemistry Randhir Singh and SK Sawhney Alpha Science International Ltd

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| --- | --- |
| Course code | LC-BT-215G |
| Category | Professional Core Course |
| Course title |  **Cell Biology Lab** |
| **Scheme and Credits** | **L** | **T** | **P** | **Credits** | **Semester-III** |
|  |  | **3** | **1.5** |
| Branches (B. Tech.) |  **Biotechnology Engineering** |
| Class work | 25 Marks |
| Exam | 25 Marks |
| Total | 50 Marks |
| Duration of Exam | 03 Hours |

**LIST OF EXPERIMENTS:**

1. Study of different types of microscopes.
2. To study and observe the structure of prokaryotic cell
3. To study and observe the structure of eukaryotic cell
4. To prepare temporary stained mounts of onion root tip to study mitotic cell division
5. To prepare temporary stained mounts of Polytene chromosomes.
6. To prepare temporary stained mounts of insect gonads/flower bud.
7. To study cell membrane properties.
8. Fluorescence labeling of cellular organelles.
9. Study of Drosophila as a model organism and its life-cycle.
10. Isolation of DNA.

**Course Outcomes :**

CO1 - Students will be able to operate compound microscope

CO2 - Preparation of temporary and permanent slides will be known by students.

CO3 - Students will come to know about the procedure of isolation of different organelles of the cell by means of techniques of Centrifugation on the basis of density gradient.

CO4 - Students will learn Techniques of DNA extraction

**Reference books:**

1. Principles and techniques of Practical Biochemistry: K. Wilson and J. Walker (1994), Cambridge University Press, Cambridge.

2. Introductory practical Biochemistry by S.K. Sawhney and Randhir Singh (2000), Narosa Publishing House, New Delhi.

3. An introduction to Practical Biochemistry by David T. Plummer (1988), McGraw- Hill, Book company, UK.

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| Course code | PCC-BT-202G |
| Category | Professional Core Course |
| Course title | **Microbiology** |
| **Scheme and Credits** | **L** | **T** | **P** | **Credits** | **Semester-IV** |
| **3** |  |  | **3** |
| Branches (B. Tech.) | **Biotechnology Engineering** |
| Class work | 25 Marks |
| Exam | 75 Marks |
| Total | 100 Marks |
| Duration of Exam | 03 Hours |

**Instructions for setting of paper:** Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 15 marks.

**Course Objectives**

To convey that Microbiology is an important a scientific discipline.

To learn the Microbial diversity and systems of classification.

 The fundamental principles of microbial nutrition, growth and control.

#### UNIT-I

**Introduction to Microbiology:** Importance and brief history of microbiology. Members of microbial world- General characteristics of Archaebacteria, Eubacteria. Algae, Fungi and Protozoa. Scope and relevance of microbiology, the future of microbiology.

**Microbial Cell Structure and Function:** Overview of prokaryotes and eukaryotes. The prokaryotic cell, size, shape and arrangement of bacterial cells. Structure and chemical composition of prokaryotic cell. Bacterial endospore.

**Viruses**:Introduction and general characteristics, the bacteriophages, Structure and life cycle of

virus (Lytic and Lysogenic)

**UNIT-II**

**Microbial taxonomy**, systems of classification, microbial phylogenetic groups, Bergey’s manual; Criteria for classification including molecular approaches.

**Microscopic Techniques:** The light microscopy, electron microscopy, preparation and staining of specimens, simple stains, differential and special stains.

**UNIT-III**

**Microbial Nutrition:** Microbial nutrient requirements, Classification of microorganisms on nutritional basis. Uptake of nutrients by cell. Culture media, types of media. Preservation techniques for microbial cultures.

**Microbial Growth**: Bacterial Modes of cell division and process of sporulation. Growth curve (log, exponential, stationary and cell death), mathematical expression of growth, diauxic growth, synchronous and continuous growth, methods of growth measurement, effects of environmental factors on growth: temperature, pH, water availability and oxygen.

**UNIT-IV**

**Microbial Control:** Basic principle of microbial control, selection of microbial control method, use of Physical and Chemical method in microbial control.

**Microbial Metabolism:** An overview of Metabolism, Carbohydrate catabolism: glycolysis, alternate to glycolysis-ED pathway, pentose phosphate pathway; cellular respiration: aerobic and anaerobic; fermentation, photosynthesis; overview of lipid and protein metabolism.

**Course Outcomes**

Students would be able to explain the basic of microbiology, relevance, microbial diversity and details of prokaryotic cell.

Students would be able to understand classification of microorganisms and techniques of microscopy.

Students would be having familiarization about microbial nutrition, preservation and growth.

Students would be able to appreciate microbial control techniques, microbial metabolism and photosynthesis.

**List of Text / References Books:**

1. Jeffery C. Pommerville. Alcamo's Fundamentals of Microbiology (Tenth Edition). Jones and Bartlett Student edition.

2. Gerard J. Tortora, Berdell R. Funke, Christine L. Case. Pearson - Microbiology: An Introduction. Benjamin Cummings.

3. Lansing M. Prescott, John P. Harley and Donald A. Klein. Microbiology. Mc Graw Hill companies.

4. Microbiology, Pelczar. M.J , Chan E.C.S, Kreig N.R, 5th edition (2007)

5. Biology, Raven and Jhonson, 6 th edition (2001)

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| --- | --- |
| Course code | PCC-BT-204G |
| Category | Professional Core Course |
| Course title | **Molecular Biology** |
| **Scheme and Credits** | **L** | **T** | **P** | **Credits** | **Semester-IV** |
| **3** |  |  | **3** |
| Branches (B. Tech.) | **Biotechnology Engineering** |
| Class work | 25 Marks |
| Exam | 75 Marks |
| Total | 100 Marks |
| Duration of Exam | 03 Hours |

**Instructions for setting of paper:** Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 15 marks.

**Course Objectives**

To convey the importance of molecules of life and their processes.

To convey the role of central dogma related processes in practical applications.

**UNIT-I**

**DNA:** Introduction, structure, properties: physical and chemical, biological significance of double strand, DNA bending, DNA super coiling, cruciform and ZDNA structure, DNA Triplex, Denaturation and renaturation of DNA-Tm values and cot curves analysis, C-value paradox, Repetitive and non-repetitive DNA and its relevance to plants and animals, inverted and tandem repeats. Gene, split genes, housekeeping genes.

**Genome organization**:Genome organization in eukaryotes and prokaryotes, euchromatin and heterochromatin,DNA protein interactions, packaging in nucleosomes, Meiosis, mitosis and practical applications.

**UNIT-II**

**DNA Replication:** Origin of replication, DNA polymerase, mechanism of DNA replication in prokaryotes and eukaryotes, DNA replication models, DNA damage, mutations, DNA repair and practical applications.

**Transcription:** Mechanism in prokaryotes and eukaryotes, RNA polymerase, sigma factor, regulation of transcription, transcriptional factors, post transcriptional processing (5’ and capping and 3’ polyadenylation), Zinc finger motifs, helix loop helix, leucine Zippers. RNA splicing: Intron and exon, splicing mechanism for mRNA,tRNA, spliceosome, lariat formation, Ribozymes, cis splicing and trans splicing, practical application of transcription.

**UNIT-III**

**Translation:** Genetic code, Wobble hypothesis, Component of protein synthesis, ribosomes, tRNA, mRNA, rRNA, mechanism of protein synthesis, regulation of protein synthesis, post transitional modification, chaperones, transport and degradation of proteins and practical applications of translation.

**Gene Regulation:**Operon model, Regulation of gene expression in prokaryotes and eukaryotes; Lactose and Tryptophan operon, inducible and repressible systems; positive and negative control.

Applications of gene regulations in diseases, control and evolution.

**UNIT-IV**

**Transposons:** The dynamic genome: Mobile genetic elements in prokaryotes-insertion sequences, composite and non-compositetransposons, replicative and conservative transposition, retrotransposon, eukaryotic jumping genes and practical applications.

Introduction to stem cells and cellular differentiation; RNA interference, epigenetic regulation of genes (DNA methylation and histone modifications), oncogenes, tumour suppressor genes and apoptosis, oncogenes and cancer. Genome editing tools, CRISPR, applications, future prospective and drawbacks.

**Course Outcomes**

Students will be able to understand and apply the principles of basic molecular biology in real life applications.

**List of Text/ Reference Books:**

1. DNA Structure and Function by Richard.
2. Genes by Lewin.
3. Molecular Cell Biology by Alberts and Watson.
4. The Cell-AMolecular Approach by Cooper.
5. Cell and Molecular Biology byRobertis.

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| Course code | PCC-BT 206 G |
| Category | Professional Core Courses |
| Course title |  **Immunology** |
| **Scheme and Credits** | **L** | **T** | **P** | **Credits** | **Semester- IV** |
| **3** | **0** |  **0** | **3** |
| Branches (B. Tech.) | **Biotechnology Engineering** |
| Class work | 25 Marks |
| Exam | 75 Marks |
| Total | 100 Marks |
| Duration of Exam | 03 Hours |

**Instructions for setting of paper:** Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 15 marks.

**Course Objectives:**

In this course, emphasis will be on :

* The structural features of the components of the immune system and their functions.
* Understanding the mechanisms involved in immune system development and responsiveness.
* To understand about how immunologists think and work.

**UNIT-I**

**Basic Immunology** : Types of immunity: innate and acquired: cells and organs of immune system B-Lymphocytes and T- Lymphocytes, Primary and secondary lymphoid organs, humoral and cell mediated immune response.

**UNIT-II**

**Immune System** : Antigens, immunoglobulins : structure and function, antigenic determinants : Isotype, allotype & idiotype; Monoclonal Ab , Hybridoma techonology Organization and expression of immunoglobulin genes, Generation of Ab. Diversity, class switching , and Ab. Engg.

**UNIT-III**

**Generation of B-Cell and T-Cell Responses** : Major histocompatibility complex , Peptide binding by class I and class II molecules , Ag. Processing presentation, T-Cell receptor ,T-cell maturation , activation & differtiation, Positive & negative selection, 􀙛 ignaling pathways.

**Immunological Techniques :** ELISA , Radio immunoassay , immuno-precipitin reactions.

**UNIT-IV**

**Immune Effector Responses :** Cytokines properties , The complement system, Role of T- helper cells in cytokine production , cell mediated effector responses.

**Immune system in Health & Disease** : Hypersensitive reaction, auto immunity, and immune response to infectious disease, tumor immunity, tissue and organ transplant , vaccines & peptide vaccines.

**Course Outcomes:**

After completing the course, students will know :

Types of immunity and its importance and relevance in our daily life

Antigens, immunoglobulin’s structure, function and organization

Major histo-compatibility complex and its importance in transplantation

Autoimmune disease and Hypersensitive reaction and vaccines.

**TEXT / REFERENCE BOOKS**

**1. Kuby,s Immunology** 4th edition ) R.A. Goldsby ,T. J. Kindt, B.A. Osborne, W.H.Freeman & company, New.York.

**2. Essential Immunology** ( 10th edition ), Ivon Roitt, Peter Delves, Blackswell, Scientific Publications. Oxford.

**3. Fundanental of immunology** . Paul W.E.( Eds) Raven press ,New York.

4.**Immunology** by Presscot .

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| --- | --- |
| Course code | ESC-BT-208G |
| Category | Engineering Science Courses |
| Course title | **Bioprocess Engineering** |
| **Scheme and Credits** | **L** | **T** | **P** | **Credits** | **Semester-IV** |
| **3** | **0** |  | **3** |
| Branches (B. Tech.) | **Biotechnology Engineering** |
| Class work | 25 Marks |
| Exam | 75 Marks |
| Total | 100 Marks |
| Duration of Exam | 03 Hours |

**Note**: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

**Course Objectives**

Understanding of basic principles of bioprocesses, mass transfer, heat transfer and fluid mechanics.

Understanding basic principles of sterilization.

Understanding fundamental of downstream processing of fermented products

#### UNIT – I

**Introduction to Bioprocess Engineering:** Overview of Bioprocess including upstream and downstream processing. Bioprocess development: An interdisciplinary challenge. Steps in bioprocess development, Role of bioprocess engineering in biotechnology.

**Introduction to Engineering calculation:** Physical variables, dimensions and units, dimensionally homogeneous and non-homogeneous equations, Concept of materials balance, types of material balance,mass balance in steady and unsteady state, elemental balance ,electron balance and energy balance, Enthalpy calculations.

**UNIT-II**

**Fermentation:** Bioreactor- general characteristics , components, and types of bioreactors**.**

Formulation of fermentation medium, factors influencing the choice of various carbon and nitrogen sources.

**Sterilization:** Thermal death kinectics of microorganisms, Batch sterilization- design aspects, del factors during heating and cooling, methods for evaluating del factors, Continuous sterilization, sterilization of gases and liquids by filtration.

#### UNIT – III

**Rheology of Fermentation Fluids:** Nature of fluids and their classification, Bernoulli’s equation.boundary layer concept, flow through pipes, Newtonian and non Newtonian fluids, mixing in fermentation broth.

**Microbial Growth Kinetics:** Growth kinetics in batch culture, effect of substrate concentration in batch culture, growth yield coefficient, heat generation during microbial growth, fed batch culture, continuous culture and continuous growth kinetics

**UNIT-IV**

**Transport Phenomena in Bioprocess:** Mass Transfer- molecular diffusion, role of diffusion in bioprocessing, film theory. Convective mass transfer; liquid solid mass transfer, liquid liquid mass transfer, Gas-Liquid mass transfer. Oxygen uptake in cell cultures, factors affecting oxygen transfer in fermentations.

Heat Transfer- Basic concept of heat transfer in bioreactor, Principle and mechanism of Heat transfer by Conduction, Convection, and Radiation. Process equipment for heat transfer, double pipe heat exchanger, shell and tube heat exchangers, condensers.

**Course Outcomes**

After studying the course, the student will be able to:

* Students will be able to understand basic principles and role of bioprocess engineering in biotechnology, mass and energy principles involved in bioprocesses.
* Students will be able to understand fermentation, sterilization of bioprocess equipments, materials, downstream processing of fermented
* Students will be able to understand role of fluid mechanics and microbial growth kinetics during bioprocesses
* Students will be get familiar with mass and heat transfer in bioprocess engineering.

**References:**

1. Bioprocess Engineering Principles, PM Doran, Academic Press, Elsevier
2. Bioprocess engineering Basic concepts M.A Shuler, Fikiret Kargi, PHI, India
3. Introduction to Biochemical Engineering D G Rao Second edition

#### Biochemical Engineering Fundamentals James E. Bailey, David F. Ollis Mc Graw Hill Education

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| Course code | **BSC-BS 210G** |
| Category | Basic Science Course |
| Course title | **Biostatistics** |
| **Scheme and Credits** | **L** | **T** | **P** | **Credits** | **Semester-IV** |
| **3** | **1** |  | **4** |
| Branches (B. Tech.) | **Biotechnology Engineering** |
| Class work | 25 |
| Exam | 75 |
| Total | 100 Marks |
| Duration of Exam | 03 Hours |

**Note**: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

**Course Objectives**

Understanding the fundamental of statistics.

Understanding the types of data, data collection and data representation

Understanding the measure of central tendency

Understanding the principles of probability

Understanding the principles of correlation and regression

#### UNIT – I

**Introduction to Biostatistics:** Definition, types of data and Application, data collection, random and non random, Data representations, Bar, Histogram, Frequency Polygon, frequency curve, relative frequency curve, pie chart (with merits and demerits).

**Descriptive Statistics:**Introduction to basic quantities methods, Measure of central tendency, mean , mode, median, Harmonic mean, Geometrical mean, Partitions, measure of dispersion, Range, Quartile deviation, mean deviation, standard deviation and, coefficient of variation.

#### UNIT – II

**Probability Distributions:**Introduction to probability and types of probability with applications in biostatistics. Probability theorems (addition, multiplication), independent events, Baye’s theorem. Probability Distributions, properties and application of binomial, poisson and Normal distributions.

#### UNIT – III

**Sampling**:Introduction to sampling, Types of sampling, errors, standard error, confidence limits, large sample test, single probability test, deference of probability, single mean difference of mean difference of standard deviation. Student’s t-distribution test (applications only), F-test, Chi-square test of goodness of fit.

**UNIT – IV**

**Correlation and regression:** Introduction, definition and types to correlation, properties, covariance and methods of studying correlation. Karl Pearson’s Coefficient of Correlation, Rank Correlation methods. Properties of regression, Introduction to regression lines, regression coefficients, properties of regression. Advantages and disadvantages of Correlation and regression.

**Course Outcomes**

Students will be able to understand the fundamental of statistics such as data, data collection and representation of data

Students will be able to understand the concepts of mean, median and mode.

Students will be able to understand the principles of probability and probability theorems

Students will be able to understand the study of correlation, regression and coefficients

**References books:**

1Biostastics, K Balaji, AVS Raghavaiah, KN Jayavera. I.K. International publishing House Pvt. Ltd, New Delhi

2. An Introduction to Biostastics, N Gurumani, MJP Publisher

3. Principles and Application of Biostastics, B. Antonosamy, PS Premkumar, S Christopher, Elsevier

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| --- | --- |
| Course code | **HSMC-02G** |
| Category |  Humanities and Social Sciences |
| Course title | **ORGANIZATIONAL BEHAVIOUR** |
| **Scheme and Credits** | **L** | **T** | **P** | **Credits** |  |
| **3** | **0** | 0 | **3** |
| Branches (B. Tech.) |  |
| Class work | 25 |
| Exam | 75 |
| Total | 100 Marks |
| Duration of Exam | 03 Hours |

The objective of this course is to expose the students to basic concepts of management and provide insights necessary to understand behavioral processes at individual, team and organizational level.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

**SYLLABUS**

**UNIT - 1**

**Introduction of Management**- Meaning, definitions, nature of management; Manageriallevels, skills and roles in an organization; Functions of Management: Planning, Organizing, staffing, Directing & Controlling, Interrelationship of managerial functions, scope of management & Importance of management. Difference between management and administration.

**UNIT - 2**

**Introduction of organization:-** Meaning and process of Organization, Management v/s Organization; **Fundamentals of Organizational Behavior:** Concepts, evolution, importance andrelationship with other Fields; Contemporary challenges and opportunities of OB. **Individual Processes and Behavior**-**Personality**- Concept, determinants andapplications; **Perception-** Concept, process and applications, **Learning**- Concept (Brief Introduction) ; **Motivation-** Concept, techniques and importance

**UNIT - 3**

**Interpersonal Processes**- **Teams and Groups**- Definition of Group, Stages of groupdevelopment, Types of groups, meaning of team, merits and demerits of team; difference between team and group, **Conflict-** Concept, sources, types, management of conflict; **Leadership:** Concept, function, styles & qualities of leadership. **Communication –** Meaning, process, channels of communication, importance and barriersof communication.

**UNIT 4**

**Organizational Processes: Organizational structure** - Meaning and types oforganizational structure and their effect on human behavior; **Organizational culture -** Elements, types and factors affecting organizational culture. **Organizational change:** Concept, types & factors affecting organizational change, Resistance to Change.

**Course Outcomes:** By the end of this course the student will be able to:

1. Students will be able to apply the managerial concepts in practical life.
2. The students will be able to understand the concept of organizational behavior at individual level and interpersonal level.
3. Students will be able to understand the behavioral dynamics in organizations.
4. Students will be able to understand the organizational culture and change

**Suggested Books:**

1. Robbins, S.P. and Decenzo, D.A. Fundamentals of Management, Pearson Education Asia, New Delhi.
2. Stoner, J et. al, Management, New Delhi, PHI, New Delhi.
3. Satya Raju, Management – Text & Cases, PHI, New Delhi.
4. Kavita Singh, Organisational Behaviour: Text and cases. New Delhi: Pearson Education.
5. Pareek, Udai, Understanding Organisational Behaviour, Oxford University Press, New Delhi.
6. Robbins, S.P. & Judge, T.A., Organisational Behaviour, Prentice Hall of India, New Delhi.
7. Ghuman Karminder, Aswathappa K., Management concept practice and cases, Mc Graw Hill education.
8. Chhabra T. N., Fundamental of Management, Sun India Publications-New Delhi.

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| Course code | LC-BT-212G |
| Category | Professional Core Course |
| Course title | **Microbiology Lab.** |
| **Scheme and Credits** | **L** | **T** | **P** | **Credits** | **Semester-IV** |
|  |  | **3** | **1.5** |
| Branches (B. Tech.) | **Biotechnology Engineering** |
| Class work | 25 Marks |
| Exam | 25 Marks |
| Total | 50 Marks |
| Duration of Exam | 03 Hours |

**LIST OF EXPERIMENTS/PRACTICALS**

1. Microscopy: Different parts of compound microscope and its use.

2. Morphology study of microorganisms using permanent slides.

3. Preparation of culture media.

4. Sterilization techniques used in microbiology laboratory.

5. Isolation and enumeration of microorganisms from soil.

6. Pure culture techniques – Streak plate, Pour plate, Spread plate

7. Sub culturing of isolate to get pure culture.

8. Preparation of bacterial smear and simple staining.

9. Gram staining of bacterial culture.

10. Measurement of bacterial growth using turbidity method.

11. Effect of temperature on microbial growth.

12. Effect of pH on bacterial growth. Biochemical tests useful in bacterial taxonomy.

13. Milk Microbiology –Standard Plate Count.

 **Course Outcome**

Students will be able to

* Students get familiarity with principle of simple and compound microscopes and their application for morphological study of microorganisms.
* Students would learn the techniques of smear preparation, simple staining and Gram staining of microbial cultures.
* Students would be able to prepare liquid and solidified media by using the sterilization technique.
* Students would be able to enumerate microbes and isolate the pure culture of microorganisms from the soil and water.

**TEXT / REFERENCES BOOKS**

1. Experiment in Microbiology, Plant pathology,Tissue Culture & Mushroom

production technology: Aneja K.R, .2001, 3RD Edition, New Age International

Publishers, New Delhi.

2. Microbiology –A Lab manual, Cappuccino J. & Sheeman N, 2000, 4th Edition,

Addison Wesley California .

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| Course code | LC-BT-214G |
| Category | Professional Core Course |
| Course title | **Molecular biology Lab.** |
| **Scheme and Credits** | **L** | **T** | **P** | **Credits** | **Semester-IV** |
|  |  | **3** | **1.5** |
| Branches (B. Tech.) | **Biotechnology Engineering** |
| Class work | 25 Marks |
| Exam | 25 Marks |
| Total | 50 Marks |
| Duration of Exam | 03 Hours |

**LIST OF EXPERIMENTS/PRACTICALS (Any ten)**

1. Isolation of Prokaryotic genomic DNA
2. Isolation of Prokaryotic plasmid DNA
3. Isolation of DNA from Eukaryotes
4. mt-DNA/Y-Chromosome isolation
5. Isolation of DNA from saliva/blood/different tissues/dried blood/hair
6. RNA/s isolation
7. Simultaneous extraction of RNA, DNA and proteins
8. Purification of DNA/RNA/Protein
9. Molecular weight characterization of a given DNA/Protein
10. Electrophoresis/AgroseGel Extraction/SDS/PAGE of DNA/Protein.
11. Polymerase Chain Reaction/PCR
12. Blotting Techniques
13. RAPID
14. RFLP

**Course Outcome:**

Students will be able to isolate, identify, purify and amplify the molecules of life.

Students will be able to apply the theoretical knowledge of molecular biology for practical applications.

 **List of References/ Suggestive Books.**

1. Molecular Cloning-a laboratory manual by Sambrook and Russell.
2. Cell and Molecular Biology: Concepts and Experiments by Karp.
3. Genomes by Brown.
4. Molecular Cell Biology by Alberts and Watson.

NOTE: A College must offer 70% of the above listed experiment. The remaining 30% experiment may be modified by college according to facilities available.

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| Course code | LC-BT-216G |
| Category | Professional Core Courses |
| Course title |  **Immunology Lab** |
| **Scheme and Credits** | **L** | **T** | **P** | **Credits** | **Semester-IV** |
| **0** | **0** |  **3** | **1.5** |
| Branches (B. Tech.) |  **Biotechnology Engineering** |
| Class work |  25 Marks |
| Exam |  25 Marks |
| Total |  50 Marks |
| Duration of Exam |  03 Hours |

**Course Objectives:**

To acquire knowledge on immunological techniques

To train in various techniques involving antigen and antibody reactions

**LIST OF EXPERIMENTS:**

1. Double diffusion, Immuno-electrophoresis and Radial Immuno diffusion.

2. Rocket electrophoresis

3. Antibody titre by ELISA method.

4. ELISA for detection of antigens and antibodies-DOT ELISA

5. Sandwich ELISA

6. Blood group mapping

7. Separation of leucocytes by dextran method

8. Separation of mononuclear cells by Ficoll-Hypaque

9. Preparation of antigens from pathogens and parasites

10. Slide and tube agglutination reaction

11. Complement fixation test.

12. Immunofluorescence technique

13. Lymphoproliferation by mitogen / antigen induced

14. SDS-PAGE, Immunoblotting, Dot blot assays

**Course Outcomes:**

Students will be able to perform diagnostics assays involving antigen-antibody reaction.

Students will be able to learn the preparation of antigen.

Students will be able to learn the immuno-diffusion & immuno-precipitation

Students will be able to learn ELISA test and SDS-PAGE.

**REFERENCES:**

1. Rose et al., Manual of Clinical laboratory Immunology, 6th Ed ASM Publications, 2002.

2. Lefkovis and Pernis. Immunological methods. Academic Press, 1978.

3. Hudson L. and Hay F.C. Practical Immunology. Black Well publishers, 1989