**Integral University, Lucknow**

| **Effective from Session:** 2020-2021 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | BS211 | **Title of the Course** | Immunology | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | V | 3 | 1 | 0 | 4 |
| **Pre-Requisite** | 10+2 with Biology | **Co-requisite** | | | | | |
| **Course Objectives** | This course aims to develop the understanding of basics of Immunology, types of Immune Responses, antigens and antibodies, histocompatibility, vaccines and Immunization | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Know the history and scope of Immunology. |
| **CO2** | Understand the types of Immunity: Passive, Active, Innate and Acquired immunity, Humoral and Cell Mediated Immunity and the cell and organs of immune responses and their functions, B & T cells |
| **CO3** | Have basic knowledge of Antigens as haptens, epitopes and Factors influencing immunogenicity, and Antibodies structure, types, production and functions of immunoglobulins, Clonal selection theory and Antigen Antibody reactions as Precipitation, Immunoelectrophoresis, Haem-agglutination, RIA and ELISA. |
| **CO4** | Comprehend Histocompatibility, structure of MHC class I, II & III antigens and their mode of antigen presentation, MHC restriction Complement system: Components, Classical and alternate pathways of complement activation, Hypersensitivity, Autoimmunity |
| **CO5** | Understand Passive and Active immunization, Types of Vaccines: Inactivated, Attenuated, Recombinant and Subunit Vaccines, Peptide and DNA Vaccines. |

| **Unit No.** | **Title of the Unit** | **Content of Unit** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|---|
| 1 | Basics of Immunology | History and scope of Immunology, Types of Immunity: Passive, Active, Innate and Acquired immunity, Humoral and Cell Mediated Immunity | 8 | CO-1 |
| 2 | Immune Responses | Cell and organs of immune responses and their functions, B & T cells. | 8 | CO-2 |
| 3 | Antigens and Antibodies | Antigens: haptens, epitopes and Factors influencing immunogenicity, Antibodies: Structure, types, production and functions of immunoglobulins Clonal selection theory. Antigen Antibody reaction: Precipitation, Immunoelectrophoresis, Haem-agglutination, RIA and ELISA. | 8 | CO-3 |
| 4 | Histocompatibility: | structure of MHC class I, II & III antigens and their mode of antigen presentation, MHC restriction; Complement system: Components, Classical and alternate pathways of complement activation, Hypersensitivity, Autoimmunity. | 8 | CO-4 |
| 5 | Vaccines and Immunization | Passive and Active immunization, Types of Vaccines: Inactivated, Attenuated, Recombinant and Sub Unit Vaccines, Peptide and DNA Vaccines | 8 | CO-5 |

**Reference Books:**


1. William, E. Paul (1989) Fundamental Immunology, 2nd Edition Raven Press, New York
2. Basic Immunology, A.K. Abbas and A.H. Lichtman, Saunders W.B. Company
3. Fundamentals of Immunology, W. Paul, Lippincott Williams and Wilkins
4. Immunology, W.L. Anderson, Fence Creek Publishing (Blackwell)..
5. Immunology: A Short Course, E. Benjamin, R. Coico and G. Sunshine, Wiley-Leiss Inc


**e-Learning Source:**

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 1 | | | | | 3 | 3 | | | |
| **CO2** | 3 | 1 | | | | 1 | 3 | 3 | | | |
| **CO3** | 3 | 1 | | | 1 | | 3 | 3 | | | |
| **CO4** | 3 | 1 | | 3 | 1 | | 3 | 3 | | | |
| **CO5** | 3 | 1 | | 1 | 1 | 1 | 3 | 3 | | | |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| | |
|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2020-21 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | BS341 | **Title of the Course** | Nutritional Biochemistry | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | V | **3** | **1** | **0** | **4** |
| **Pre-Requisite** | 10+2 in Biology | **Co-requisite** | | | | | |
| **Course Objectives** | The objective of this course is to develop the understanding of the basic concepts of nutritional biochemistry which comprises nutritional values of foods, dietary requirements of carbohydrates, lipids, proteins and the factors responsible for malnutrition and measures to overcome malnutrition in infants and adults. | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Concept of nutrition, energy measurements, BMR, SDA, RNI and RDA |
| **CO2** | Classification, Functions, Bioavailability and deficiency of Minerals and vitamins |
| **CO3** | Distribution, composition and functions of fluid in human body |
| **CO4** | Classification, composition, food sources, functions of carbohydrates, proteins, fats and oils |
| **CO5** | Introduction to various clinical diagnostic tests |

| **Unit No.** | **Title of the Unit** | **Content of Unit** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|---|
| 1 | Nutrition and energy metabolism | Food as a source of nutrients, function of foods, definition of nutrition, nutrients, adequate, optimum and good nutrition, malnutrition. Unit of energy measurements of food stuffs by Bomb colorimeter, calorific value and RQ of food stuffs. Basic metabolic rate (BMR), its measurements and influencing factors, SDA of food. Recommended Nutrient Intakes (RNI) and Recommended Dietary Allowances for different age groups. | 8 | CO-1 |
| 2 | Minerals and Vitamins | Minerals Classification: Macronutrients and Micronutrients, Functions, sources, Bioavailability, and deficiency of minerals. Vitamins - Classification, Bioavailability, sources, functions and deficiency: Fat soluble vitamins, Water soluble vitamins and few members of B-complex | 8 | CO-2 |
| 3 | Water metabolism | Distribution & composition of fluid in human body, ECF, ICF, Functions of water, fluid balance disorder of water metabolism, Homeostasis. | 8 | CO-3 |
| 4 | Carbohydrates | Classification, composition, food sources, functions, storage in body. Fat and Oils: Composition, saturated unsaturated fatty acids, classification food sources, functions of fats. Proteins: Composition, sources, essential, non essential amino acids, source of proteins, functions, protein deficiency. | 8 | CO-4 |
| 5 | Biochemical test | Introduction to liver function test, Liver function test LFT profile, Glucose tolerance test, renal function test, Evaluation of filtration barrier, Total Protein Albumin/Globulin Ratio (A-G Ratio). | 8 | CO-5 |

**Reference Books:**


1. Tom Brody: Nutritional Biochemistry (Second Edition), Academic Press.
2. David A. Bender: Nutritional Biochemistry of the Vitamins, Second Edition, University College London, Cambridge University Press.
3. Harper's Illustrated Biochemistry, 29th edition, Mc Graw Hill Education, Lange
4. Denise R. Ferrier, Richard A. Harvey, Biochemistry (Lippincott Illustrated Reviews Series), 6th edition. Wolters Kluwer/Lipincott, Williams and Wilkins


**e-Learning Source:**

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 1 | | | | | 1 | 3 | | | |
| **CO2** | | | | | | | | 3 | | | |
| **CO3** | 3 | 1 | | | | | 1 | 3 | | | |
| **CO4** | 3 | 1 | | | | | 1 | 3 | | 1 | |
| **CO5** | 3 | 1 | | | | | 1 | | | 3 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |
|---|---|

# Integral University, Lucknow

| **Effective from Session:** 2020-21 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | BS303 | **Title of the Course** | Genetic Engineering | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | V | **3** | **1** | **0** | **4** |
| **Pre-Requisite** | 10+2 in Biology | **Co-requisite** | | | | | |
| **Course Objectives** | The course has been designed to make students aware of DNA manipulative enzymes and Gene cloning vectors, Screening and selection of recombinants, Techniques used as Polymerase chain reaction (PCR), Site directed mutagenes is (SDM), Nucleic acid sequencing and Application of r-DNA techniques | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Get proper knowledge about the DNA manipulative enzymes: Restriction enzymes and DNA ligases, and Gene cloning vectors. |
| **CO2** | Gain knowledge about In vitro construction of recombinant DNA molecules, passenger and vector DNA, and Transformation |
| **CO3** | Learn about screening and selection of recombinant host cells, Gene Libraries, cloning techniques, Expression of cloned DNA |
| **CO4** | Learn about the basics of Electrophoretic techniques, Polymerase chain reaction (PCR), Site directed mutagenesis (SDM), Nucleic acid sequencing: Blotting techniques. |
| **CO5** | Gain knowledge of Application of r-DNA technique in human health, Production of Insulin, Production of recombinant vaccines: Hepatitis B, Production of human growth hormone. |

| **Unit No.** | **Title of the Unit** | **Content of Unit** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|---|
| 1 | DNA manipulative enzymes | Restriction enzymes and DNA ligases, Gene cloning vectors: Plasmids, Bacteriophage and Chimeric plasmids. | 8 | CO-1 |
| 2 | rDNA | *In vitro* construction of recombinant DNA molecules (pBR332, pUC19), Isolation of passenger and vector DNA, creation of r-DNA, Transformation of r-DNA by different methods. | 8 | CO-2 |
| 3 | Screening and selection of recombinant host cells | Immunological screening and colony hybridization, Gene Libraries: Genomic DNA and cDNA cloning techniques, Expression of cloned DNA in *E. coli*. | 8 | CO-3 |
| 4 | Techniques | Electrophoretic techniques, Polymerase chain reaction (PCR), Site directed mutagenesis (SDM), Nucleic acid sequencing: Sanger's method, Blotting techniques: Southern, Western and Northern blot. | 8 | CO-4 |
| 5 | Applications | Application of r-DNA technique in human health, Production of Insulin, Production of recombinant vaccines: Hepatitis B, Production of human growth hormone. | 8 | CO-5 |

**Reference Books:**


1. Glick, B.R & Pasternak J.J (1994) Molecular Biotechnology, Princi[ples and Applications of Recombinant DNA, American Society for Microbiology, Washington D.C
2. Christopler H. (1995) Gene cloning and Manipulating, Cambridge University Press
3. Nicholl, D.S.T (1994) An Introduction of Genetic Engineering, Cambridge University Press.
4. Old. R.W. and Primrose, S.B. (186) Principles of Gene manipulation, An introduction to genetic engineering (3rd Edition) Black well Scientific Publications
5. Watson J.D. Hopkins, N.H Roberts, J.W.Steitz J.A and Weiner A.M (1988). Molecular biology of society for Microbiology
6. Lewin b. (1994) Genes VI, New York, Oxford University Press


**e-Learning Source:**

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 1 | | | | | 2 | 3 | 3 | 3 | |
| **CO2** | 3 | 1 | | | | | 2 | 3 | 3 | 3 | |
| **CO3** | 3 | 1 | | | | | 2 | 3 | 3 | 3 | |
| **CO4** | 3 | 1 | | 2 | 2 | | 3 | 3 | 3 | 3 | |
| **CO5** | 3 | 1 | | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |
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# Integral University, Lucknow

| **Effective from Session:** 2020-21 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | BS306 | **Title of the Course** | Applied Biotechnology | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | V | **3** | **1** | **0** | **4** |
| **Pre-Requisite** | 10+2 with Biology | **Co-requisite** | | | | | |
| **Course Objectives** | The objective of this course is to make students familiar with principle, methodology and application of Drug and target identification, target validation, Bioprospecting and conservation: importance of biodiversity, General theory of free radical and antioxidants, Significance of IPR; Requirement of a patentable novelty and Detailed, information on patenting biological products and biodiversity | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Get proper knowledge about Genomics and Proteomics and gene expression. |
| **CO2** | Gain knowledge about Drug Discovery and Designing: Drug and target identification, target validation. |
| **CO3** | Learn about Bioprospecting and conservation: importance of biodiversity. |
| **CO4** | Learn about the basics of Free Radical Biology: General theory of free radical and antioxidants. |
| **CO5** | Have knowledge of Significance of IPR; Requirement of a patentable novelty and Detailed, information on patenting biological products and biodiversity. |

| **Unit No.** | **Title of the Unit** | **Content of Unit** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|---|
| 1 | Genomics and Proteomics | Introduction to genomics, Genome annotation, Human genome project and its application, Introduction to Proteomics: Protein expression and its analysis | 8 | CO1 |
| 2 | Drug Discovery and Designing | Drug and target identification, target validation, Molecular docking studies and its Insilco tools e.g. Autodock, GOLD. | 8 | CO2 |
| 3 | Bioprospecting and conservation | Importance of biodiversity. biodiversity informatics, databases in biological materials. International efforts and issues of sustainability. | 8 | CO3 |
| 4 | Free Radical Biology | General theory of free radical and antioxidants. Free radical mediated damage to lipids, proteins and DNA; Natural antioxidants and their applications. | 8 | CO4 |
| 5 | IPR and Patenting | Significance of IPR; Requirement of a patentable novelty; Issues related to IPR protection of software and database; IPR protection of life forms; International convention in IPR; Obtaining patent; Invention step and prior art and state of art procedure; Detailed information on patenting biological products and biodiversity. | 8 | CO5 |

**Reference Books:**

**e-Learning Source:**

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 1 | | | | | 1 | 3 | 3 | 3 | |
| **CO2** | 3 | 1 | | | | | 2 | 3 | 3 | 3 | |
| **CO3** | 3 | 1 | | | 1 | 3 | 3 | 3 | 3 | 3 | 1 |
| **CO4** | 3 | 1 | | | | | 2 | 3 | 3 | 3 | |
| **CO5** | 3 | 1 | | | 3 | 2 | 3 | 3 | 3 | 3 | 3 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

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| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

**Integral University, Lucknow**

| **Effective from Session:** 2020-21 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | BS305 | **Title of the Course** | Genomics, Proteomics & Metabolomics | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | V | 3 | 1 | 0 | 4 |
| **Pre-Requisite** | 10+2 with Biology | **Co-requisite** | | | | | |
| **Course Objectives** | The course has been designed to make students aware of Genome sequencing, genome databases, Genome analysis, Proteomics and Metabolomics. | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | The students will be able to explain genome sequencing techniques and Sequencing technology. |
| **CO2** | The students will be able to discuss about Major genome databases, Genome analysis, Comparative genomics, Functional genomics techniques. |
| **CO3** | The students will be able to describe about basic proteomics technologies. |
| **CO4** | The students will be able to describe the basics technologies used in metabolomics. |
| **CO5** | The students will be able to discuss Applications of genomics and proteomics in various fields of life. |

| **Unit No.** | **Title of the Unit** | **Content of Unit** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|---|
| 1 | Genome sequencing | Genome sequencing, Sequencing technology: Sanger sequencing, Pyrosequencing, Illumina/Solexa, SOLiD System. Pros and cons of sequencing Maxam-Gilbert sequencing, Whole shotgun genome sequencing | 8 | CO-1 |
| 2 | Structural and functional genomics | Major genome databases, Genome analysis and their applications-Structural genomics: Classical ways of genome analysis, large fragment genomic libraries; Physical mapping of genomes; sequence assembly and annotation; Comparative genomics Functional genomics: DNA chips and their use in transcriptome analysis; Mutants and RNAi in functional genomics. | 8 | CO-2 |
| 3 | Proteomics | Introduction to basic proteomics technology; Bioinformatics in proteomics; Proteome analysis. Proteomics classification. Yeast-two-hybrid system, cDNA microarrays 1D-SDS-PAGE, 2D-SDS PAGE. Detection and quantitation of proteins in gels. Pros and cons of various staining methods. Basics of mass spectrometry. MALDI TOFF and ESI, and their application in proteomics, Tandem MS/MS spectrometry, Peptide sequencing by tandem mass spectrometry, Affinity purification of protein TAP tag. | 8 | CO-3 |
| 4 | Metabolomics | Technologies in metabolomics, Role of Spectroscopy, Electrophoretic and Chromatographic techniques in metabolic profiling Nutrigenomics. | 8 | CO-4 |
| 5 | Applications | Applications of genomics and proteomics in agriculture, human health, and industry. | 8 | CO-5 |

**Reference Books:**


1. Griffiths JF, “An Introduction to Generic Analysis”.
2. Gene Cloning and DNA Analysis: An Introduction, 6th Edition by T. A. Brown
3. Genomics and Proteomics: Functional and Computational Aspects by Suhai and Sándors,
4. Genomics and Proteomics: Principles, Technologies, and Applications by Devarajan Thangadurai and Jeyabalan Sangeetha
5. The Handbook of Metabolomics and Metabolomics by John C. Lindon, Jeremy K. Nicholson and Elaine Holmes


**e-Learning Source:**

**Course Articulation Matrix: (Mapping of COs with POs and PSOs)**

| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | | | | | 1 | 1 | 3 | 3 | 1 |
| **CO2** | 3 | 1 | | | | | 2 | 1 | 3 | 3 | 1 |
| **CO3** | 3 | 1 | | | | | 1 | 1 | 3 | 3 | 1 |
| **CO4** | 3 | 1 | | | | | 1 | 1 | 3 | 3 | 1 |
| **CO5** | 3 | 1 | | | | | 1 | 1 | 3 | 3 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| | |
|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2020-21 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | BS342 | **Title of the Course** | Introduction To Tissue Culture Technology | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | V | **3** | **1** | **0** | **4** |
| **Pre-Requisite** | 10+2 in Biology | **Co-requisite** | | | | | |
| **Course Objectives** | This course aims to develop an understanding of: Plant tissue culture, types and importance of culture media, plant growth regulators, importance of aseptic conditions, haploid plant production, economic importance of plant tissue culture, Animal tissue culture; history and scope, types media, Primary culture and Cell lines. | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Understand use of aseptic Techniques, types of growth media, types growth regulators, and their use in plant tissue culture |
| **CO2** | Understand techniques, methods and source of haploid plant production, techniques used for organ culture, somatic Embryogenesis and their applications, and other methods for Protoplast Culture, somatic hybridization, protoplast fusion |
| **CO3** | Learn and understand the importance of plant tissue culture in various fields of application, various methods for development of transgenic plants |
| **CO4** | Learn the history and scope of Animal Tissue culture, Understand the types, importance and composition of various growth media and growth factors |
| **CO5** | Learn and understand the types of cells in culture that includes primary cells, transformed cells and cell lines, different methods of disaggregation of cells from tissues, monolayer formation and methods used for synchronization of cell growth in culture |

| **Unit No.** | **Title of the Unit** | **Content of Unit** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|---|
| 1 | Aseptic Technique | Aseptic Techniques, Nutrient media, and use of growth regulators (Auxins, Cytokininis and Gibberellins). Callus and suspension culture. | 8 | CO-1 |
| 2 | Haploid plant production | Haploid plant production: microspore and ovule culture, Organ Culture and their applications, Somatic Embryogenesis: Techniques and applications. Protoplast Culture, somatic hybridization, methods of protoplast fusion: chemical and electro fusion, practical application of somatic hybridization. | 8 | CO-2 |
| 3 | Role of tissue culture | In agriculture, horticulture and forestry, Transgenic plants, Technique of transformation: Agrobacterium-mediated and physical methods (Micro projectile bombardment and electroporation). | 8 | CO-3 |
| 4 | History and Scope of Animal Tissue Culture | History and Scope of Animal Tissue Culture. Culture Media, Simulating natural conditions for growth of animal cells, Natural media: Plasma Clot, biological fluids tissue extract, Importance of Serum in media, Chemical defined media, serum free media | 8 | CO-4 |
| 5 | Primary Culture | Primary Culture: Cell lines, and cloning, isolation and mechanical disaggregation of tissue, enzyme. Secondary Culture: transformed animal cells and continuous cell lines. Monolayer formation, Synchronization. | 8 | CO-5 |

**Reference Books:**


1. Ravishankar G.A and Venkataraman L.V(1997) Biotechnology applications of Plant Tissue & cell culture. Oxford & IBH Publishing co., Pvt Ltd.
2. H. S. Chawla “Plant Biotechnology: A Practical Approach”
3. Davis, Cell culture techniques.
4. Brown TA “Gene cloning: An introduction”
5. Ian Freshney Animal cell culture.(4th Edition)
6. Buttler. Elements of Biotechnology – P.k. Gupta (1st Edition -2000) Rastogi Publications.


**e-Learning Source:**

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 1 | | | | | 1 | 3 | | 3 | |
| **CO2** | 3 | 1 | | | | | 1 | | | 3 | |
| **CO3** | 3 | 1 | | | | | 1 | 3 | | 3 | |
| **CO4** | 3 | 1 | | | | | 1 | | | 3 | |
| **CO5** | 3 | 1 | | | | | 1 | 1 | | 3 | |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |
|---|---|

# Integral University, Lucknow

| **Effective from Session:** 2020-21 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | BS343 | **Title of the Course** | Tissue Culture & Bioinformatics Lab | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | V | **0** | **0** | **6** | **3** |
| **Pre-Requisite** | 10+2 with Biology | **Co-requisite** | | | | | |
| **Course Objectives** | On completion of this course, students will be able to develop an understanding of Bioinformatics as tools for Sequence Alignment, FASTA & BLAST search, Multiple Sequence Alignment, Protein Structure Visualization, Gene Finding as well as for tissue culture. | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Know about sequence databases and FASTA & BLAST search |
| **CO2** | Learn Pair wise and multiple Sequence Alignment |
| **CO3** | Learn how to visualize Protein Structure |
| **CO4** | Learn *In vitro* germination of seeds and maintenance of Callus and suspension culture |
| **CO5** | Learn Plant propagation through axillary and adventitious bud culture |

| **Unit No.** | **Title of the Unit** | **Content of Unit** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|---|
| 1 | **Exp-01** | Introduction to types of sequence databases (Nucleotides & Protein) | 3 | CO-1 |
| 2 | **Exp-02** | Pair wise Sequence Alignment (NW and SW approach) | 3 | CO-1 |
| 3 | **Exp-03** | FASTA & BLAST search | 3 | CO-2 |
| 4 | **Exp-04** | Multiple Sequence Alignment (ClustalX & Treeview) | 3 | CO-2 |
| 5 | **Exp-05** | Protein Structure Visualization (RASMOL, Swiss-PDB Viewer) | 3 | CO-3 |
| 6 | **Exp-06** | Gene Finding tools (Grail or Genscan) | 3 | CO-3 |
| 7 | **Exp-07** | Preparation of plant culture media and its sterilization. | 3 | CO-4 |
| 8 | **Exp-08** | *In vitro* germination of seeds | 3 | CO-4 |
| 9 | **Exp-09** | Initiation and maintenance of Callus and suspension culture. | 3 | CO-4 |
| 10 | **Exp-10** | Plant propagation through axillary bud culture. | 3 | CO-5 |
| 11 | **Exp-11** | Plant propagation through adventitious bud culture | 3 | CO-5 |

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 3 | 1 | | | | 3 | 2 | | 3 | 2 |
| **CO2** | 3 | 3 | 1 | | | | 3 | 2 | | 3 | 2 |
| **CO3** | 3 | 3 | 1 | | | | 3 | 2 | | 3 | 2 |
| **CO4** | 3 | 3 | 1 | | | | 3 | 2 | | 3 | 2 |
| **CO5** | 3 | 3 | 1 | | | | 3 | 2 | | 3 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| | |
|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

**Integral University, Lucknow**

| **Effective from Session:** 2020-21 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | BS216 | **Title of the Course** | Immunology Lab | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | V | 0 | 0 | 6 | 3 |
| **Pre-Requisite** | 10+2 with Biology | **Co-requisite** | | | | | |
| **Course Objectives** | The objective of this course is to enable students learn about basics of immunology, types of Blood grouping, cell counts, ELISA, Ouchterlony Double diffusion (ODD) and Separation of serum from blood & precipitation of Immunoglobulins | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Analyze Blood grouping |
| **CO2** | Perform and analyze differential counting of WBC and detergent lysis of RBC |
| **CO3** | Perform and analyze Dot Elisa, ELISA |
| **CO4** | Have knowledge of and can perform Ouchterlony Double diffusion assay. |
| **CO5** | Perform and analyze separation of serum from blood & precipitation of Immunoglobulin |

| **Exp. No.** | **Title of Experiment** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|
| **Exp-01** | Blood grouping | 3 | CO-1 |
| **Exp-02** | Differential Count of WBC | 3 | CO-1 |
| **Exp-03** | Detergent lysis of RBC | 3 | CO-2 |
| **Exp-04** | Dot Elisa | 3 | CO-3 |
| **Exp-05** | ELISA – Demonstration | 6 | CO-3 |
| **Exp-06** | Ouchterlony Double diffusion (ODD) | 6 | CO-4 |
| **Exp-07** | Separation of serum from blood & precipitation of Immunoglobulins | 6 | CO-5 |

**Reference Books:**


1. Asim Roy Kumar, Immunology Theory & Practical, 5th Sem. (Kalyani Pub.)
2. Talwar Gupta A Handbook of Practical & Clinical Immunology
3. A.K. Abbas and A.H. Lichtman, Saunders,Basic Immunology, W.B. Company


**e-Learning Source:**

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 3 | 1 | | | 3 | 1 | 3 | 3 | 3 | 1 |
| **CO2** | 3 | 3 | 1 | | | 2 | 1 | 3 | 3 | 3 | 1 |
| **CO3** | 3 | 3 | 1 | | | 3 | 3 | 3 | 3 | 3 | 1 |
| **CO4** | 3 | 3 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 1 |
| **CO5** | 3 | 3 | 1 | 1 | 2 | 3 | 1 | 3 | 3 | 3 | 1 |

**1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| | |
|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2020-21 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | BS 204 | **Title of the Course** | IPR and Biosafety | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | VI | **3** | **1** | **0** | **4** |
| **Pre-Requisite** | 10+2 with Biology | **Co-requisite** | | | | | |
| **Course Objectives** | The objective of this course is to develop the understanding of Intellectual property, IPR, Biosafety, GMO and bioethics. | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Have basic concept of Intellectual Property and its types |
| **CO2** | Know detailed description of various types of IPRs, its protection and infringement |
| **CO3** | Have knowledge of international treaties and case studies |
| **CO4** | Display understanding of Biosafety, GMOs and various Institutional committees |
| **CO5** | Have knowledge of Bioethics and its legal implications |

| **Unit No.** | **Title of the Unit** | **Content of Unit** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|---|
| 1 | Concept of Intellectual Property. Kinds of Property | Patents, Copyrights, Designs, Trademarks, Geographical Indication. Infringement of IPR, Its protection and Remedies Licensing and its types. | 8 | CO1 |
| 2 | Requirement of a patentable novelty | Issues related to IPR protection of software and database; IPR protection of life forms; International convention in IPR; Geographical indication; Distinction among various forms of IPR; Rights / protection, infringement or violation, remedies against infringement: civil and criminal. | 8 | CO2 |
| 3 | Obtaining patent | Invention step and prior art and state of art procedure; Detailed information on patenting biological products and biodiversity; Appropriate case studies; Indian Patent Act 1970 (amendment 2000); Major changes in Indian patent system as post TRIPS effects; Budapest treaty. | 8 | CO3 |
| 4 | Biosafety | Primary Containment for Biohazards; Biosafety Levels; Biosafety guidelines - Government of India; Definition of GMOs; Roles of Institutional Biosafety Committee, RCGM, GEAC etc. for GMO applications in food and agriculture; Environmental release of GMOs; Risk Analysis; Risk Assessment; Risk management and communication | 8 | CO4 |
| 5 | Bioethics | Introduction, necessity and limitation; Ethical conflicts in Biotechnology; Different paradigms of bioethics: National and International; Bioethics of genes; Bioethics in health care: Bioethical dilemmas in medical and surgical treatment; Legal implications in bioethics. | 8 | CO5 |

**Reference Books:**


1.Genome, T.A. Brown, John Willey & Sons Inc.

2. Molecular Biology of the Cell, B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson, Garland Publishing

3. Molecular Cell Biology, H. Lodish, A.Berk, S. Zipursky, P Matsundaira, D. Baltimore and J.E. Barnell, W.H. Freeman and Company.

4. Molecular Biology of the Gene, J.D. Watson, A.M. Weiner and N.H. Hopkins, Addison- Wesley Publishing.

5. Introduction to Practical Molecular Biology, P.D. Dabre, John Wiley and Sons Inc.

6. Biotechnology- B.D. Singh


**e-Learning Source:**

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 1 | | 3 | 3 | | 3 | 3 | 1 | 1 | 3 |
| **CO2** | 3 | 1 | | 3 | 3 | | 3 | 3 | 1 | 1 | 3 |
| **CO3** | 3 | 1 | | 3 | 2 | | 3 | 3 | 1 | 1 | 3 |
| **CO4** | 3 | 1 | | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 3 |
| **CO5** | 3 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 3 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |
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# Integral University, Lucknow

| **Effective from Session:** 2022-2023 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | BS 312 | **Title of the Course** | Bionanotechnology | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | VI | **3** | **1** | **0** | **4** |
| **Pre-Requisite** | 10+2 with Biology | **Co-requisite** | | | | | |
| **Course Objectives** | The objective of this course is to develop the understanding of the Basics of nanotechnology and overview of nanoscale materials, Nanomaterials: Biosensors: Biophotonics and Bioimaging and Principles of toxicology. | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Understand the basics of nanotechnology and overview of nanoscale materials |
| **CO2** | Understand the basics of Nanomaterials Understand the basics of Biosensors |
| **CO3** | Understand the basics of Biosensors |
| **CO4** | Understand the basics of Biophotonics and Bioimaging |
| **CO5** | Understand the Principles of toxicology |

| **Unit No.** | **Title of the Unit** | **Content of Unit** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|---|
| 1 | Introduction | Introduction to nanotechnology and overview of nanoscale materials, effect of length scale on properties, introduction to bionanotechnology, challenges and opportunities associated with biology on the Nanoscale, bionanotechnology systems, biological and medical applications of Bionanomaterials. | 8 | CO1 |
| 2 | Nanomaterials | Introduction to nanomaterials. DNA based nanostructures. General surface and colloid chemistry, principles, experimental techniques, surface potential, DLVO theory; Characteristics of nanoparticles, chemical speciation of dissolved species, Environmental behaviour of nanoparticles. | 8 | CO2 |
| 3 | Biosensors | Introduction to biosensors, the biological component, the sensor surface, Immobilization of the sensor molecule, Transduction of the sensor signal: Optical, Electrochemical and Mechanical sensors, Sensor stabilization. | 8 | CO3 |
| 4 | Biophotonics and Bioimaging | Overview of imaging biological systems, from the cellular level through to whole-body medical imaging, Introduction to biophysics, basic physical concepts in imaging, Major techniques using ionizing and non-ionizing radiation: fluorescence and multi-photon microscopy, spectroscopy, OCT, MRI, X-ray CT, PET and SPECT imaging. | 8 | CO4 |
| 5 | Nanotoxicology | Principles of toxicology; toxicology models, experimental toxicology studies; activation and detoxification mechanisms, importance of biological membrane in toxicology; Toxicology and bioaccumulation of particles. Biological activity of nanomaterials. | 8 | CO5 |

**Reference Books:**


1.Engines of Creation, K E Drexler, Oxford Paperbacks, New York

2. Our Molecular Future: How Nanotechnology, Robotics, Genetics and Artificial Intelligence Will Transform the World, Prometheus ISBN 1573929921

3. Nanosystems: Molecular Machinery, Manufacturing and Computation, K E Drexler, Wiley, ISBN 0471575186

4. Nanobiotechnology-Concepts, Applications and Perspectives edited by CM Niemeyer and CA Mirkin, Wiley-VCH ISBN 3-527-30658-7


**e-Learning Source:**

www.nanotechweb.org; www.nano.gov; www.nanotec.org.uk

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 1 | | | | | 1 | 2 | | 3 | 2 |
| **CO2** | 3 | 1 | | | | | 1 | 2 | | 3 | 2 |
| **CO3** | 3 | 1 | | | | | 1 | 2 | | 3 | 2 |
| **CO4** | 3 | 1 | | | 2 | | 1 | 2 | | 3 | 2 |
| **CO5** | 3 | 1 | | | | | 1 | 2 | | 3 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

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| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| Effective from Session: 2020-21 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | BS 351 | **Title of the Course** | Human Physiology | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | VI | **3** | **1** | **0** | **4** |
| **Pre-Requisite** | 10+2 with Biology | **Co-requisite** | | | | | |
| **Course Objectives** | The objective of this course is to develop the understanding of the Basics of human physiology; | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Understand the components of blood and diseases associated |
| **CO2** | Understand the basics of respiration, its regulation and respiratory illnesses |
| **CO3** | Understand the basics of excretion, its regulation and its role in homeostasis |
| **CO4** | Understand the basics of diseases of kidney and nervous system |
| **CO5** | Understand the basics of digestion, diseases associated and liver function tests |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | Blood | Blood: composition of blood, plasma proteins, blood cells counting and its significance, Blood coagulation – mechanism and regulation, Blood volume regulation and Blood pressure Haematopoiesis. Disease of Blood: Thalassemia, sickle cell anemia, Anemias; Cardiovascular Disorders – Atherosclerosis. | 8 | CO-1 |
| 2 | Respiration | Respiration: Transfer of blood gases, role of 2,3-diphosphoglycerate, Bohr's effect, and Haldane effect, chloride shift, Neural & chemical regulation of respiration. Respiratory illnesses: Asthma, COPD, Cystic Fibrosis, Emphysema, Pneumonia. | 8 | CO-2 |
| 3 | Excretion | Structure of nephron, glomerular filtration, reabsorption and tubular secretion. Homeostatic regulation of water and electrolytes, Acid-base balance, composition of urine, hormones of the kidney. | 8 | CO-3 |
| 4 | Diseases | Diseases: Kidney: Uremia & Glomerulonephritis, Kidney stone; Synapses, central and peripheral nervous system. Neurological: Epilepsy, Parkinson & Alzheimer's significance of diagnostic enzymology. | 8 | CO-4 |
| 5 | Digestion | Digestion: functions and regulation of saliva, gastric, pancreatic, intestinal and bile secretions. Digestion and absorption of biomolecules. Gall Stone, Ulcers, Liver: Jaundice, Liver Function Tests: SGOT, SGPT, CPK, LDH, Hepatitis. | 8 | CO-5 |

**Reference Books:**


Introduction to Physiology by Davidson H and Segal M.B. Academic Press.

Fox S I – Human Physiology, (McGraw Hill, 1998, ISBN: 0071157069)

Moffett D and Schauf C L – Human Physiology: Foundations & Frontiers, (Mosby, 1993, ISBN: 801669030)


**e-Learning Source:**

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 1 | | | | | 1 | 2 | | 3 | 2 |
| **CO2** | 3 | 1 | | | | | 1 | 2 | | 3 | 2 |
| **CO3** | 3 | 1 | | | | | 1 | 2 | | 3 | 2 |
| **CO4** | 3 | 1 | | | | | 1 | 2 | 2 | 3 | 2 |
| **CO5** | 3 | 1 | | | | | 1 | 2 | | 3 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

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|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2020-21 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | BS 352 | **Title of the Course** | Seminar | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | VI | | | | **2** |
| **Pre-Requisite** | 10+2 with Biology | **Co-requisite** | | | | | |
| **Course Objectives** | The students will be able to summarize and present the existing data related to a specific topic in the form of a report. Every student will present a seminar on a topic related to theoretical or experimental, advanced topic | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | The students will understand and interpret latest advancements through different technical papers, reports, Journals, Data sheets, books etc. |
| **CO2** | The students will inculcate the skills for literature survey and will learn to manage resources effectively |
| **CO3** | The students will be able to summarize the recent research and technologies in the form of review and will be able to deliver power point presentations on an assigned topic. |
| **CO4** | Communicate his/her ideas with his peers as audience, which will enhance both oral and written communication skills. |
| **CO5** | Create interest to pursue lifelong learning |

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 2 | 1 | | 2 | | 2 | 2 | | 3 | 2 |
| **CO2** | 3 | 2 | 1 | | 2 | | 2 | 2 | | 3 | 2 |
| **CO3** | 3 | 2 | 1 | | 2 | | 2 | 2 | | 3 | 2 |
| **CO4** | 3 | 2 | 1 | | 2 | | 2 | 2 | | 3 | 2 |
| **CO5** | 3 | 2 | 1 | | 2 | | 2 | 2 | | 3 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| | |
|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2020-21 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | BS 315 | **Title of the Course** | Project & Training | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | VI | | | | **4** |
| **Pre-Requisite** | 10+2 with Biology | **Co-requisite** | | | | | |
| **Course Objectives** | The main objective of this course is to acquaint the student with various techniques used in contemporary research in biochemistry or allied areas. | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | To be able to define a research problem |
| **CO2** | To conduct bench work. |
| **CO3** | To prepare the research report and its oral demonstrations. |
| **CO4** | To correlate theoretical knowledge of techniques with practical application |
| **CO5** | To promote lifelong learning |

| Students would carry out individual projects at any research institution/industry/in house trainings of their choice for 3 months. The detailed project report/dissertation should be submitted in the Department followed by presentation and viva. |
|---|
| • Students are allocated a dissertation topic individually under the supervision of faculty of the department. |
| • The dissertation must be similar to the thesis style and encompass: (i) Introduction / Rationale and Review of Literature (ii) Materials and Methods, (iii) Results, (iv) Discussion and (v) Bibliography. |
| • The dissertation should be submitted in type-written, bound form to the department for record. |

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 3 | | 1 | 1 | | 3 | 2 | | 3 | 2 |
| **CO2** | 3 | 3 | 2 | 1 | 3 | | 3 | 2 | | 3 | 2 |
| **CO3** | 3 | 3 | 2 | 1 | 3 | | 3 | 2 | | 3 | 2 |
| **CO4** | 3 | 3 | | | | | 3 | 2 | | 3 | 2 |
| **CO5** | 3 | 3 | | | | | 3 | 2 | | 3 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| | |
|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2020-21 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | BS 316 | **Title of the Course** | Educational Tour | **L** | **T** | **P** | **C** |
| **Year** | III | **Semester** | VI | | | | **2** |
| **Pre-Requisite** | 10+2 with Biology | **Co-requisite** | | | | | |
| **Course Objectives** | The main objective of this course is to provide the students an exposure to various research activities in the country and acquaint the student with state-of-the-art technique/instruments used in various research institutions and industries of national repute. The student needs to submit a report after completion of the tour. | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Develop understanding of state-of-the-art techniques/instruments used in various reputed research institutions and industries |
| **CO2** | Take part in Group discussion and learn Team work. |
| **CO3** | Enhance communication and social skills by communication with peers |
| **CO4** | Student shall be able to plan and improve the Technical Report writing skills |
| **CO5** | Have created Interest to pursue lifelong learning. |

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | 3 | 2 | 1 | | | | 3 | 2 | | 3 | 2 |
| **CO2** | 3 | 2 | 2 | 1 | | | 3 | 2 | | 3 | 2 |
| **CO3** | 3 | 2 | 2 | 1 | | | 3 | 2 | | 3 | 2 |
| **CO4** | 3 | 2 | | | | | 3 | 2 | | 3 | 2 |
| **CO5** | 3 | 2 | | 1 | | 2 | 3 | 2 | | 3 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

| | |
|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |