



(Bachelor of Science)  
(B.Sc) (Biotechnology) Semester V

|                             |   |                     |                           |
|-----------------------------|---|---------------------|---------------------------|
| Course Code                 | US05CBIT51  | Title of the Course | Cell biology and Genetics |
| Total Credits of the Course | 4   | Hours per Week      | 4                         |
| Course Objectives:          | <ol style="list-style-type: none"><li>1. To teach the students about the organelles used in protein transport and modification.</li><li>2. To educate the students cell- cell communications and cancer biology</li><li>3. To educate the students in deviations in Mendelian genetics and mobile genetic element</li></ol> |                     |                           |

| Course Content |  |                |
|----------------|--|----------------|
| Unit           | Description  | Weightage* (%) |
| 1.             | Endoplasmic reticulum (Smooth& Rough) Overview of vesicle budding, targeting and fusion. Endoplasmic reticulum to Golgi vesicle (Transport & COPII coated vesicles), Golgi Apparatus- Glycosylation and covalent modification of protein in the Golgi apparatus, Retrograde & anterograde transport, leaving the Golgi complex, Molecular motors (dynein, kinesin and myosin). Concept of sarcomere and muscle contraction and relaxation. | 25%            |
| 2.             | Checkpoints & regulations in Cell division, Cell signalling-Structure and signal transmission ( Tyrosine kinases & G protein coupled receptors) Cancer Biology- carcinogenic agents, characteristics & molecular basis of cancer, Types of cancer, Introduction to apoptosis   | 25%            |
| 3.             | Variation in Mendelian genetics- Incomplete and codominance, multiple alleles, epistasis. Sex linked inheritance in humans – Thallasemia, color blindness, extra chromosomal inheritance. Population genetics- Pedigree analysis   | 25%            |
| 4.             | Recombination- site specific and homologous, (Holliday model). Role of rec genes and protein. Mobile genetic element prokaryotic-IS and Composite and eukaryotic-Ac/DS element. Retrotranspos on-properties, types – LTR and NON LTR. Significance of retrotranspos on in eukaryotes.  | 25%            |

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| Teaching-Learning Methodology | Chalk board, Power point presentation,quizzes, Videos available on NPTEL and BISAG |
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| Evaluation Pattern |  |           |
|--------------------|--|-----------|
| Sr. No.            | Details of the Evaluation  | Weightage |
| 1.                 | Internal Written / Practical Examination (As per CBCS R.6.8.3)   | 15%       |
| 2.                 | Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3) | 15%       |
| 3.                 | University Examination   | 70%       |

| Course Outcomes: Having completed this course, the learner will be able to |  |
|--|--|
| 1.   | Understand the post translational protein modification and movement through various organelles.          |
| 2.   | Understand the necessity of cell cycle regulation, basics in cell-cell communications and cancer biology |
| 3.   | Understand the deviations in Mendelian genetics and extrachromosomal genetics                            |
| 4.   | Understand the structure and functions of mobile genetic element in evolution process.                   |

| Suggested References: |  |
|-----------------------|--|
| Sr. No.               | References                             |
| 1.                    | Cell biology – Karp                    |
| 2.                    | The Cell- Molecular Approach - Cooper  |
| 3.                    | Development Biology – Gilbert, Barrest |
| 4.                    | Concepts of Genetics- Klug, Cummins    |

| On-line resources to be used if available as reference material |
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| On-line Resources   |
| Nptel.ac.in   |
| SANDHAN BISAG you tube  |

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(Bachelor of Science)  
(B.Sc) (Biotechnology) Semester V

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|-----------------------------|------------|---------------------|-------------------------|
| Course Code                 | US05CBIT52 | Title of the Course | Enzymology & Metabolism |
| Total Credits of the Course | 4          | Hours per Week      | 4                       |

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|--------------------|---|
| Course Objectives: | To understand mechanism of enzyme catalysis, enzyme kinetics<br>To understand enzyme immobilization and industrial application of enzymes<br>To understand the concept of the metabolic reaction of cells that is essential for the sustenance of life. |
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| Course Content |   |                |
|----------------|---|----------------|
| Unit           | Description   | Weightage* (%) |
| 1.             | Enzymology—General characteristics. Structure of active site of enzymes, specificity of enzyme action- Types and factors affecting enzyme activity. Brief introduction of allosteric enzymes. Enzyme kinetics—Derivation of Michaelis and Menten equation and its modifications (Line-weaver Burk plots).   | 25%            |
| 2.             | Mechanism of action of enzymes--General features - proximity and orientation, strain and distortion, acid-base and covalent catalysis (chymotrypsin, lysozyme). Overview of enzyme inhibition. Purification of enzymes (chromatography). Immobilization: Definition, techniques and applications. Industrial application of amylase, protease & lipase. | 25%            |
| 3.             | Glycolysis, Pentose phosphate pathway, Gluconeogenesis, Glycogenolysis and glycogen synthesis. TCA cycle. Electron Transport Chain, Oxidative phosphorylation, Chemiosmotic theory, ATP synthase  | 25%            |
| 4.             | FAS complex enzyme. Synthesis of saturated fatty acids, $\beta$ oxidation of saturated fatty acid, Ketone-body metabolism. Nucleotide biosynthesis. De novo and salvage pathway. Role of essential and non-essential amino acids in growth and development, Urea cycle.   | 25%            |

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| Teaching-Learning Methodology | Classroom interaction, Use of blackboard and chalk<br>ICT tools involving smart boards, power point presentation, videos, animations & models.<br>Assignments Seminar, unit test, and quiz |
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| Evaluation Pattern |  |           |
|--------------------|--|-----------|
| Sr. No.            | Details of the Evaluation  | Weightage |
| 1.                 | Internal Written / Practical Examination (As per CBCS R.6.8.3)   | 15%       |
| 2.                 | Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3) | 15%       |
| 3.                 | University Examination   | 70%       |

| Course Outcomes: Having completed this course, the learner will be able to |  |
|--|--|
| 1.   | Explain enzyme characteristics ,enzyme specificity and enzyme kinetics   |
| 2.   | Understand the different techniques of enzyme immobilization and industrial applications of enzymes                    |
| 3.   | Students will get an understanding of how living organisms get energy at molecular level through metabolic activities. |

| Suggested References: |  |
|-----------------------|--|
| Sr. No.               | References   |
| 1.                    | Biochemistry - Zubay                                       |
| 2.                    | Enzymology - Palmer;                                       |
| 3                     | Fundamentals of Enzymology – Nicolas Price & Lewis Stevens |
| 4                     | Biochemistry –Stryer                                       |
| 5                     | Text book of biochemistry- Vasudevan & Shreekumari         |
| 6                     | Principle of Biochemistry –Lehninger                       |

| On-line resources to be used if available as reference material |
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| On-line Resources   |
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**B.Sc.-Biotechnology---Semester -V**

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|-----------------------------|---|---------------------|-----------------|
| Course Code                 | US05CBIT53  | Title of the Course | rDNA Technology |
| Total Credits of the Course | 4   | Hours per Week      | 4               |
| Course Objectives:          | <ol style="list-style-type: none"><li>1. To familiarize and understanding the students with emerging field of biotechnology i.e., Recombinant DNA Technology.</li><li>2. To learn about different tools used in rDNA technology.</li><li>3. To learn about different vectors and markers used in rDNA technology.</li><li>4. To learn about different applications and uses of rDNA technology.</li></ol> |                     |                 |

| Course Content |   |                |
|----------------|---|----------------|
| Unit           | Description   | Weightage* (%) |
| 1.             | <ul style="list-style-type: none"><li>• Introduction to basic rDNA technology:</li><li>• Milestones in genetic engineering and biotechnology</li><li>• The basic principles, and steps of gene cloning</li><li>• Tools of recombinant DNA technology - restriction enzymes, its types and restriction modification system, Nucleic acid modifying enzymes-klenow fragment of DNA pol-I, alkaline phosphatase, polynucleotide kinase, reverse transcriptase, DNA ligase, DNase-1, RNase, methylase, exonuclease.</li><li>• Cloning using linkers and adaptors.</li></ul> | 25%            |
| 2.             | <p>Vectors for cloning: Prokaryotic and eukaryotic cloning and expression vectors-</p> <ul style="list-style-type: none"><li>• Bacteriophage-<math>\lambda</math> vectors- replacement &amp; insertional vectors Cosmid, phagemid. BAC,</li><li>• Yeast vectors-YEP, YIP, YCP, SV-40, retroviral vector, MAC.</li><li>• Introduction into eukaryotic expression system.</li></ul>   | 25%            |
| 3.             | <ul style="list-style-type: none"><li>• Screening and selection of recombinant host cells: Insertional inactivation, Antibiotic resistance gene, blue/white selection.</li><li>• Molecular markers- RFLP, RAPD, AFLP, SNP, micro satellite DNA, DNA fingerprinting – process and applications.</li><li>• Southern hybridization, Western, Northern blotting, In situ hybridization, FISH (radioactive and non-radioactive detection of hybridization), Autoradiography.</li></ul>   | 25%            |





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| 4. | <ul style="list-style-type: none"><li>• Polymerase Chain Reaction (PCR), Site-directed mutagenesis, DNA Sequencing, DNA protein interaction Assays, DNA fingerprinting, Construction of Genomic library, and cDNA library</li><li>• Applications of rDNA technology in industry, medicine (health and diseases), food and agriculture, and environment.</li></ul> | 25% |
|----|---|-----|

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|--------------------------------------|--|
| <b>Teaching-Learning Methodology</b> | Classroom lectures and uses of chalk and blackboard.<br>ICT tools involving smart boards, power point presentations, videos, animations, and models. |
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| Evaluation Pattern |  |           |
|--------------------|--|-----------|
| Sr. No.            | Details of the Evaluation  | Weightage |
| 1.                 | Internal Written / Practical Examination (As per CBCS R.6.8.3)   | 15%       |
| 2.                 | Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3) | 15%       |
| 3.                 | University Examination   | 70%       |

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| Course Outcomes: Having completed this course, the learner will be able to |  |
| 1.   | The students will have sufficient scientific understanding of the subject and have good knowledge of application of recombinant DNA techniques in Life Sciences. |
| 2.   | The students will have understood different tools, methodologies of rDNA technology.   |

| Suggested References: |  |
|-----------------------|--|
| Sr. No.               | References   |
| 1.                    | Recombinant DNA 2nd Edition. Watson, James D. and Gilman, M. (2001) W.H Freeman and Company, New York  |
| 2.                    | Molecular Biotechnology: Principles Application of Recombinant DNA 2 nd Edition. Glick, B. R. and Pasternak, J. J. (1998) ASM press Washington DC. |
| 3.                    | Genetic Engineering. Ahluwalia, K. B. (2002) New Age International (P) Ltd.  |





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| 4 | An Introduction to Genetic Engineering 2nd edition Desmond Nicholl S.T. (2002) Cambridge University Press.   |
| 5 | Genetic Engineering: An introduction to Gene analysis and exploitation in eukaryotes. Kingsman and Kingsman (1998) Blackwell Scientific Publication, Oxford. |
| 6 | DNA cloning: A Practical Approach. Glover and Hames (2001) Oxford Univ. Press.   |

On-line resources to be used if available as reference material

On-line Resources

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(Bachelor of Science)  
 (B.Sc) (Biotechnology) Semester V

|                             |   |                     |                            |
|-----------------------------|---|---------------------|----------------------------|
| Course Code                 | US05CBIT54  | Title of the Course | Fundamentals of Immunology |
| Total Credits of the Course | 4   | Hours per Week      | 4                          |
| Course Objectives:          | 1. To understand basic concept of Infection and Immunology<br>2. To understand Immune disorder and concept of Epidemiology<br>... |                     |                            |

| Course Content |  |                |
|----------------|--|----------------|
| Unit           | Description  | Weightage* (%) |
| 1.             | Concept of Infection (source, method of transmission, types of infection, factors predisposing infection). Immunity; Innate immunity (species/racial/individual level), General mechanism of Innate immunity. Acquired Immunity (Active and Passive) Primary and secondary immune response, Concepts of Humoral and cell mediated immune response. Immune cell (B cell, T cell, APC, Nk cell). Introduction to Primary and secondary lymphoid organs.  | 25             |
| 2.             | Antigen and Immunogen, Hapten Epitope, adjuvant, Properties of Antigen. Antibodies - structure of IgG, classes of Ig (physiochemical and biological properties and function). Complement (classical pathway, alternate pathway and lectin pathway). Structure and function of MHC molecule. Introduction to inflammation and cytokines.  | 25             |
| 3.             | Immune Disorder: Hypersensitivity( gel and coomb classification) , introduction to tolerance system , Mecanism and disorder of Autoimmunity ( localised reaction(Hashimoto thyroiditis, Myasthenia gravis, Systemic reaction(SLE, MS, Rheumatoid arthritis), Introduction to transplantation immunology (graft, need for transplantation, graft vs. host rejection, types of rejection), ,Immunodeficiency disease: -(SCID and HIV)<br>Epidemiology: Concept, Epidemiology markers, carrier, Epidemic disease (Plague and Influenza), Herd immunity. | 25             |
| 4.             | Properties and Mechanism of Ag-Ab reaction (Zone phenomenon, Lattice formation,), Principle application of Ag-Ab reaction (agglutination reaction, Precipitation reaction immune diffusion, Immunoelectrophoresis, ELISA, CFT, RIA).<br>Immune Haematology: Blood group antigen (ABO-Rh), importance of blood group in transfusion and outline to blood constituents.<br>Immunophylaxis: Introduction and types of vaccine.  | 25             |







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| Teaching-Learning Methodology | Chalk board, power point presentation, quizzes, Video available on NPTEL and BISAG |
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| Evaluation Pattern |  |           |
|--------------------|--|-----------|
| Sr. No.            | Details of the Evaluation  | Weightage |
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| 2.                 | Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3) | 15%       |
| 3.                 | University Examination   | 70%       |

| Course Outcomes: Having completed this course, the learner will be able to |   |
|--|---|
| 1.   | Understand infection and types of immunity and immune cells and organs. |
| 2.   | Understand Antigen, Antibody, complement, MHC and inflammation.         |
| 3.   | Understand Immune disorder and Concept of Epidemiology                  |
| 4.   | Understand Ag-Ab reaction and Haematology and Immunoprophylaxis.        |

| Suggested References: |  |
|-----------------------|--|
| Sr. No.               | References   |
| 1.                    | Immunology, Kuby                                     |
| 2.                    | Textbook of Microbiology, Ananthanarayan and Panikar |
| 3.                    | Immunology, Roitt's                                  |

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| On-line Resources |
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