POST GRADUATE DIPLOMA IN BIOTECHNOLOGY

Scheme of examination (PGDBT) Session 2023-24

Semester I

Sr. No.	Course Code	Subject/Title	Credits	Marks Theory/ Practicals		Internal Assessment
1	23CBTD101DS01	Cell & Molecular Biology Theory (02 credits); Practical (02 credits)	04	35 T 35 P	70	30
2	23CBTD101DS02	Genetic Engineering Theory (02 credits); Practicals (02 credits)	04	35 T 35 P	70	30
3	23CBTD101DS03	Microbiology Theory (02 credits); Practicals (02 credits)	04	35 T 35 P	70	30
4	23CBTD101DS04	Immunology Theory (02 credits); Practicals (02 credits)	04	35 T 35 P	70	30
5	23CBTD101SE01	Skill Enhancement course (From the pool of courses offered by MDU/SWAYAM courses of same credit)	04	70		30
6	VAC1	Value Added Course (From the pool of courses offered by MDU/SWAYAM courses of same credit)	02	35		15
	Total		22	385		165
						550

Semester II

Sr. No.	Course Code	Subject/Title	Credits	Marks Theory/ Practicals		Internal Assessment
1	23CBTD102DS01	Plant & animal Tissue culture Theory (02 credits); Practicals (02 credits)	04	35 T 35 P	70	30
2	23CBTD102DS02	Plant molecular Bio. Mol Breeding Theory (02 credits); Practicals (02 credits)	04	35 T 35 P	70	30
3	23CBTD102DS03	Environmental Biotech Theory (02 credits); Practicals (02 credits)	04	35 T 35 P	70	30
4	23CBTD102DS04	Animal Biotechnology Theory (02 credits); Practicals (02 credits)	04	35 T 35 P	70	30
5	23CBTD102IN01	Internship	04	70		30
6	VAC2	Value Added Course (From the pool of courses offered by MDU/SWAYAM courses of same credit)	02	35		15
	Total		22	385		165
						550

POST GRADUATE DIPLOMA IN BIOTECHNOLOGY

Centre for Biotechnology
Cell & Molecular Biology
: Semester I

Course Code	23CBTD10JDS01	Course Credits	L: 2 P:2
Max. Marks	100 (Theory: 35; Practical: 35; Internal Assessment: 30)	Time of end term examination	3 Hours

Note: In all nine questions will be set, two from each unit and one compulsory question of short answer type covering all the units. Students are required to attempt one compulsory question and four others selecting at least one from each unit. All questions are of equal marks.

Learning Objectives:

This course aims to introduce;

1. Basic information of cell Biology
2. Cell Cycle
3. Concept of central dogma
4. Bimolecular Techniques

Learning Outcomes:

Students completing this course will be able to:

1. Understand the origins of cells and the generation of cell diversity.
2. Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells.
3. Students will understand the cellular components underlying mitotic cell division.
4. The understanding of Molecular Biology and its Techniques

Unit - I

Basic of Cell Biology: Cell size and shape, Cell Theory. Structure of Prokaryotic and Eukaryotic cells, Cellular organelles- Plasma membrane, cell wall and their structural organization. Cellular organelles and their organization, Transport across membrane

Unit – II

Cell cycle & Cell Division Cellular responses to environmental signals in plants and animals-mechanisms of signal transduction. Cell motility

Unit – III

DNA Replication: Prokaryotic and eukaryotic DNA replication, Mechanics of DNA replication; enzymes and accessory proteins involved in DNA replication and DNA repair. Transcription: Prokaryotic transcription, Eukaryotic transcription & translation

Unit – IV

Oncogenes and Tumor Suppressor Genes: Viral and cellular oncogenes, tumor suppressor genes from humans, Structure, Function and mechanism of action of pRB and p53 tumor suppressor proteins. Antisense and Ribozyme Technology

Molecular markers in genome analysis: RFLP, RAPD and AFLP analysis, Molecular markers linked to disease resistance genes, Application of RFLP in forensic, disease, Prognosis, genetic counselling

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Practicals:

1. Microscopy: Bright field, phase contrast & Fluorescence Microscopy.
2. Sub cellular fractionation and marker enzymes.
3. Histochemical techniques
4. Mitosis & Meiosis
5. Isolation & quantification of genomic DNA.
6. Plasmid isolation & quantification.
7. Southern blotting.
8. RFLP analysis
9. Isolation and quantification of RNA.
10. Northern blotting

Suggested Readings:

1. Benjamin Lewin. Gene X, 10th Edition, Jones and Barlett Publishers 2010.
2. J D Watson et al., Biology of Gene, 6th Edition, Benjamin Cummings publishers Inc. 2007
3. Alberts et al., Molecular Biology of the Cell, Garland, 2002
4. Primose SB, Molecular Biotechnology, Panima, 2001.
5. Lodish et al., Molecular Cell Biology Freeman and Company 2000.
6. Smith and Wood. Cell Biology. Chapman and Halls 1996
7. Watson et al. Molecular Biology of the gene. Pearson Prentice Hall, USA 2003

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Centre for Biotechnology
Genetic Engineering
Semester I

Course Code	23CBTD101DS02	Course Credits	L: 2 P:2
Max. Marks	100 (Theory: 35; Practical: 35; Internal Assessment: 30)	Time of end term examination	3 Hours

Note: In all nine questions will be set, two from each unit and one compulsory question of short answer type covering all the units. Students are required to attempt one compulsory question and four others selecting at least one from each unit. All questions are of equal marks.

Learning Objectives:

1. Students will develop a comprehensive understanding of the principles of classical genetics, and molecular genetics
2. Students will learn and master molecular biology techniques used in genetic engineering, such as DNA isolation, Polymerase Chain Reaction, gel electrophoresis, and gene cloning etc.
3. Students will understand the methods of genetic modification, including gene editing technologies.
4. Students will explore the various applications of genetic engineering in different fields, including agriculture, medicine, and biotechnology.
5. Students will acquire hands-on laboratory skills and experience in working with genetic engineering tools and technologies.

Learning Outcomes:

1. Students will demonstrate Proficiency in Genetic Engineering Techniques by performing DNA isolation, PCR, gel electrophoresis, gene cloning, and other molecular biology techniques with precision and accuracy.
2. Students will be able to design and execute experiments to address specific genetic questions or challenges, showcasing problem-solving skills in a laboratory setting.
3. Students will be able to apply genetic engineering principles to real-world biotechnological applications, such as the development of genetically modified organisms, gene therapy, and production of biopharmaceuticals.
4. Students will be able to apply critical thinking skills to analyze and address challenges in genetic engineering, considering alternative approaches and solutions.

Unit - I

Genetic engineering guidelines, Molecular Tools and Their Applications, Restriction enzymes, modification enzymes, DNA and RNA markers, Nucleic Acid Purification, Yield Analysis, Nucleic Acid Amplification and its Applications, Gene Cloning Vectors, Restriction Mapping of DNA Fragments and Map Construction, Nucleic Acid Sequencing, cDNA Synthesis and Cloning , mRNA enrichment, reverse transcription, DNA primers, linkers, adaptors and their chemical synthesis, Library construction and screening, Alternative Strategies of Gene Cloning

Unit – II

Cloning interacting genes-Two-and three hybrid systems, cloning differentially expressed genes. Nucleic acid microarray arrays, Site-directed Mutagenesis and Protein Engineering, How to Study Gene Regulation? DNA transfection, Northern blot, Primer extension, S1 mapping, RNase protection assay, Reporter assays Expression strategies for heterologous genes, Vector engineering and codon optimization, host engineering, in vitro transcription

and translation, expression in bacteria, expression in yeast, expression in insect cells, expression in mammalian cells, expression in plants.

Unit – III

Processing of recombinant proteins: Purification and refolding, characterization of recombinant proteins, stabilization of proteins. Phage Display, T-DNA and Transposon Tagging Role of gene tagging in gene analysis, Identification and isolation of genes through T-DNA or Transposon.

Unit – IV

Transgenic and gene knockout technologies Targeted gene replacement, chromosome engineering. Gene therapy: Vector engineering strategies of gene delivery, gene replacement/augmentation, gene correction, gene editing, gene regulation and silencing.

Practicals:

1. Bacterial culture and antibiotic selection media. Preparation of competent cells and
2. Isolation of plasmid DNA.
3. Isolation of lambda phage DNA.
4. Agarose gel electrophoresis and restriction mapping of DNA.
5. Construction of restriction map of plasmid DNA.
6. Cloning in plasmid/phagemid vectors.
7. Preparation of helper phage and its titration
8. Preparation of single stranded DNA template
9. DNA sequencing
10. Gene expression in E. coli and analysis of gene product
11. PCR and Reporter Gene assay (Gus/CAT/b-GAL)

Suggesting Reading

1. "Molecular Biology of the Gene" by James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, and Richard Losick
2. "Genentech: The Beginnings of Biotech" by Sally Smith Hughes
3. "Genentech: The Beginnings of Biotech" by Jeremy M. Berg, John L. Tymoczko, and Lubert Stryer
4. "Genomes" by T.A. Brown
5. "Principles of Gene Manipulation and Genomics" by Sandy B. Primrose and Richard M. Twyman
6. "Ethical Issues in Biotechnology" by Richard Sherlock and John P. DeGrazia
7. "Introduction to Genetic Analysis" by Anthony J.F. Griffiths, Susan R. Wessler, Richard C. Lewontin, Sean B. Carroll
8. "The Epigenetics Revolution: How Modern Biology is Rewriting Our Understanding of Genetics, Disease, and Inheritance" by Nessa Carey
9. "Human Genetics and Genomics" by Bruce R. Korf

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Centre for Biotechnology
Microbiology
Semester I

Course Code	23CBTD101DS03	Course Credits	L: 2 P:2
Max. Marks	100 (Theory: 35; Practical: 35; Internal Assessment: 30)	Time of end term examination	3 Hours

Note: In all nine questions will be set, two from each unit and one compulsory question of short answer type covering all the units. Students are required to attempt one compulsory question and four others selecting at least one from each unit. All questions are of equal marks.

Learning Objectives: The course aims to provide adequate knowledge about Microbiology.

1. History and development of microbiology
2. Study the microbial growth.
3. Study various group of microbes
4. Study microbial recombination and transformation

Learning Outcomes: On completion of the course, the students will be able to

1. Demonstrate various methods of inoculation
2. Understand the growth pattern of microbes
3. Comparisons of the Transformation, Conjugation, Transduction.
4. Detection of mutagenic

Unit - I

History of Microbiology: Contribution of Antony von Leeuwenhoek, Joseph Lister, Paul Ehrlich, Edward Jenner, Louis Pasteur, Robert Koch, Martinus W. Beijerinck, Sergei N. Winogradsky, Alexander Fleming, Selman A. Waksman, Elie Metchnikoff, Norman Pace, Carl Woese and Ananda, Chakraborty. Spontaneous generation versus biogenesis. Scope of Microbiology; Basic sterilization techniques in microbiology laboratory

Unit – II

Microbial growth and generation time, specific growth rate, Synchronous growth; Batch and Continuous culture; Growth affected by environmental factors like temperature, pH, water availability, radiation, pressure and oxygen concentration, anaerobic culture. Determination of microbial growth. Culture collection, and preserving and stocking of pure cultures, pure culture concept, nutritional classification of microorganisms

Unit – III

Cyanobacteria; Homoacetogenic bacteria; Pseudomonads; Lactic and propionic acid bacteria; Mycobacteria: Rickettsias, Chlamydies and Mycoplasma. Archaea: Archaea as earliest Life forms: Halophiles; Methanogens; Hyperthermophilic archaea; Thermoplasma Eukaryotic: Algae, Fungi, Slime molds and Protozoa.

Unit – IV

Viruses: Structure of Viruses: Capsid symmetry: enveloped and non-enveloped viruses. Isolation purification and cultivation of viruses. Concepts of Viroids, Virusoids, satellite viruses and Prions; life cycle of RNA phages; Lytic and lysogenic phages (lambda and P1 phage). Different types of Mutation and Ames test for mutagenesis. Bacterial Transformation, Conjugation, Transduction.

Practicals:

1. Light microscope demonstration
2. Isolation of pure culture by streaking method

3. CFU enumeration by spread plate method.
4. Measurement of microbial growth by turbidometry methods.
5. Effect of temperature, pH and carbon and nitrogen sources on growth.
6. Microscopic examination of bacteria by Gram stain,
7. Acid fast stain and bacterial staining for spores and capsule.
8. Bacterial transformation and transduction

Suggested Readings:

1. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T. Brown Publishers.
2. Black JG. (2008). Microbiology: Principles and Explorations. 7th edition. Prentice Hall
3. Pelczar Jr MJ. Chan ECS. and Krieg NR (2004) Microbiology. 5th edition Tata McGraw Hill.
4. Stanier RY, Ingraham JL, Wheelis ML and Painter PR. (2005). General Microbiology. 5th edition. McMillan. 5. Willey JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. 7th edition. McGraw Hill Higher Education.

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Centre for Biotechnology
Immunology
Semester I

Course Code	23CBTD101DS04	Course Credits	L: 2 P:2
Max. Marks	100 (Theory: 35; Practical: 35; Internal Assessment: 30)	Time of end term examination	3 Hours

Note: In all nine questions will be set, two from each unit and one compulsory question of short answer type covering all the units. Students are required to attempt one compulsory question and four others selecting at least one from each unit. All questions are of equal marks.

Learning Objectives:

The course aims to provide the Knowledge

1. Antigen and antibody properties
2. Study various cells and organs related to our immune cells
3. Antigen and antibody reaction
4. Study the immunological disorder

Learning Outcomes:

1. Demonstrate the antigen and antibody properties
2. Study various cells and organs related to our immune cells
3. Comparisons of hypersensitivity reactions
4. Study the immunological disorder

Unit - I

Phylogeny of Immune System, Innate and acquired immunity, Clonal nature of immune response, Organization and structure of lymphoid organs, Cells of the Immune system

Unit – II

Nature and Biology of antigens and super antigens Antibody structure and function, Antibody diversity, Antigen - antibody interactions, Major histocompatibility complex, B-lymphocytes, T-lymphocytes, BCR & TCR, Complement system, Macrophages, Dendritic cells, Natural killer and Lymphokine-activated killer cells, Eosinophils, Neutrophils and mast cells

Unit – III

Regulation of immune response: Antigen processing and presentation, humoral and cell mediated immune responses: Activation of B and T Lymphocytes; Cytokines and their role in immune regulation, Cell-mediated cytotoxicity; Mechanism of T cell and NK cell mediated lysis, antibody dependent cell mediated cytotoxicity, macrophage mediated cytotoxicity, Hypersensitivity

Unit – IV

Immunological tolerance; Autoimmunity, Transplantation Immunity to infectious agents (intracellular parasites like *M. tuberculosis*, helminthes and viruses); Tumor Immunology; AIDS and other Immuno deficiencies; Hybridoma technology and applications of monoclonal antibodies

Practicals:

1. Blood film preparation and identification of cells.
2. Lymphoid organs and their microscopic organization
3. Immunization, Collection of Serum
4. Double diffusion and Immune-electrophoresis Radial Immuno-diffusion
5. Purification of IgG from serum
6. Separation of mononuclear cells by Ficoll-HypaqueWestern-blotting, ELISA
7. Immunodiagnostics (demonstration using commercial kits) e.g. Widal test for typhoid fever.

Suggested Readings:

1. Kuby Immunology (2006) by Thomas J. Kindt, Richard A. Goldsby, Barbara A. Osborne, Janis Kuby (W.H. Freeman).
2. Immunology-'A short course (2009) by Richard Coico, Geoffrey Sunshine (Wiley Wilkins).
3. Fundamentals of immunology (1999) by William Paul (Lippincott Williams & Wilkins).
4. Immunology (2001) by Ivan Maurice Roitt, Jonathan Brostoff, David K. Male (Mosby).
5. Understanding immunology (2007) by Peter John Wood, Dorling Kindersaley (Pearson Education, India)
6. Immunology (2007) by Kannan, I (MJP Publishers, India).

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Centre for Biotechnology
Biotechnological Techniques (Skill Enhancement course)
Semester:I

Course Code	23CBTD101SE01	Course Credits	L: 2 P:2
Max. Marks	100 (Theory: 35; Practical: 35; Internal Assessment: 30)	Time of end term examination	3 Hours

Note: In all nine questions will be set, two from each unit and one compulsory question of short answer type covering all the units. Students are required to attempt one compulsory question and four others selecting at least one from each unit. All questions are of equal marks.

Learning Objectives:
The course aims to provide:
1. Students will learn plant tissue culture technique
2. Students will learn basic molecular technique
3. Basic techniques of diagnosis
4. Modern tools and techniques of genomics and proteomics

Learning Outcomes:
Upon completion of the course, the students will be able to:
1. Perform plant and animal tissue culture techniques
2. Perform basic molecular biology techniques
3. Perform basic techniques of diagnosis
4. Modern tools and techniques of genomics and proteomics perform techniques of genomics and proteomics

Unit - I

Plant tissue culture: Culture media, In Vitro differentiation, Micro-propagation, Somaclonal and gametoclonal variations, Protoplast isolation, culture and regeneration; Somatic hybridization - methods and applications and cryopreservation. Plasmid isolation from E. Coli and Agrobacterium tumefaciens

Unit – II

Molecular Biology techniques: Isolation, purification & quantification of DNA and RNA from plants, animal and microbes; Electrophoretic separation of DNA, RNA, Blotting techniques- Southern blotting and Northern blotting, Protein analysis, purification & characterization techniques

Unit – III

Collection and processing sample, Various types of Microscopy, Various Immunological diagnostic assays (ELISA and RIA), Molecular diagnostic assays (Reverse Transcription Conventional PCR, Real Time PCR and RT-LAMP). Concept, composition, principle and applications of biosensors

Unit - IV

Bio- Nanotechnology: Synthesis, Properties & characterization: Carbon Nanotubes, Gold-, Silver- and Zinc oxide - nanoparticles, Physical, Optical, magnetic, chemical, antimicrobial properties of Nanoparticles and there characterization with XRD, SEM/TEM, UV-Visible spectroscopy techniques, FTIR etc

Partials

1. Isolation of genomic DNA from plant fungi & bacterial cells
2. Agrose gel electrophoresis
3. Isolation of RNA from plant sample.
4. SDS-PAGE.

5. PCR for gene amplification
6. Chemical Synthesis & characterization of nanoparticles

Suggested Readings:

1. Wilson, Keith, Andreas Hofmann, John M. Walker, and Samuel Clokie, eds. Wilson and Walker's principles and techniques of biochemistry and molecular biology. Cambridge university press, 2018.
2. Voet D, Voet JG and Pratt CW. Fundamentals of Biochemistry; 2nd ed. Wiley2006
3. Glick BR & Pasternak JJ, Molecular Biotechnology, 3rd ed, ASM Press, 1998
4. Tortora, G.J., Case, C.L., Bair III, W.B., Weber, D. and Funke, B.R. Microbiology: an introduction. Pearson
5. Gero Decher, Joseph B. Schlenoff. Multilayer Thin Films, Wiley- VCH Verlag, GmbH & Co. KGaA, 2003.
6. David S. Goodsell, Bionanotechnology: Lessons from Nature, 1st Edition, Wiley-Liss, 2004.

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Centre for Biotechnology
Plant and animal tissue culture
Semester II

Course Code	23CBTD102DS01	Course Credits	L: 2 P:2
Max. Marks	100 (Theory: 35; Practical: 35; Internal Assessment: 30)	Time of end term examination	3 Hours

Note: In all nine questions will be set, two from each unit and one compulsory question of short answer type covering all the units. Students are required to attempt one compulsory question and four others selecting at least one from each unit. All questions are of equal marks.

Learning Objectives:

This course aims to introduce the concept and applications of:

1. Plant Tissue Culture, organogenesis, somatic embryogenesis and micro-propagation, large-scale production ofalkaloids
2. Artificial seeds, androgenesis and gynogenesis, somaclonal and gametoclonal variations, somatic hybrids and cybrids
3. Basic of animal cell culture
4. Importance of animal cell culture

Learning Outcomes:

Students completing this course will be able to:

1. Discuss and explain the concept of Plant Tissue Culture, organogenesis, somatic embryogenesis, micro-propagation and Large-scale production ofalkaloids
2. Understand the techniques like Artificial seeds, androgenesis and gynogenesis, somaclonal and gametoclonal variations, somatic hybrids and cybrids.
3. Learning of basic related to animal cell culture
4. Understand the procedure of maintenance of animal cell culture

Unit - I

History of plant cell and tissue culture; Culture media; various types of cultures: callus and cell suspension, In Vitro differentiation: Organogenesis and somatic embryogenesis; Micro-propagation, Artificial seeds, Applications of plant tissue culture. Virus elimination by shoot tip culture, Large-scale production of alkaloids and other secondary metabolites through cell culture techniques.

Unit – II

In vitro pollination and fertilization, Wide hybridization and Embryo rescue, Androgenesis and Gynogenesis, dihaploids and their applications in genetics and plant breeding; Somaclonal and gametoclonal variations; Protoplast isolation and purification; Protoplast viability test; Protoplast culture and regeneration; Somatic hybridization - methods and applications; Cybrids.

Unit – III

History and scope of Animal Cell and Tissue culture. Laboratory Facilities Required for Animal Cell Culture. Animal Cell Culture Media and its Composition. Types of Animal Cell Culture Media. Role of Serum in Culture Media. Advantages and Disadvantages of Serum-free Culture Media. Sterilization of Animal Cell Culture Surface, Media, and Reagents.

Unit – IV

Disaggregation of Tissue and Primary Culture, Types of Animal Cell Culture. Maintenance of Animal Cell Culture. Splitting procedure of Animal Cell Culture. Preservation and Reviewing of Animal Cell Culture. Large Scale Production of Animal Cells for Biotech Processes. Identification of viable and non-viable cells. Advantages and Disadvantages of Animal Cell Culture.

Practicals:

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1. Preparation of Murashige and Skoog medium, stocks solutions of macronutrients, micronutrients, vitamins and hormones.
2. Excision of explants and *In vitro* shoot induction on Murashige and Skoog medium.
3. In vitro callus induction in tobacco/ other plant leaf discs explants.
4. Preparation and sterilization of animal cell culture media.
5. Maintenance of cell-line
6. Splitting or passaging of animal cell-line

Suggested Readings:

1. R. H. Smith, Plant Tissue Culture: Techniques and Experiments, Elsevier Science Press, 2021.
2. S S. Bhojwani and M K Razdan, Plant Tissue Culture, Elsevier Publ.
3. P.K. Gupta, Animal Biotechnology, Rastogi Publication.
4. Freshney RI. Culture of animal cells: a manual of basic technique and specialized applications. John Wiley & Sons.

POST GRADUATE DIPLOMA IN BIOTECHNOLOGY

Centre for Biotechnology
Semester II
Plant molecular Biology & Molecular Breeding

Course Code	23CBTD102DS02	Course Credits	L: 2 P: 2
Max. Marks	100 (Theory: 35; Practical: 35; Internal Assessment: 30)	Time of end term examination	3 Hours

Note: In all nine questions will be set, two from each unit and one compulsory question of short answer type covering all the units. Students are required to attempt one compulsory question and four others selecting at least one from each unit. All questions are of equal marks.

Learning Objectives:
This course aims to introduce:
1. Regulatory mechanisms in plants
2. Biosynthesis and metabolism of hormones in plants
3. Advances in the plant breeding using biotechnology approaches
4. Strategies for crop improvement for various traits

Learning Outcomes:
Students completing this course will be able to:
1. Understanding of novel plant genes and regulation of their expression
2. Biosynthesis and metabolism of plant hormones
3. Explain the conventional plant breeding practices and the advanced strategies using biotechnological approaches.
4. Understand the application of Marker Assisted Selection strategies in various plant breeding programmers for the development of new plant varieties with enhanced quality traits.

Unit - I

Concept of plasticity in plant development; Analyzing plant growth; Mobilization of food reserves during seed germination; Hormonal control of seed germination and seedling growth; Tropisms; Photoperiodism and its significance; Molecular genetics of floral development and floral organ differentiation; Source-sink relationship; Molecular biology of photosynthesis; Nitrogen, sulphur and phosphorus metabolism; Symbiotic and non-symbiotic nitrogen fixation; Mycorrhizal-plant symbiosis.

Unit – II

Signal Transduction– Basic concepts; Senescence and Programmed Cell Death (PCD) – Senescence and its regulation; Biosynthesis of Plant Hormones and Elicitors; Structure and metabolism of auxins, gibberellins, cytokinins, abscisic acid, ethylene, brassinosteroids, salicylic acid, jasmonates and related compounds.

Unit – III

Conventional methods for crop improvement, Breeding methods for self and cross pollinated crops, Heterosis breeding, Mutation breeding. Limitations of conventional breeding. Molecular markers: Definition, properties, types of molecular markers, Molecular markers and IPR issues, Marker Assisted Selection (MAS)

Unit – IV

Trait related markers and characterization of genes involved; Mapping genes on specific chromosomes; QTL mapping; Gene pyramiding, Marker Assisted Breeding in crop improvement, Allel mining, TILLING and Eco-TILLING

Practicals:

1. Isolation of DNA, DNA purify and quantification tests
2. Agarose gel electrophoresis and restriction mapping of DNA
3. PCR amplification
4. Homogenization of leaves, sub-cellular fractionation by differential centrifugation, chloroplast purification, SDS-PAGE analysis of chloroplast proteins.
5. PCR-based DNA markers.
6. DNA finger printing methods.
7. Molecular markers

Suggested Readings:

1. Lincoln Taiz, Eduardo Zeiger, Plant Physiology, Sinauer Associates, 2010.
2. Buchanan, Wilhelm Gruissem, Russell Jones, Biochemistry and Mol Biol of Plants, John Wiley and Sons, 2002.
3. Xu, Yunbi, Molecular plant breeding, Cabi International, 2010.
4. Clark, D. P., Molecular Biology, Elsevier, USA, 2005.
5. HenryR. J., Plant Genotyping: The DNA fingerprinting of plants. CABI, New Delhi, 2005

POST GRADUATE DIPLOMA IN BIOTECHNOLOGY

Centre for Biotechnology
Environmental Biotechnology
Semester II

Course Code	23CBTD102DS03	Course Credits	L: 2 P:2
Max. Marks	100 (Theory: 35, Practical: 35; Internal Assessment: 30)	Time of end term examination	3 Hours

Note: In all nine questions will be set, two from each unit and one compulsory question of short answer type covering all the units. Students are required to attempt one compulsory question and four others selecting at least one from each unit. All questions are of equal marks.

Learning Objectives:

1. Students will get an overview of the principles, scope, and applications of environmental biotechnology, emphasizing its role in sustainable development.
2. Students will understand the microbial diversity in natural environments and understand the interactions between microorganisms and their surroundings.
3. Students will be introduced to bioremediation strategies for the cleanup of contaminated environments, covering microbial degradation of pollutants, phytoremediation, and bioaugmentation.
4. Students will be able to understand the use of biotechnological methods to recover valuable resources from waste streams, such as energy production from organic waste and nutrient recovery.
5. Emphasize the importance of sustainability in the application of biotechnological solutions to environmental challenges, considering economic, social and environmental aspects.

Learning Outcomes:

1. Students will gain a comprehensive understanding of key environmental challenges and issues, including pollution, waste management, and resource depletion.
2. Students will learn the diversity and roles of microorganisms in natural ecosystems and their importance in biotechnological applications.
3. Students will acquire competence in various bioremediation techniques for the cleanup of contaminated environments, including microbial degradation, phytoremediation, and bioaugmentation.
4. Students will develop skills in the application of biotechnological methods for solid waste management, including composting, anaerobic digestion, and waste-to-energy processes.
5. Students will develop competence in environmental monitoring techniques, including the use of biotechnological tools for detecting and quantifying pollutants in environmental samples.

Unit – I

Environmental Pollution: types of pollution, Methods for the measurement of pollution; Methodology of environmental management - the problem solving approach, its limitations. Air pollution and its control through Biotechnology. Global Environmental Problems: Ozone depletion UV-Br green-house effect and acid rain their impact and biotechnological approaches for management.

Unit – II

Water Pollution and its Control: Water as a scarce natural resource, need for water management. Measurement of water pollution, sources of water pollution. Waste water

collection, Waste water treatment-physical, chemical and biological treatment process. Microbiology of Waste Water Treatments, Aerobic Process; activated sludge, Oxidation ditches, trickling filter, towers, rotating discs, rotating drums oxidation ponds.

Unit – III

Anaerobic Processes: Anaerobic digestion, anaerobic filters Up flow anaerobic sludge blanket reactors, Treatment schemes for waste waters of dairy, distillery, tannery, sugar, antibiotic industries.

Unit – IV

Microbiology of degradation of Xenobiotics in Environment Ecological considerations, decay behaviour & degradative plasmids; Hydrocarbons, substituted hydrocarbons, oil pollution, surfactants, pesticides, Bioremediation of contaminated soils and waste land. Biopesticides in integrated pest management. Solid wastes; sources and management (composting vermiculture and methane production)

Practical:

1. Detection of coliforms for determination of the purify of potable water Determination of total dissolved solids of water.
2. Determination of dissolved oxygen concentration of water sample. Determination of biological oxygen demand (BOD) of a sewage sample. Determination of chemical oxygen demand (COD) of sewage sample Isolation of xenobiont degrading bacteria by selective enrichment techniques Test for degradation of aromatic hydrocarbons by bacteria.
3. Survey of degradative plasmids in microbes growing in polluted environmen Effect of sulphur dioxide on crop plants.
4. Estimation of heavy metals in water/soil by Atomic absorption spectrophotometry Estimation of nitrate in drinking water
5. Study on biogenic methane production in different habitats.

Suggested Readings:

1. G M Evans, J C Furlong, Environmental Biotechnology-Theory and Applications, John Wiley & Sons, e-book, 2003.
2. Hans-Joachim Jordening, Josef Winter, Environmental Biotechnology: Concepts and Applications, John – Wiley and Sons, 2006.
3. Indu Shekhar Thakur, Environmental Biotechnology: Basic concepts and Applications, I K Internationals Pvt. Ltd., 2006.
4. A H Scragg, Environmental Biotechnology, Longman, 1999.
5. Recent reviews from scientific journals.

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Centre for Biotechnology
Animal Biotechnology
Semester II

Course Code	23CBTD102DS04	**Course Credits**	L: 2, P:2
Max. Marks	100 (Theory: 35; Practical: 35; Internal Assessment: 30)	**Time of end term examination**	3 Hours

Note: In all nine questions will be set, two from each unit and one compulsory question of short answer type covering all the units. Students are required to attempt one compulsory question and four others selecting at least one from each unit. All questions are of equal marks.

Learning Objectives:

This subject is designed to provide the concept of :

1. Requirement for animal cell culture
2. Culture media preparation and sterilization.
3. Stem cells
4. Modification of animal cell

Learning Outcomes:

Upon completion of the course, the student shall be able to understand

1. Enlist the equipments for animal cell culture
2. Role of serum in culture media
3. Importance of stem cells
4. Demonstrate the three dimensional culture &tissue engineering.

Unit – I

Structure and organization of animal cell, Equipments and materials used for animal cell culture technology, Asepatic Technique, Balanced salt solutions and simple growth medium, Chemical, physical and metabolic functions of constituents of culture medium, Role of carbon dioxide, Role of serum and supplements, Serum & protein free defined media and their application, Primary and established cell line cultures, Subculture and Cell Line.

Unit – II

Measurement of viability and cytotoxicity, Biology and characterization of the cultured cells, Measuring parameters of growth, Basic techniques of mammalian cell culture in vitro disaggregation of tissue and primary culture maintenance of cell culture cell separation, Scaling-up of animal cell culture, Cell synchronization, Cell cloning and micromanipulation.

Unit – III

Stem cell cultures, Somatic stem cells, Embryonic stem cells and their applications, Cell transformation, Cell culture based vaccines, Transgenic animals, Hybridoma Technology, Production and application of polyclonal and monoclonal antibodies, Applications of animal cell culture.

Unit – IV

Somatic cell genetics, Organ and histolytic cultures, Measurement of cell death Apoptosis, Three dimensional culture & tissue engineering, Application of somatic cell genetics, Factor affecting the cell death.

Practicals:

1. Preparation of tissue culture medium and membrane filtration
2. Preparation of single cell suspension from spleen and thymus
3. Cell counting and cell viability
4. Macrophage monolayer from PEC, and measurement of phagocytic activity
5. Trypsinization of monolayer and sub culturing
6. Cryopreservation and thawing
7. Measurement of doubling time
8. Role of serum in cell culture
9. Preparation of metaphase chromosomes from cultured cells
10. Isolation of DNA and demonstration of apoptosis of DNA laddering
11. MTT assay for cell viability and growth
12. Cell fusion with PEG

Suggested Readings:

1. Freshney I. Culture of Animal Cells: A Manual of Basic Technique. 5th Edition Publisher: Wiley-Liss, 2005 ISBN: 0471453293
2. Igel Jen, Animal Cell Biotechnology: Methods and protocols, Humana Press

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1.0. Definition of keywords

Course:

Course refers to a paper having specified credits mentioning its learning objectives and learning outcomes. A course may be designed comprising credits for lectures/ tutorials/laboratory work/field work/outreach activities/project work/internship/ vocational training etc. or combination thereof.

Credit:

Credit is the weightage given to each course of the study. It is the numerical value assigned to a course according to the contact hours required to teach the prescribed syllabi of the program.

As per prescribed UGC standards; 1 credit = 15 hours of lectures.

Mechanism for Computation of Work-load:

The following mechanism shall be adopted for computation of work-load:
(a) 1 Credit = 1 Theory period of one hour duration/week/semester;
(b) 1 Credit: 1 Tutorial period of one hour duration/week/semester;
(c) 1 Credit: 1 Practical period of two hours duration/week/semester;
(d) 1 Credit: Internship of 30 hours per semester.

The marks distribution according to the credit hours is 25 marks per credit.

Discipline Specific Course (DSC):

Discipline specific course is the discipline or subject of main focus in which the diploma will be awarded.

Skill Enhancement Course (SEC):

Skill Enhancement Course aims to promote skills pertaining to a particular field of study, impart practical skills, hands-on training, soft skills, etc., in order to enhance the student's employability.

Value Added Course (VAC):

Value Added Course aims to add the knowledge of the learner beyond academic disciplines.

Internship:

Internship is a course to develop a professional ability through an appropriate learning. The duration of Internship is of 120 hours for 4 credits during summer vacation.

Semester/Academic Year:

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A semester comprises of atleast 15 weeks of study within 90 working days (excluding the time spent for the conduct of final examination of each semester) and an academic year is divided into two semesters.

Academic Bank of Credit (ABC)

Academic Bank of credit is an academic service mechanism to facilitate students to become its academic account holders, thereby paving the way for seamless student's mobility between or within degree-granting Higher Educational Institutions through a formal system of credit recognition, credit accumulation, credit transfers and credit redemption to promote distributed and flexible teaching-learning. ABC will digitally store the academic credits earned by students from HEIs registered with ABC for awarding degrees / diplomas / certificates taking into account credits earned by the students.

Credit Point

It is the product of the grade point and the number of credits for a course.

Grade Point

It is a numerical weight allotted to each letter grade on a 10-point scale.

Letter Grade

It is an index of the performance of students in a said course. Grades are denoted by letters O, A+, A, B+, B, C, P and F.

Semester Grade Point Average (SGPA)

The SGPA is the ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places.

Cumulative Grade Point Average (CGPA)

The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

2.0. Components of course/program of study

The following types of courses/activities may be used to build program of study. Each of them will require specific number of hours of teaching/guidance/practicum/ laboratory/studio/workshop activities, field-based learning/projects, internships and community engagement and service.

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Lecture courses: Courses involving lectures relating to a field or discipline by an expert or qualified personnel in a field of learning, work/vocation, or professional practice.

Tutorial courses: Courses involving problem-solving and discussions relating to a field or discipline under the guidance of qualified personnel in a field of learning, work/vocation, or professional practice.

Practicum or Laboratory work: A course requiring students to participate in a project or practical or lab activity that applies previously learned/studied principles/theory related to the chosen field of learning, work/vocation, or professional practice under the supervision of an expert or qualified individual in the field of learning, work/vocation or professional practice.

Seminar: A course requiring students to participate in structured discussion/conversation or debate focused on assigned tasks/readings, current or historical events, or shared experiences guided or led by an expert or qualified personnel in a field of learning, work/vocation, or professional practice.

Internship: A course requiring students to participate in a professional activity or work experience, or cooperative education activity with an entity external to the education institution, normally under the supervision of an expert of the given external entity. A key aspect of the internship is induction into actual work situations. Internships involve working with local industry, government or private organizations, business organizations, artists, crafts persons, and similar entities to provide opportunities for students to actively engage in on-site experiential learning.

Studio activities: Studio activities involve the engagement of students in creative or artistic activities. Every student is engaged in performing a creative activity to obtain a specific outcome. Studio-based activities involve visual- or aesthetic focused experiential work.

Field practice/projects: Courses requiring students to participate in field-based learning/projects generally under the supervision of an expert of the given external entity.

Community engagement and service: Courses requiring students to participate in field-based learning/projects generally under the supervision of an expert of the given external entity. The curricular component of 'community engagement and service' will involve activities that would expose students to the socio-economic issues in society so that the theoretical learnings can be supplemented by actual-life experiences to generate solutions to real-life problems.

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3.0 Course/Program Structure

3.1 Structure of PG Diploma Program

Semester	Discipline-Specific Courses (DSC)	Skill Enhancement Courses (SEC) / Internship	Value-Added Courses (VAC)	Total Credits
I	DSC 1 @ 4 credits	SEC1 @4 credits	VAC1 @2 credits	22
	DSC 2 @ 4 credits			
	DSC 3 @ 4 credits			
	DSC 4 @ 4 credits			
II	DSC 5 @ 4 credits	Internship @4 credits	VAC2 @2 credits	22
	DSC 6 @ 4 credits			
	DSC 7 @ 4 credits			
	DSC8 @ 4 credits			
				44

3.2 Issuance of Certificate

Students who are declared to have qualified all the course work as prescribed for concerned Certificate/Diploma Program will be awarded relevant certificate.

3.3 Maximum Duration to complete Certificate Course/Diploma Program

Duration of Certificate Course/Diploma Program + Two years.

4.0. Course Curriculum, Syllabus and Pedagogical Practices

The course curriculum and syllabus of every Certificate Course and Diploma Program shall be developed by the concerned Board of Studies (BOS) and be implemented after obtaining approval of the Academic Council. The course content and structure of Discipline Specific Courses (DSC) may vary from discipline to discipline depending upon the learning requirement of the program. However, the total credit to be earned for award of diploma shall be 44 credits. The concerned BOS may decide the mode of delivery of course i.e. offline/online/blended.

Pedagogical Practices

Effective learning requires an appropriate curriculum, an apt pedagogy, continuous formative assessment and adequate student support. The intention is to contextualize curriculum through meaningful pedagogical practices, which determine learning experiences directly influencing learning outcomes. Active, cooperative, collaborative and experiential learning pedagogies are some of the examples. The use of technology in creating a learning environment that connects learners with content, peers and instructors all through the learning process, respecting learners' pace is the need of the hour.

a) Classroom processes must encourage rigorous thinking, reading and writing, debate, discussion, peer learning and self-learning.

b) The emphasis is on critical thinking and challenge to current subject orthodoxy and develops innovative solutions. Curricular content must be presented in ways that invite questions, not as a body of ready knowledge to be assimilated or reproduced. Faculty should be facilitators of questioning and not authorities on expertise.

c) Classroom pedagogy should focus on the 'how' of things, i.e. applying theory and ideas. All courses, including social sciences and humanities, should design projects and practicums to enable students to get relevant hands-on experiences.

d) Learning must be situated in the Indian context to ensure no sense of alienation from their context, country and culture.

e) Classroom processes must address issues of inclusion and diversity since students are likely to be from diverse cultural, linguistic, socio-economic and intellectual backgrounds.

f) Cooperative and peer-supported activities must be part of empowering students to take charge of their own learning.

g) Faculty will have the freedom to identify and use the pedagogical approach best suited to a particular course and student.

h) Pedagogies like PBL (Problem/Project Based Learning) and Service Learning be brought into practice as part of the curriculum. Experiential learning in an internship with a specified number of credits is to be made mandatory.

i) UGC suggests implementing Blended Mode (BL) as a new mode of teaching-learning in higher education. BL is not a mere mix of online and face-to-face mode, but it refers to an well-planned combination of meaningful activities in both modes. The blend demands consideration of several factors, mainly focusing on learning outcomes and the learner-centered instructional environment.

5.0. Learning assessment

A variety of assessment methods that are appropriate to a given discipline/subject area and a program of study will be used to assess progress towards the course/program learning outcomes. Priority will be accorded to formative and summative assessment. Evaluation will be based on continuous assessment, in which sessional and the terminal examinations will contribute to the final grade. Sessionals will consist of class tests, mid-semester examination(s), homework assignments, class presentations etc., as determined by the concerned Board of Studies.

5.1. Examination and Internal Assessment

The internal assessment work and the End-Semester examination shall have the weightage of 30% and 70%, respectively. For practical examination also, 70 percent of the marks will be awarded through an end semester practical exam and remaining 30 percent of the marks will consist of internal assessment to be awarded by concerned faculty member(s) of the department.

a. Internal Assessment shall be done on the basis of student's class attendance, submission of assignments, seminar presentations and performance at the two compulsory sessional tests to be conducted in a semester.

b. First Internal Assessment Test shall be held around the sixth week of the semester for the syllabi covered till then. Second Internal Assessment Test shall be held around the twelfth week for the syllabi covered between seventh and twelfth week. Third Internal Assessment Test, if required, may be held around the fourteenth week for the syllabi covered between seventh and fourteenth week. However, the best scores in any two sessional tests shall be counted.

c. The Internal Assessment for theory shall consist of the following components with marks indicated against each:

Credit Hours	4	3	2	1
Total Marks	100	75	50	25
Criteria				
Attendance	5	5	5	5
Assignments/Seminars/Presentations	5	5	-	-
Sessional Examination	20	15	10	-
Total	30	25	15	5

% of attendance	Marks
Below 65	0
65 to < 70	2
70 to < 75	3
75 to < 80	4
80 and above	5

d. The Internal Assessment for practical shall consist of the following components with marks indicated against each:

Credit Hours	4	3	2	1
Total Marks	100	75	50	25
Criteria				
Attendance	5	5	5	5

% of attendance	Marks
Below 65	0

65 to < 70	2				
70 to < 75	3				
75 to < 80	4				
80 and above	5				
Practical Assignments/ Practical File		25	20	10	-
	Total	30	25	15	5

e. The HOD/Director shall display the internal assessment awards of each course on the notice board of the Department/Institute/Centre atleast fifteen days before the commencement of the end semester examinations to give an opportunity to the students to make representation, if any regarding the dispute of sessional marks within two days of notification which shall be addressed by a three member appellate committee constituted by the concerned HOD/Director. The appellate committee shall submit its recommendation within three days and the corrective measures if any based on the recommendation of the committee shall be taken by the HOD/Director within next three days.

f. The HOD/Director shall forward the internal assessment marks awarded by the concerned teacher on the basis of class test, written assignment/ presentation/seminar and attendance in the classes to the Controller of Examinations as per the following schedule: (i) The Internal Assessment/Sessional marks should be supplied by the Heads of the Departments/Directors/Principals of the Colleges invariably within 20 days after the commencement of the examination. (ii) Thereafter, a late fee @ Rs.100/ per student per subject shall be levied upon the Department/ College/ Institute upto 10 days from the expiry of 20 days of the commencement of the examinations. This penalty/late fee shall not be charged from the student by the Department/College/Institute. (iii) If still, internal assessment/ sessional marks are not supplied by the Department/College/institute, then the result of the candidate(s) shall be declared by proportionating the marks of concerned theory/practical paper in which he/she has been declared as pass. Marks of candidates having reappear shall not be proportionate in this case.

g. The internal assessment awards as well as viva-voce awards of a candidate who fails in any semester examination shall be carried forward to the next examination.

h. The end semester examination for the odd semesters shall ordinarily be held in the month of December/January and for the even semesters in the month of May/June on such dates as may be notified by the Controller of Examinations.

i. The examination schedule containing the dates of receipt of examination forms with and without late fee, shall be notified by the Controller of Examinations from time to time.

j. Students failing in one or more courses of end semester examinations will be entitled to clear them during the regular semester examinations of courses to be held in subsequent years.

k. The examination fee to be paid by the candidate for each semester shall be as prescribed by the University from time to time.

l. Every student shall be examined in the courses as prescribed in the syllabus and scheme of examination approved by the Academic Council from time to time. The fail/re-appear candidates will appear in the exam as per the syllabus applicable to regular students at that time.

m. The HOD/Director shall preserve the records pertaining to internal assessment awards for verification, if needed, by the University up to three months from the date of declaration of the semester examination results.

n. The candidate shall be allowed to appear in the examination if he/she fulfils the following requirements:-

i. Bears a good character

ii. Has been on the rolls of the Department/College/Institution during the semester.

iii. Has attended not less than 65% of lectures delivered in theory as well as practicals. Relaxation in shortage of lectures up to 20% will be allowed by the Head of the Department/Principal of the College/institute on the following grounds: (i) Self-illness: (ii) Illness/death of parents, brother, sister or any other close family member; (iii) Any other reason beyond the control of the student to the satisfaction of the HOD/Director/Principal.

o. The minimum percentage of marks to pass the examination in each semester shall be:

(i) 40% in each theory paper

(ii) 40% in each practical examination.

(iii) 40% in the aggregate of each theory paper and internal assessment (and practical where practical is a component of theory paper).

p. The grace marks will be allowed as per University rules.

q. **Letter Grades and Grade Points:** The Semester Grade Point Average (SGPA) is computed from the grades as a measure of the student's performance in a given semester. The SGPA is based on the grades of the current term, while the Cumulative

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GPA (CGPA) is based on the grades in all courses taken after joining the program of study. University may also mention marks obtained in each course and a weighted average of marks based on marks obtained in all the semesters taken together for the benefit of students.

Marks (%)	Letter Grade	Grade Point
> 90	O(outstanding)	10
> 75 to 90	A+(Excellent)	9
> 65 to 75	A(Very good)	8
> 55 to 65	B+(Good)	7
> 50 to 55	B(Above average)	6
> 40 to 50	C(Average)	5
40	P (Pass)	4
Less than 40	F(Fail)	0
	Ab(Absent)	0

r. **Computation of SGPA and CGPA**

The SGPA is the ratio of the sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student in a semester and the sum of the number of credits of all the courses undergone by a student, i.e.

$$SGPA\ (Si) = \Sigma(Ci \times Gi) / \Sigma Ci$$

Where Ci is the number of credits of the i^{th} course and Gi is the grade point scored by the student in the i^{th} course.

Example for Computation of SGPA

Semester	Course	Credit	Letter Grade	Grade point	Credit Point (Credit x Grade)
I	Course 1	3	A	8	3X8= 24
I	Course 2	4	B+	7	4X7= 28
I	Course 3	3	B	6	3X6= 18
I	Course 4	3	O	10	3X 10 =30
I	Course 5	3	C	5	3X5= 15
I	Course 6	4	B	6	4X6= 24
		20			139
			SGPA		139/20=6.95

The Cumulative Grade Point Average (CGPA) is also calculated in the same manner taking into account all the courses undergone by a student in all the semesters of a program, i.e.

$$CGPA = \Sigma(Ci \times Si) / \Sigma Ci$$

where Si is the SGPA of the i^{th} semester and Ci is the total number of credits in that semester.

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Example for Computation of CGPA

Semester 1	Semester 2
Credit:22 SGPA:6.9	Credit:22 SGPA:7.8
CGPA = 7.35 (22 x 6.9 + 22 x 7.8)/44	

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

5.2. Setting of Question Papers and Evaluation

a. The question papers for the End-Semester theory examination shall be set and evaluation of answer books shall be done by the examiners (Internal and/or External ordinarily) out of the Panel of Examiners recommended by the Board of Studies of the Department concerned on the basis of their expertise/ specialization/area of interest.

b. In the case of the practical examination of the courses, the assessment shall be jointly undertaken by the internal and external examiners. The External examiners shall be invited from amongst the panel of examiners recommended by the concerned Board of Studies. In case of unavailability of external examiners due to unavoidable circumstances, the Controller of Examinations may allow the conduct of practical examination by the internal examiners so that the conduct of examination and declaration of results is not delayed.

c. The pattern of Question Papers for End-Semester theory examinations shall be as under:

Question 1: Answer to Question no. 1 shall be compulsory	Short answer type questions from all units
Question 2 and 3	Two questions from Unit-I and the student should answer one question
Question 4 and 5	Two questions from Unit-II and the student should answer one question
Question 6 and 7	Two questions from Unit-III and the student should answer one question
Question 8 and 9	Two questions from Unit-IV and the student should answer one question

All the questions shall carry equal marks

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5.3. Improvement of Grades: For improvement of grades, a student shall have to apply on the prescribed form available on the University Website or the Examination Branch of the University, along with the original Detailed Marks Certificate or the copy of the result sheet and the prescribed fee, as revised from time to time.

i. After passing each semester examination, a candidate will be allowed to appear for improvement of result in one or more theory papers only once within the period prescribed for completion of the Program. Only improved marks (higher score) will be taken into account.

ii. A student improving the Division/grade shall not be considered for award of Gold Medal/Rank Certificate.

6.0. Removal of the Name of a Student from the Program:

a. The name of a student remaining absent for 15 consecutive days (excluding Sunday/Holiday) after the start or during the academic session without any notice shall be struck off from the rolls of the Department/ Institute. A fine of Rs.20/- per lecture/day shall be charged on account of remaining absent from the classes.

b. Re-admission may be allowed on payment of Rs. 2000/- alongwith required fine within 15 days with the permission of the Dean Academic Affairs. If a student fails to report within this time limit, the seat will be declared vacant and will be filled according to University rules. In respect of an applicant seeking re-admission, his/her previous record shall be carefully scrutinized and the decision of the Dean Academic Affairs in this regard shall be final.

c. Re-admission may be allowed by the Dean Academic Affairs only once on the recommendations of the concerned HOD/Director on payment of prescribed re-admission fee and fine as applicable. However, while giving his/her specific recommendations, the concerned Head of the Department/Director must ensure that the student will fulfill the minimum requirement of attendance for appearing in the examinations as per Ordinance.

6.1. For Detained Student:

A student, who had been detained in semester end examination on account of shortage of attendance, will not be promoted to the next semester till he/she completes the requirements as mentioned (i) and (ii) below in the preceding semester:

(i) he/she seeks re-admission within the prescribed date in the relevant semester in the next academic session.

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(ii) his/her conduct has been satisfactory; and he/she shows sufficient cause to the satisfaction for not having put in the requisite percentage of attendance.

(ii). However, such students will have to pay fee being charged for that semester. If such a student had been detained in 1st semester of a program, he/she may be readmitted next year without competing with the other students seeking admission to the 1st semester. Supernumerary seat(s) be created for readmitting such student(s) in the corresponding semester.

7.0 Credit Transfer through Academic Bank of Credits (ABC):

a. The University shall provide the facility of Academic Bank of Credits in consonance with UGC (Establishment and Operationalization of Academic Bank of Credits (ABC) Scheme in Higher Education) Regulations, 2021, as amended from time to time.

b. Each student shall have to register on Academic Bank of Credits (ABC) portal for creation of the unique ABC ID.

c. Credits earned and deposited with Academic Bank of Credits (ABC) shall be valid for the purpose of redemption to a Certificate/Diploma/Degree, for varying duration as specified in the Ordinance subject to a maximum duration of 7 years.

d. Provided that once any credit is redeemed for the award of a degree, diploma or certificate, such credit shall be irrevocably debited from the student's Academic Bank Account and cannot be reused for the award of any other formal academic qualifications.

e. A student can take the courses of any other university subject to equivalence of the DSC courses and availability of seats, adopting due administrative process and formal consent of the University/Universities through the Equivalence Committee(s).

8.0. Power to Remove Difficulties:

If any difficulty arises in giving effect to the provisions of this Ordinance, the Vice Chancellor may, by order, make such provisions not inconsistent with the Act, Statutes, Ordinances or other Regulations, as appears to be necessary or expedient to remove the difficulty, however subject to ratification of such order by the Statutory bodies of the University.