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UG BOS - BIOTECHNOLOGY

①

Scheme for the Six Semesters (Three Years), B.Sc., Course in Biotechnology

Theory Paper		Theory			Practical	Grand Total
		Marks	IA	Total	Marks	
I Sem	Paper 1.1: Cell Biology and Genetics	50	10	60	40	100
II Sem	Paper 2.1: Biochemistry, Metabolism and Biotechniques	50	10	60	60	100
III Sem	Paper 3.1: Molecular Biology, Biostatistics and Bioinformatics	50	10	60	40	100
IV Sem	Paper 4.1: Genetic Engineering, Bioethics and Biosafety	50	10	60	60	100
V Sem	Paper 5.1: Microbial Biotechnology and Bioprocess Engineering	50	10	60	40	100
	Paper 5.2: Immunology and Medical Biotechnology	50	10	60	60	100
VI Sem	Paper 6.1: Plant and Agricultural Biotechnology	50	10	60	40	100
	Paper 6.2: Animal Biotechnology	50	10	60	60	100
Total						800

PAPER 1.1- CELL BIOLOGY AND GENETICS

US BOS Bio-tech.

Total teaching Hours: 45 hours

②

Cell Biology

UNIT -1

Introductory Biotechnology - Definition, Historical perspective, current status, and scope; Research institutes. 21

UNIT -2

Introduction to the Cell: History of cell, Cell as the basic unit of life, cell theory, Structural organization of prokaryotes and eukaryotes. organization of plant and animal cells - comparison of microbial, plant and animal cells. 4 hr

UNIT - 3

Ultrastructure of a cell. Structure and functions of cell organelles-Endoplasmic reticulum, Golgi complex, Chloroplasts, Ribosomes, Liposomes, Peroxisomes, Nucleus (Nuclear envelope with nuclear pore complex, nucleolus, and chromatin), Vacuole, Cytosol and Cytoskeleton structures (Microtubules, Microfilaments and Intermediate filaments). Mitochondrial biogenesis, Semiautonomous nature of mitochondria and chloroplast. Cell junctions - types and functions. 8 hr

UNIT - 4

Chromosomes, chromatin and nucleosome: Chromosome structure in bacteria and eukaryotes (centromere, telomere, Hetero- and euchromatin, Nucleosome model) Cell division: Cell cycle, mitosis and meiosis. Cell signaling - types; signaling molecules- cAMP, Ras-DAG, calmodulin. 6 hr

UNIT -5

Cell Senescence and Programmed Cell Death (apoptosis) 2 hr

Genetics

UNIT -6: Mendelism - Mendelian Laws and chromosome theory of inheritance. Inheritance patterns, phenomenon of Dominance, Inheritance patterns in Human (Sex-linked & Autosomal), Sex linked disease - hemophilia. Problems-- on Mendelian genetics, gene interactions, multiple alleles; sex linked inheritance. 5 hrs

UNIT -7

Gene interaction – Supplementary factors, complementary genes, multiple allelism-blood groups in humans, pseudoallelism with reference to eye colour in *Drosophila*, lethality of genes, simple problems. Linkage & Crossing over - Chromosome theory of Linkage, kinds of linkage, linkage groups, Relationship between Linkage & Crossing over, mechanism of Crossing over, significance of Crossing over.

9hrs

UNIT -8

Non-Mendelian inheritance – Evidences for Cytoplasmic factors, cytoplasmic inheritance, extranuclear inheritance (mitochondrial, chloroplast), maternal inheritance.

4 hrs

UNIT -9

Chromosomal variations – euploidy, aneuploidy, polyploidy.

2 hrs

UNIT -10

Human genetics – karyotype, Genetic disorders. Down, Turner and Klinefelter syndromes, cystic fibrosis.

3 hrs

B.Sc., Biotechnology, I Semester

Practical Syllabus – Cell Biology and Genetics

1. Study of cell structure (Prokaryotes & Eukaryotes).
2. Study of mutants of *Drosophila* and maintenance
3. Cell division: mitosis in onion root tip.
4. Cell division: meiosis in flower buds/grass hopper testis.
5. Simple genetic problems on interaction of genes
6. Buccal smear – Barr bodies.
7. Isolation of chloroplast and mitochondria
8. Observation of salivary gland chromosome.

PAPER 2.1 - BIOCHEMISTRY, METABOLISM AND BIOTECHNIQUES**Total teaching Hours: 45 hours****Biochemistry****UNIT -1**

Introduction to Biochemistry – current status and scope; Biomolecules – Introduction, types. **1 hr.**

UNIT -2

Carbohydrates – Definition and classification -

Monosaccharides – Classification, Open and ring structure, optical isomerism; important reactions – reducing property, glycoside formation; Disaccharides – Structure and importance of sucrose, lactose and maltose; Polysaccharides – Structure and importance of starch and cellulose. Artificial sweeteners – significance. **4 hrs**

UNIT-3

Amino acids – Definition, general structure and properties, classification, non standard amino acids, peptide bond, ninhydrin reaction and edman degradation.

Proteins – Classification, properties, structure – primary, secondary, tertiary and quaternary. Protein Stability, Protein Denaturation and renaturation. biological importance **5 hrs**

UNIT-4

Nucleic acids – Nucleosides and nucleotides; DNA double helical model; types of RNA; significance of DNA and RNA. **3 hrs.**

UNIT-5

Lipids- Classification, triglycerides, fatty acids, phospholipids and steroids. Hormones – Functions and deficiency disorders of insulin, thyroxine, and growth hormones **4 hrs**

UNIT-6

Vitamins – Sources, functions and deficiency symptoms of Vit A, B₁, B₂, B₆, C, D, E and K. **3 hrs**

UNIT-7

Secondary metabolites – General properties, structure and functions of alkaloids, flavonoids, saponins and terpenoids. 2 hrs.

UNIT-8

Enzymes – Definition, classification, nomenclature, general properties.

Active site, mechanism of enzyme action (lock and key, induced fit theories), units of activity, Factors affecting enzyme activity – pH, temperature and substrate concentration. Derivation of michelis-menten equation, significance of K_m and V_{max} .

Competitive and non competitive inhibition. Allosteric regulation of enzymes. Isoenzymes, Enzyme immobilization - types and applications. 9 hrs

Metabolism

UNIT-9

Thermodynamics of Biological System: The Laws, Free Energy, ATP and other High Energy Compounds.

Carbohydrate Metabolism - Glycolysis, Krebs cycle, Electron transport chain in mitochondria. cyclic and non cyclic photo phosphorylation in chloroplast, Calvin cycle. 5 hrs.

Biotechniques

UNIT-10

Chromatography – Principle, and Methodology of TLC and column chromatography – Gel Filtration.

Electrophoresis – Principle and Methodology of PAGE.

Colorimeter and Spectrophotometer – Principle and Methodology

Centrifugation – Principle and Methodology of Density gradient and Ultra centrifugation.

Radioactivity – Principle, half-life period, types; Detection methods; Role of isotopes in biology 9 hrs

Practical Syllabus – Biochemistry, Cellular Metabolism and Biotechniques

I. Qualitative analysis:

1. Carbohydrates – Glucose, Fructose, Lactose, Sucrose and Starch
2. Amino acids – Histidine, cystein, proline and Tyrosine
3. Proteins – Albumin and Casein
4. Lipids – oils and fats (available source)

II Quantitative analysis:

1. Estimation of Proteins by Lowry's method.
2. Estimation of creatinine by Jaffe's method.
3. Estimation of sugar by DNS method.
4. Estimation of cholesterol by Zak's method.

III Biotechniques:

1. Separation of amino acids by Circular paper Chromatography.
2. Separation of plant pigments by Thin layer chromatography (TLC).
3. Demonstration of Gel Electrophoresis technique

**PAPER 3.1 - MOLECULAR BIOLOGY, BIostatISTICS AND
BIOINFORMATICS**

Total teaching Hours: 45 hours

Molecular Biology

UNIT-1

Molecular Biology – Scope and importance; Structure of Genetic material- Introduction – Nature of genetic materials; Discovery of DNA as genetic material (Griffith, Avery, Hershey Chase): Central dogma of molecular biology. **3 hrs**

UNIT-2

Replication of DNA – types; mechanism. DNA replication in prokaryotes and eukaryotes. **3hrs**

UNIT-3

Molecular Mechanism of Recombination - – Homologous recombination, site-specific recombination; Models of recombination (Holliday Model, Double Strand break etc.). **5 hrs**

UNIT-4

Transcription - central dogma, mechanism in prokaryotes and eukaryotes, transcriptional factors, post-transcriptional modifications. Genetic code – General properties, deciphering of genetic code-Nirenberg and Khorana experiments. Wobble hypothesis. **7 hrs**

UNIT-5

Translation – activation of amino acids; mechanism - initiation, elongation and termination stages, translational factors, inhibitors of protein synthesis. Post-translational modifications of proteins - cleavage, methylation, sulfur-sulfur bridges, protein splicing, folding, glycosylation. **5 hrs**

UNIT-6

Gene structure and function –operator, repressor and promoter. Negative and positive gene regulation in prokaryotes – *trp* and *lac* operon. **4 hrs**

UNIT-7

Signal transduction – Cell Signaling; Signaling molecules and their receptor; functions of cell surface receptors; Intracellular signal transduction pathway; signaling networks. **3 hrs**

UNIT-8

DNA damage and repair - Photoreactivation, base excision repair, nucleotide excision repair, mismatch repair, translation synthesis, recombinational repair.
Mutation – types, physical and chemical mutagens, molecular basis. **5 hrs**

Bioinformatics and Biostatistics

UNIT-9

History of Bioinformatics. The notion of Homology. Basics of Genomics and Proteomics. Nucleic acid and Protein Sequence Information Sources: FASTA, BLAST, EMBL, GENBANK, Entrez, Unigene, SWISS PROT, UNIPROT, PDB, Pub Med. Understanding the structure of each source and using it on the web. Drug discovery - role of bioinformatics in drug discovery, target discovery, lead discovery, microarray, docking and prediction of drug quality. Bioinformatics companies. **6 hrs**

UNIT-10

Types of Data, Collection of data; Primary & Secondary data; Classification and Graphical representation of Statistical data. Measures of central tendency (Mean, Median and Mode) and Dispersion. **4 hrs**

Molecular Biology

UNIT-8

1. Estimation of DNA by DPA method.
2. Study of DNA replication using a Chart (Semi conservative).
3. Study of Gene Regulation- Lac Operon Concept (Positive & Negative Control)
4. Study of Transcription using Chart.
5. Study of Translation using Chart
6. Study of genetic code through chart

UNIT-9

Bioinformatics and Biostatistics

Types of Biological Databases and Using it.

Genbank.

Protein Data Bank.

Uniprot.

Sequence Analysis Tools

Use of BLAST, FASTA (Nucleic Acids & Proteins).

Use of Clustal W.

Use of EMBOSS.

Phylogenetic Analysis

Use of Phyllip.

Molecular Modeling

Homology Modeling – Swissmodeller or Any Open Source Softwares

UNIT-10

Biostatistics

Problems on Mean, Median and Mode.

PAPER 4.1- GENETIC ENGINEERING, BIOETHICS AND BIOSAFETY

Total teaching Hours: 45 hours

Genetic Engineering

UNIT-1

History - Historical perspective, Milestones in genetic engineering and biotechnology. **1 hr**

UNIT-2

Tools of recombinant DNA technology, Hosts, E. coli strains; Yeast (*Saccharomyces cerevisiae*, *Pichiapastoris*); Fungi (*Penicillium*, *Aspergillus*), Mammalian cell lines - names and genotypes, Enzymes -Restriction modification systems:Types I, II and III. Mode of action, nomenclature. Application of Type II restriction enzymes in genetic engineering, Polymerases, reverse transcriptase, polynucleotide kinase, ligases. **8hrs**

UNIT-3

Cloning Vectors- Definition and Properties. Plasmid vectors – pUC 8, pBR 322; stability of plasmid vectors, phage vector – lambda phage, cosmids, YAC, BAC, *Agrobacterium*, animal viral vectors.

UNIT-4

Methods of gene delivery in plants and animals: Microinjection, biolistic method (gene gun), liposome mediated, electroporation. Screening of recombinants – replica plating, blue screen method, colony hybridization **8hrs**

UNIT-5

DNA isolation from plants, animals and bacteria – CTAB method, Phenol-chloroform method, SSC method. **2 hrs**

UNIT-6

Genetic Engineering techniques – Hybridization techniques-Southern, Western and Northern blotting, Chromosome walking and jumping. DNA sequencing – chemical and enzymatic methods; Pyrosequencing method. Microarray technique. **8 hrs**

UNIT-7

Applications of Genetic Engineering -

PCR

DNA Finger printing

Genomic library, cDNA library.

Cloning – Ex: Dolly

Transgenic technology – GMOs, Ex- Superbug, Bt cotton.

Knock-out technology- Ex: Knockout mice.

9 hrs

Bioethics and Biosafety

UNIT-8

IPR – Types; Introduction to Indian Patent Law. World Trade Organization and its related intellectual property provisions. Intellectual/Industrial property and its legal protection. Patenting in Biotechnology with examples, economic, ethical and depository considerations.

3 hrs

UNIT-9

Bioethics – Necessity of Bioethics, Bioethics on GMOs- Legal, Social and ethical issues.

3 hrs

UNIT-10

Biosafety– Introduction to biosafety and health hazards concerning biotechnology. Biosafety levels. Introduction to the concept of containment level and Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).

3 hrs

Practical Syllabus – Genetic Engineering, Bioethics and Biosafety

1. Isolation of DNA from Liver/ Spleen.
2. Isolation of DNA from Onion/ Coconut Endosperm.
3. Isolation of DNA from Bacteria/ Yeast.
4. Gel Electrophoresis of isolated DNA.
5. Study of DNA Finger Printing.
6. Demonstration of PCR.
7. Study of Instruments used in Genetic Engineering:
 - a) Refrigerated Centrifuge.
 - b) Ultra Centrifuge.
 - c) Lyophilizer.
 - d) UV trans-illuminator.
 - e) Gene Gun.
 - g) Electroporator.
 - h) DNA Sequencer.
 - i) Gel doc unit.
8. Biosafety manuals

Microbial Biotechnology

UNIT-1

History and scope. Contribution of Jenner, Pasteur, Koch and Iwanowsky. 2 hrs

UNIT-2

Development of microscopy -Bright field, fluorescent and electron microscope -SEM and TEM.
Sterilization – Physical, radiation and chemical methods. 6 hrs.

UNIT-3

Culture media – types. Preparation of NA and PDA. Concept of pure culture, methods; Culture collection centres.

Microbial nutrition and growth - Nutritional requirements and nutritional grouping of microorganism
Growth curve; Methods of enumeration of microorganisms and preservation of microbes. Single cell proteins and their applications – Ex: Spirulina 7 hrs

UNIT-4

Food Microbiology: Important microorganism in food Microbiology: Moulds, Yeasts, bacteria. Major food born infections and intoxications, Preservation of various types of foods. Fermented Foods: Food Poisoning – Botulism, Salmonellosis. 3 hrs

UNIT-5

Medical Microbiology – Microbial Diseases: Pathology, epidemiology and control of Bacterial Tuberculosis, Bacterial Blight in vegetables; Fungal – Candidiasis, Rust of wheat; Viral – AIDS
Tobacco Mosaic disease; Protozoan – Malaria. 6 hrs

UNIT-7

14

Environmental Microbiology – Bioleaching (Ex: Copper), Bioremediation, Degradation of xenobiotics (alkane, alkene and aromatic compounds), waste water treatment (primary, secondary and tertiary), solid waste management (biogas and vermicompost production). **8 hrs**

Bioprocess Engineering

UNIT-8

Screening and isolation of industrially important microorganism. Fermentation process- Aerobic and anaerobic fermentation; substrates for fermentation. **4 hrs**

UNIT-9

Bioreactors; types of bioreactors; aeration and agitation devices; maintenance of aseptic conditions, monitoring and control parameters such as pH, temperature and anti-foam. **2 hrs**

UNIT-10

Microbial production in industries – ethanol and alcoholic beverages (wine and beer), acetic acid (acids), penicillin (antibiotic), lysine (amino acid), amylase (enzyme).

Downstream processing methods: Sedimentations, centrifugation, chromatography, dialysis and reverse osmosis. **7 hrs**

14



Practical Syllabus – Paper V: Microbial Biotechnology and Bioprocess Engineering

1. Preparation of media- Nutrient agar, Nutrient Broth, PDA and EMB.
2. Isolation of microorganisms from Air/Water/Soil.
3. Pure culture techniques - Streak Plate Method, Spread Plate Method, Pour Plate Method
4. Bacterial staining technique - Positive staining, Negative staining, Differential staining
5. Determination of microbial load by methylene blue dye reduction test.
6. Identification of industrially important microorganisms- *E.coli*, *S.cerevisiae*, *L.bacillus* and *Spirulina*.
7. Demonstration of Fermentation: Preparation of Wine from Grape/ Banana.
8. Estimation of Unfermented sugar in the Wine Sample.
9. Citric acid Production by *A.niger* and estimation.
10. Estimation of Lactic acid in the given curd sample.

PAPER 5.2 – IMMUNOLOGY AND MEDICAL BIOTECHNOLOGY

Total teaching Hours: 45 hours

UNIT-1

History and scope of immunology.

2 hr

UNIT-2

Types of immunity - innate, acquired; passive, active; humoral & cell mediated immunity.

Components of immune system: cells of immune system (myeloid and lymphoid lineage) and antigen presenting cells, importance of MHC. primary and secondary lymphoid organs and their functions. **7 hrs**

UNIT-3

Antigens: Definitions, specificity, epitopes, haptens, adjuvants, factors affecting immunity.

Antibodies: classification & types. Theories of antibody generation, general properties of immunoglobulin's: IgA, IgD, IgE, IgM, structure of IgG.

Antigen-antibody reactions: mechanism of agglutination, precipitation, complement fixation, opsonisation & phagocytosis. Immunotechniques; immunoblotting, immuno-fluorescence; RIA, ELISA – Principle, protocol & applications. **10 hrs**

UNIT-4

Complement Fixation: Introduction, Pathways & Biological Significance

Hypersensitivity: Introduction Types and properties

5hrs

UNIT-5

Immunological aspects of viral (Ex: HIV) and parasitic infections; Autoimmune Disease: Auto Immunity, Graves' Disease, Diabetes, Haemolytic Anaemia, Hashimoto's Thyroiditis, Systemic Erythromatus Lupus.

4hrs

Medical Biotechnology

UNIT-6

Vaccines – Conventional – OPV, Toxoids; Recombinant vaccines: hepatitis-B, FMDV, DNA vaccines, edible vaccines

4hrs

UNIT-7

Enzymes used in diagnosis – Creatinine kinase, SGOT, SGPT; enzymes in estimation of glucose, urea, cholesterol from biological samples.

Enzymes in therapy; important enzymes and their therapeutic applications – DNase I, Urokinase.

5 hrs

UNIT-8

Therapeutic proteins: Applications of somatotropin, somatostatin, interleukin, interferon, human factor VIII and IX.

3 hrs

UNIT - 9

Human gene therapy; Somatic and germline therapy, *in vivo* and *in vitro* gene therapy with examples.

3 hrs

UNIT-10

Human genome project and its implication

2 hrs



Practical Syllabus –Paper VI: Immunology and Immunotechnology

1. Morphological Studies of Leucocytes.
2. Total Count of WBC.
3. Differential Count of WBC.
4. Study of Antigen-Antibody Reaction by Agglutination reaction.
5. Pregnancy Test: HCG Strip Method.
6. HIV Detection Test by Strip Dot Method.
7. Study of Immunotechniques:
 - a) ELISA.
 - b) RIA
 - c) Compliment Fixation Test.
 - d) Rocket Electrophoresis.
8. Compulsory visit to Blood bank; A report to be submitted.

PAPER 6.1-PLANT AND AGRICULTURAL BIOTECHNOLOGY

Total teaching Hours: 45 hours

UNIT-1

Historical Review, laboratory organization, techniques in plant tissue culture, culture média **2 hrs**

UNIT-2

Totipotency: Definition, Expression of totipotency in culture.

Callus culture: definition, initiation maintenance and sub culture of callus. Morphology and cytology of callus. Importance of callus culture. **5 hrs**

UNIT-3

Organogenesis: Adventitious organogenesis, factors influencing organogenesis

Organ culture: principle, protocol and importance of root, Meristem and flower culture. **4 hrs**

17

UNIT-4

18

Cytodifferentiation: Dedifferentiation and Redifferentiation, factors influencing cytodifferentiation. Somatic embryogenesis: Definition embryonic potential, embryoid, principle, protocol and importance of somatic embryogenesis. Artificial seeds: Definition, production methods and importance.

4 hrs

UNIT-5

Suspension culture: definition, principle and protocol, Batch culture and continuous culture, importance of suspension culture.

Protoplast culture: Anther; pollen and ovule culture, homozygous diploids, importance.

4 hrs

UNIT-6

Haploid culture - Anther, pollen and ovule culture homozygous diploids, importance of haploid culture.

Somaclonal variation: Definition, mechanism causing somaclonal variation isolation and selection of somaclonal variation, application of somaclonal variations.

4 hrs

UNIT-7

Mechanism of biological nitrogen fixation process- role of nif gene; Biofertilizers: Rhizobium Azospirillum, Azotobacter, Mycorrhizae, Azollae, advantage and limitations of biofertilizers.

5hrs

UNIT-8

GM Technology: Crop improvement, productivity, performance and fortification of agricultural products-Bt cotton, Bt brinjal. Herbicide resistance, viral resistance, bacterial resistance, fungal resistance crops. Golden rice and transgenic sweet potato. Agrobacterium mediated gene transfer, direct gene transfer to protoplasts.

4 hrs

UNIT-9

Post-harvest technology: RNAi and antisense RNA technology for extending shelf life of fruits and flowers (ACC synthase gene and polygalacturonase); delay of softening and ripening of fleshy fruit (tomato, banana, watermelons). Post-harvest protection of cereals, millets and pulses.

5hrs

UNIT-10

19

Metabolic engineering of plants: Plant cell culture for the production of useful chemicals and secondary metabolites (Hairy root culture, Biotransformation, Elicitation) - pigments, flavanoids, alkaloids
Production of Industrial enzymes, biodegradable plastics, therapeutic proteins, edible vaccines and antibiotics using transgenic technology.

8 hrs

B.Sc., Biotechnology, VI Semester

Practical Syllabus – Paper VII: Plant Biotechnology

1. Preparation of culture media
2. Callus culture
3. Leaf disc culture
4. Anther bud culture
5. Rhizogenesis and caulogenesis
6. Protoplast isolation
7. Animal cell culture media preparation – BSS, Serum free media
8. Chart studies: Golden rice, Bt crops, Artificial insemination, Stem cell culture.
9. Study Tour – Visit to Biotechnology Labs (University, national, R&D labs): A report to be submitted compulsorily.

PAPER 6.2 – ANIMAL BIOTECHNOLOGY

Total teaching Hours: 45 hours

UNIT-1

Historical perspective & scope of animal cell-culture, equipments & materials of animal cell culture.

2 hrs

UNIT-2

Culture media: Natural and chemically defined media: BSS, synthetic media-general composition, examples, serum containing media, serum free media.

Cell-separation physical method, separation based on cell-size, cell density, cell surface charge on affinity cell and separation by enzymes.

7 hrs

UNIT-3

Primary culture & established cell-line cultures; Biology of cultured cells - culture environment, cell adhesion, cell proliferation and differentiation. Characterization of cultured cells, viability, cytotoxicity, growth parameters, cell death and Apoptosis.

6 hrs

UNIT-4

Cancer Biology; introduction, properties of cancer cells, types of cancer with examples, theory on origin of cancer; carcinogens treatment methods.

6 hrs

UNIT-5

Organ culture: Tissue engineering, & applications, artificial skin, Spheroids.

3 hrs

UNIT-6

Animal propagation - Marker assisted selection, Artificial insemination, Animal Clones. Conservation Biology - Embryo transfer techniques. Introduction to Stem Cell Technology and its applications.

7 hrs

UNIT-7

Applications of Animal Biotechnology: Improvement of biomass, disease resistant, recombinant vaccines for poultry, livestock-pharming products. Increased production of meat, milk, wool. Pharmaceutical products produced by mammalian cells - plasminogen activator, erythropoietin, blood clotting factors, glycoprotein hormones, interleukins, interferons, Cell culture based vaccines, Use of cell cultures as alternative for animal models for research.

8 hrs

UNIT-8

Production of Mab (hybridoma technology), Insulin

Animal diseases and Biotechnology - Prospective treatment of Foot and mouth diseases, coccidiosis, and trypanosomiasis.

6 hrs

Practical VIII
(PROJECT)

21

Max.Marks:40

Each student will be allotted a PROJECT title to which, the student has to carryout review and analysis of literature pertaining to the topic under the guidance of a faculty of the Department. Students have to carry out a research project on chosen topic.

Each student has to submit the PROJECT REPORT in triplicate after thorough corrections and plagiarism check under their respective guides duly signed by the guide and Head of the Department.

The scheme of distribution of marks for Dissertation is as follows

- Project Report Submission = 25 Marks
- Presentation = 10 Marks
- Viva = 05 Marks