

**[CBCS BASED]
REGULATION & SYLLABUS
For**

**DIPLOMA IN BIOTECHNOLOGY
(ADD ON COURSE)**



Offered by

**S. S. Khanna Girls' Degree College, Prayagraj
(A Constituent College, University of Allahabad)**

Accredited Grade A by NAAC (CGPA 3.46)

**Session:
From 2020 – 2021**

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PREFACE

In an Endeavour to augment the professional abilities, especially of girl students, the College is running an add-on one year Diploma Course in Biotechnology since 2009. The Diploma is approved by University Grants Commission under the Career Oriented Scheme and also has been approved by the University of Allahabad. As the diploma is an add-on course, therefore can be very well clubbed together with the regular B.Sc. III rd year course.

REGULATIONS

The syllabus of Add on course **Diploma in Biotechnology** based on semester with credit based pattern comprises of two semesters. It is useful for those biology students interested in higher education (academic), research and scientific filed. The course is especially designed for job oriented and self employment purpose because of professional course. The syllabus covers almost all the advance knowledge along with basic knowledge.

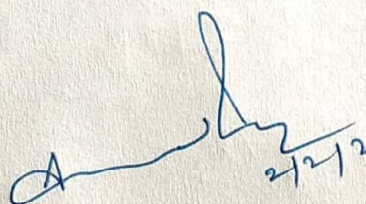
The examination shall be of 03 core theory papers, each with 4 credits ($4 \times 3 = 12$ credits) and 1 laboratory course of 8 credits ($8 \times 1 = 8$ credits). Thus, each semester offers 20 credits. Each Core course has equal weightage. Each core course (theory papers) will have 100 marks or 4 credits. The Examination in each theory paper and laboratory course shall be of three hours duration.

Minimum marks for passing the examination in each semester shall be 36% in each paper and 40% in aggregate of a semester.

SCHEME OF EXAMINATION

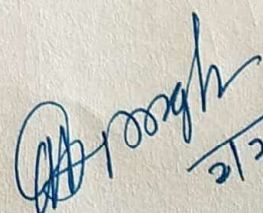
1. The evaluation scheme of examination consists of two parts: Internal Assessment (IA) and End Semester Examination (ESE). Internal assessment includes Assignments (5 marks), Presentations (5 marks), Unit tests (T1, T2) and mid sem. Test. The internal assessment will contribute 40% and the Semester examination will contribute 60% to the total marks. This Semester system is based on Choice based credit system (CBCS) based examination.

****Note: The ratio of internal assessment and semester and examination will be the same as determined by the University.**


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2. The duration of the End Semester Examination (ESE) of each course will be 3/2 Hours (As per guidelines of University).

Diploma in Biotechnology Course Pattern (CBCS)

I Semester:

Paper No.	Paper Code	Paper Title	Credit	IA	ESE	Total Marks
Paper 1	AD-BIT 101	Introduction to Biochemistry, Biotechnology and Computational Biology.	4	40	60	100
Paper 2	AD-BIT 102	Applied Microbiology	4	40	60	100
Paper 3	AD-BIT 103	Introduction to Instrumentation & Techniques	4	40	60	100
Paper 4	AD-BIT 104	PRACTICAL (Based on content of theory paper)	8	40	60	100
TOTAL			20	160	240	400

II Semester:

Paper No.	Paper Code	Paper Title	Credit	IA	ESE	Total Marks
Paper 1	AD-BIT 201	Molecular Biology and Genetic Engineering	4	40	60	100
Paper 2	AD-BIT 202	Immunology & Immunotechnology	4	40	60	100
Paper 3	AD-BIT 203	Introduction to Cell Culture Technology Plant and Animal Cell Culture Techniques	4	40	60	100
Paper 4	AD-BIT 204	PRACTICAL (Based on content of theory paper)	8	40	60	100
TOTAL			20	160	240	400

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SYLLABUS

DIPLOMA IN BIOTECHNOLOGY

(ADD ON COURSE)

(Course Duration: 1 year)

Coordinator

Dr. Preeti Singh

Department of Botany

S.S. Khanna Girls' Degree College

Preeti Singh

S. Shanti
2/2/2021

A. Singh
2/2/2021

Singh

SYLLABUS OF DIPLOMA IN BIOTECHNOLOGY

The Department offers the following courses with the duration of one year (Add on Course). The curriculum is designed to help the students supplement their basic education so that they are better equipped to handle intelligently the fundamental issues. Through combination of theoretical lectures and practical's, students will learn to seek out information and convey it in a better way.

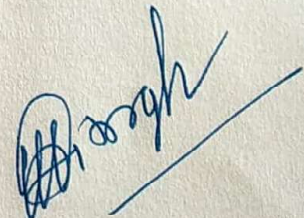
I Semester:

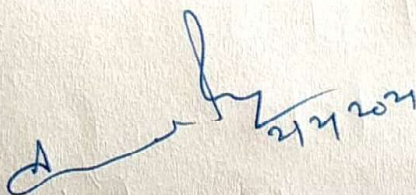
PAPERS	MAXIMUM MARKS	Credits (20)
PAPER 1: Introduction to Biochemistry, Biotechnology and Computational Biology.	100	4.0
PAPER 2: Applied Microbiology	100	4.0
PAPER 3: Introduction to Instrumentation & Techniques	100	4.0
PAPER 4: PRACTICAL (Based on content of theory paper)	100	8.0

II Semester:

PAPERS	MAXIMUM MARKS	Credits (20)
PAPER 1: Molecular Biology and Genetic Engineering	100	4.0
PAPER 2: Immunology & Immunotechnology	100	4.0
PAPER 3: Plant & Animal Cell culture Technology	100	4.0
PAPER 4: PRACTICAL (Based on content of theory paper)	100	8.0

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DIPLOMA IN BIOTECHNOLOGY

DIPLOMA COURSE: 40 CREDITS

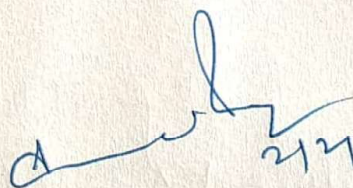
1 CREDIT = 12 HOURS

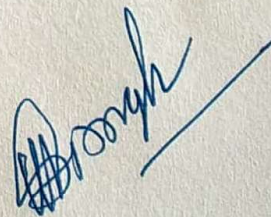
- THEORY AND PRACTICALS 40 CREDITS

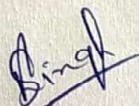
- FIRST SEMESTER 20 CREDITS (240 hrs.)
 - THEORY 12 CREDITS (144 hrs)
 - PRACTICAL 8 CREDITS (96 hrs)

- SECOND SEMESTER 20 CREDITS (240 hrs.)
 - THEORY 12 CREDITS (144 hrs)
 - PRACTICAL 8 CREDITS (96 hrs)

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FIRST SEMESTER (Credits-20)

PAPER 1: INTRODUCTION TO BIOCHEMISTRY, BIOTECHNOLOGY AND COMPUTATIONAL BIOLOGY

48 HRS.

Prerequisite Knowledge (From B.Sc. Syllabus):

18 Hours

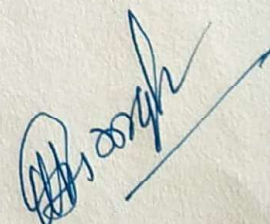
1. **Carbohydrates:** Characteristics. Classification. Glycolysis. Kreb's cycle. Oxidative phosphorylation. Gluconeogenesis. Cori cycle.
2. **Proteins:** Characteristics. Classification. Structure. Building blocks of Proteins-amino acids.
3. **Lipids:** Characteristics. Classification. Fatty acid. β oxidation.
4. **Enzymes:** Introduction to Enzyme. Properties. Classification. Co-enzymes. Prosthetic group. Nature of action of enzymes with special reference to induced fit theory.
5. **Nucleic acids:** Structure and properties of purines, pyrimidines, nucleosides. Structure of DNA and RNA. Replication of DNA –Messelson and Stahl's experiment. DNA polymerase. In Vitro DNA synthesis. Transcription. Translation. Post transcriptional changes. Genetic code.

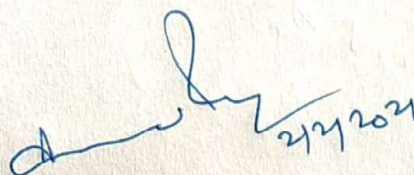
S.No.	Topics (Credits 4)	Hours: 30
1.	What is Biotechnology? History of Biotechnology. Overview of modern Biotechnology. Scopes of Biotechnology. Hazards of Biotechnology.	8.00 hrs
2.	Enzymes: Enzyme mechanism. Purification techniques. Kinetics. Types of enzyme inhibition. Immobilization techniques.	8.00 hrs
3.	Sequencing of Proteins. Sequencing of DNA. Renaturation. Denaturation Cot Curves for analysis of complexity of DNA. .	6.00 hrs
4.	Bioinformatics: Introduction, Basics. History. Bioinformatics. Importance and uses. Information technology. Biological data. Databases. Sequence to structure relationship.	8.00 hrs

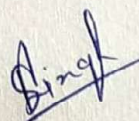
List of Books for reference:

1. Principles of Biochemistry- Nelson Cox
2. Biochemistry-Stryer 6th edition
3. Essential Gene-Lewin
4. Genetics-Strickberger
5. Cell and Molecular Biology- Karp
6. Introduction to bioinformatics- Arthur M. Lesk
7. Biotechnology- Devid P. Clark and Nanette J. Pazdernik

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PAPER2: APPLIED MICROBIOLOGY

53 HRS.

Prerequisite Knowledge (From B.Sc. Syllabus):

8 Hours

1. **Cell structure and function:** General organization of prokaryotic and eukaryotic cell. Similarities and differences between prokaryotic and eukaryotic cells.
2. **Basics of Microbiology:** Structure classification of bacteria. Cyanobacteria. Actinomycetes. Fungi, Yeast, Viruses, Mycoplasma and rickettsia etc.

Sl.No.	Topics Credits (4)	Hours: 45
1.	Microbial Diversity and Microbial Systematic: Bacteria. Bacteriophages and its life cycle. Bacteria of industrial Importance.	6.00 hrs
2.	Sterilization and disinfection.	4.00 hrs
3.	Types of media; Nutrient Media. Selective Media &. Differential Media. Culturing of microorganisms; Batch Culture. Fed Culture. Continuous culture. synchronization of cell division.	7.00 hrs
4.	Microbial Growth: Growth Condition. Physiology of growth. Methods of determining bacterial Numbers and Bacterial Mass. Exponential Growth and Generation time.	7.00 hrs
5.	Identification of Microorganism. Classification. Classical Method. Biochemical Method.	6.00 hrs
6.	Basics of Food Microbiology. Brief history. Introduction to important micro organisms in foods. Fermentation technology. Fermentation product. Food borne infections.	5.00 hrs
7.	Basics of Clinical Microbiology: Transmission of disease.	5.00 hrs
8.	Bioremediation; Organisms. Methodology. Applications. Limitations.	5.00 hrs

List of Books for reference:

1. The Desk Encyclopedia of Microbiology-Moselio Schaechter.
2. Manual of Clinical Microbiology-Murray, Baron, Jorgensen-Vol. 1 & 2
3. Molecular Genetics of Mycobacteria- Hatfull & Jacobs.
4. Microbiology: An Introduction – Batzing
5. Microbiology – Prescott, Harley & Klien.
6. General Microbiology by Stainenr.
7. Manual of Clinical Microbiology Vol 1 & 2 Edition.
8. Microbiology An Introduction by Berry L. Batzing Thomson learning 2002.
9. Medical Microbiology A Clinical Perspective By JB Sarma Paras Publishing 2001.
10. Microbiology Edition Six L.M. Prescott et al 2005 Mcgraw Hill Internation.
11. The Desk Encyclopedia of Microbiology - Moselio Schaechter
12. Text Book of Environmental Biotechnology – Vinod Soni & Vinay Sharma.
13. Practical Microbiology : Aneja

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PAPER3 : INTRODUCTION TO INSTRUMENTATION & TECHNIQUES

Sl.No.	Topics (Credits 4)	Hours:
1.	Colorimetry: Beer Lamberts' Law and its limitation. Photoelectric colorimeter.	48.0 6.00 hrs
2.	Spectrophotometer: Principles. Methodology. UV Visible Spectrophotometer. Absorption Spectra. Extinction Coefficient.	6.00 hrs
3.	Chromatography: Column Chromatography And Its Type. Thin Layer Chromatography. Gas Chromatography. HPLC.	10.00 hrs
4.	Electrophoresis: Principles. Methodology. Types of PAGE and SDS-PAGE.	8.00 hrs
5.	Centrifugation: Concept of rpm and g. Types of Centrifugation; zonal. density gradient, differential.	6.00 hrs
6.	ELISA Immunofluorescence. Immunocytochemistry. chemiluminescence. RIA.	6.00 hrs
7.	Autoradiography. radio-tracer techniques.	6.00 hrs

LIST OF BOOKS FOR REFERENCE:

1. PCR- McPherson & Moller
2. Fundamentals of Instrumentation and Measurement- Edited by Dominique Plako
3. Tools and Techniques of Biotechnology- Mousumi Debnath

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PRACTICALS (CREDITS- 8)

Sl.No.	Topics (Credits -8)	96 HRS.
1.	Biochemistry: Preparation of Buffers: Phosphate buffer. TAE buffer. Tris buffer. Acetate buffer. Titration of amino acids: Determination of titration curve of amino acids (Glycine, Glutamic acid and Lysine). Chromatography: Separation of amino acids by Paper and Thin layer Chromatography. Separation of protein by SDS- PAGE. Native PAGE	20.00 hrs
2.	UV/VIS Spectrophotometry Isolation of proteins from seeds and biological sources such as serum, egg white. Estimation of proteins in Biurette, Lowry's and Bradford method. Enzyme activity estimation of Acid. Phosphatase. Catalase. A -Amylase (Saliva). Plant Tissues (<i>Cuscuta</i>) Isolation and precipitation of protein by ammonium sulphate.	20.00 hrs
3.	Microbiology: Isolation and maintenance of pure cultures of microorganisms (a.) Preparation of media (b.) Purification (c) Maintenance of culture Gram staining of bacteria Bacterial growth curve Identification and enumeration of microorganisms from food samples by using selective media.	20.00 hrs
4.	Clinical Microbiology and Biochemistry Qualitative analysis of urine (microscopic examination of pus cells, protein, carbohydrate, Urea, creatinine etc. Demonstration of ELISA by using pregnancy kit. Blood group test. Clotting time. Haemoglobin estimation. TLC. DLC.	20.00 hrs
	Bioinformatics: How to use different website of Bioinformatics, Sequence Search, Alignment of sequence, Phylogeny analysis.	16.00 hrs

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SECOND SEMESTER (Credits- 20)

PAPER 1: MOLECULAR BIOLOGY AND GENETIC ENGINEERING

47.00 Hrs

Prerequisite Knowledge (From B.Sc. Syllabus):

Revision: 10.00 hrs

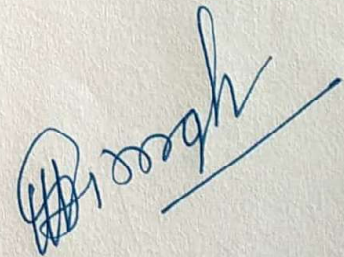
- 1 Mutation; spontaneous versus induced mutation. Molecular basis of mutation.
- 2 Enzymes related to Recombinant DNA Technology, Restriction endonucleases. Phosphatase. SI Nuclease. Terminal Transferase. DNA polymerase.
- 3 Basis and Evidences that nucleic acid is the genetic material–transformation in *Pneumococcus*. Frederick Griffith experiment. Hershey–Chase experiment. RNA as genetic material in small viruses.
- 4 Introductory experimental outline of a gene cloning experiment.

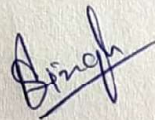
Sl.No.	Topics (Credits- 4)	Hours:
1.	DNA damage and DNA repair.	37.0
2.	Isolation of DNA. RNA. Bacteriophage and plasmid DNA.	3.00 hrs
3.	Cloning Vectors: Plasmids: structural and functional organization. Plasmid replication. Phages. Cosmids. Phagemids. YAC. BAC.	5.00 hrs
4.	Synthesis and cloning of c DNA. Construction of genomic and cDNA libraries.	6.00 hrs
5.	Introduction of plasmid and bacteriophage DNA into <i>E. coli</i> .	4.00 hrs
6.	Nick translation. Southern hybridization. Northern and Western blots. Colony hybridization.	4.00 hrs
7.	PCR Technology: Principles. Methodology. Application. Primer Designing.	6.00 hrs
8.	DNA finger printing and its applications.	4.00 hrs
9.	IPR	3.00 hrs
		2.00 hrs

List of Books for reference:

1. Genes – Lewin –Vol. V, VI, VIII & IX.
2. Molecular Biology –Clark
3. Molecular Biology of the Gene – Watson, Hopkins, Roberts & others
4. Biochemistry – Stryer – 4th edition & 6th edition.
5. Gene Cloning & DNA Analysis – Brown
6. Molecular Biology & Genomics – Mulhardt..
7. Gene Cloning – T.A.Brown.
8. Molecular Biotechnology - Glick & Pasternok
9. Cell & Molecular Biology – De Robertis.
10. Biochemistry & Molecular Biology – Elliott.
11. Plant Tissue Culture & Biotechnology – P.C.Trivedi
12. Recombinant DNA & Biotechnology – Bharat Singh
13. Medical Microbiology – J.B.Sarma
14. PCR – McPherson & Moller
15. Biotechnology – Trehan

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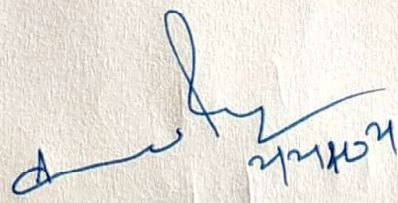
PAPER 2: IMMUNOLOGY & IMMUNOTECHNOLOGY

Sl.No.	Topics (Credits 4)	Hours: 38
1.	Introduction: Innate and acquired immunity.	4.00 hrs
2.	Nature of antigens. Antibody structure and function. Antigen - antibody reactions. Major Histocompatibility complex.	5.00 hrs
3.	Complement system. Hematopoiesis and differentiation.	5.00 hrs
4.	Cell-mediated cytotoxicity: Mechanism of cytotoxic T cells and NK cells mediated target cell lysis. Antibody dependent cell mediated cytotoxicity. Macrophage Mediated Cytotoxicity. Cytokines. MHC restriction. Immunological tolerance	6.00 hrs
5.	Interferons.	3.00 hrs
6.	Vaccines: Introduction. Types of vaccines. Vaccine development & Immunization.	5.00 hrs
7.	Hybridoma technology and production of monoclonal antibodies.	5.00 hrs
8.	Immunotechnology, Agglutination, Precipitation, application of ELISA, RIA.	5.00 hrs

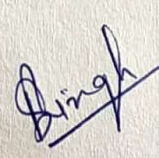
List of Books for reference:

1. Immunobiology – Kenneth, Murphy, Paul Travers, Mark Walport.
2. Immunobiology – Goldsby, Kindt, Osborne & Kuby.
3. Immunobiology – Roitt and Roitt.

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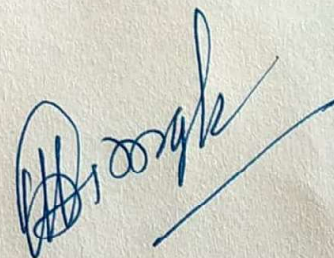
PAPER 3: PLANT & ANIMAL CELL CULTURE TECHNOLOGY

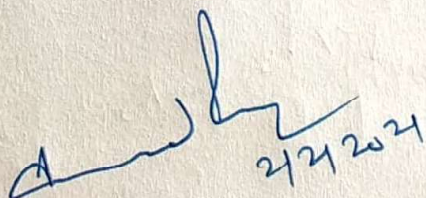
S.No.	Topics (Credits -4)	Hours:
1.	Animal cell culture: Introduction to cell and tissue culture.	5.00 hrs
2.	Synchronization in cell cultures-environmental and chemical induction.	5.00 hrs
3.	Media for cell and tissue cultures.	6.00 hrs
4.	Principles of aseptic culture techniques for Propagation and maintenance of animal's cells.	7.00 hrs
5.	Plant tissue culture: Media preparation for cell and tissue cultures.	5.00 hrs
6.	Principles of aseptic culture. Propagation and maintenance of tissue explants.	5.00 hrs
7.	Totipotency of plant cells. Embryo, endosperm, anther, pollen culture. and Protoplast culture	5.00 hrs

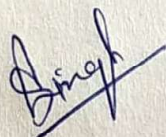
List of Books for reference:

1. Bacterial Pathogenesis – Salyer & Whitt.
2. Plant Tissue Culture & Biotechnology – P.C.Trivedi.
3. Advances in Microbial Toxin Research & its Biotechnological Exploitation – Rajeev K.Uppadhaya.
4. Medical Microbiology – J.B.Sarma.
5. Text Book of Biotechnology – Preeti Gupta.
6. Biotechnology – Trehan.
7. Biotechnology – Michael Fumento.
8. Principles of Biotechnology – R.A.Sharma.
9. Biotechnology – Smith.

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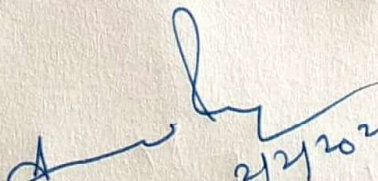
PRACTICALS SECOND SEMESTER

S.No.	Topics (Credits-8)	Hours: 120
1.	Isolation of DNA from <i>E.coli</i> and onion plants.	20.00 hrs
2.	Quantification of DNA by Spectrophotometer and gel Electrophoresis.	10.00 hrs
3.	PCR techniques.	20.00 hrs
4.	Restriction digestion of DNA using restriction endonucleases.	20.00 hrs
5.	ELISA (Enzyme Linked Immunosorbent Analysis) and Immunoelectrophoresis (using student's teaching kit)	20.00 hrs
6.	Plant tissue culture: Media preparation , Regeneration of explants by combination of auxins and cytokinins through callusing by using MS media.	30.00 hrs

PROJECT WORK / TRAINING / FIELD WORK / PROJECT WORK:

3-4 weeks training on techniques in pharmaceutical / confectionary/ agriculture/ aqua farming/ silk / cosmetic industries/ hospitals or research institutes.

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