FYUGP-CBCS

NOWGONG COLLEGE

(Autonomous)

SYLLABUS

Department of Biotechnology

Learning Outcome-based Curriculum Framework (LOCF) of
Four Year Undergraduate Programme
Choice-based Credit System with flexibility

Effective from Academic Year 2023-24

Syllabus is approved in Academic Council, Nowgong College (Autonomous)

Dated: 30th June, 2023

1 Introduction

The NEP-2020 offers an opportunity to effect paradigm shift from a teacher-centric to student-centric higher education system in India. It caters skill based education where the graduate attributes are first kept in mind to reverse-design the programs, courses and supplementary activities to attain the graduate attributes and learning attributes. The learning outcome-based curriculum framework for a degree in B.Sc. Biotechnology is intended to provide a comprehensive foundation to the subject and to help students develop the ability to successfully continue with further studies and research in the subject while they are equipped with required skills at various stages. Effort has been made to integrate use of recent technology and use of MOOCs to assist teaching-learning process among students. The framework is designed to equip students with valuable cognitive abilities and skills so that they are successful in meeting diverse needs of professional careers in a developing and knowledge-based society. The curriculum framework takes into account the need to maintain globally competitive standards of achievement in terms of knowledge and skills in Biotechnology and allied courses, as well develop scientific orientation, spirit of enquiry, problem solving skills, human and professional values which foster rational and critical thinking in the students. This course serves a plethora of opportunities in different fields right from classical to applied aspects in Biotechnology.

2. Graduate Attributes

On completion of the programme students are expected to have acquired the skills of critical thinking, effective communication, social research methods and social outreach. The attributes expected from the graduates of B.Sc Biotechnology are:

i. Develop an ability to solve, analyze and interpret data generated from experiments done in project work or practical courses.

ii. Demonstrate knowledge for in-depth analytical and critical thinking to identify, formulate and solve the issues related to Biotechnology Industry, Pharma industry, Medical or hospital related organizations, Regulatory Agencies, & Academia.

iii. Demonstrate skills to use modern analytical tools/ software/ equipment and analyze and solve problems in various courses of biotechnology.

iv. Adopt code of ethics in professional and social context and demonstrate exemplary professional, ethical and legal behaviors in decision making.

v. Apply written and oral communication skills to communicate effectively in healthcare, industry, academia and research

vi. Apply responsibilities to promote societal health and safety, upholding the trust given to the profession by the society.

vii. Develop skills, attitude and values required for self-directed, lifelong learning and professional development.

3. Flexibility-

The programmes are flexible enough to allow liberty to students in designing them according to their requirements. Students may choosea Minor and a MDC subject of their choice from the list of subjects provided to them by the institution.

4. Programme Objectives -

i. To imbibe strong foundation of Biotechnology in students.
ii. To make acquainted students with basic to high-level biotechnological concepts.
iii. To expose students with the various present time biotechnological researches.
iv. To update students with the scopes of biotechnology in various sectors like medical, industrial and entrepreneurship.
v. To make students do projects, which prepares them for jobs or researches.

5. Programme Learning Outcomes -

This programme aims to help student acquire knowledge on the fundamentals of biotechnology for sound and solid base. It also helps acquire knowledge in domains of biotechnology enabling their applications in industry and research. This course aims to provide students with major biotechnology concepts and tools necessary to implement them. The programme also includes entrepreneurship education which promotes students to think unconventional talents and skills for development of viable commercial product. It aims at teaching the skills of converting basic biology knowledge into sustainable business by providing innovative solutions to the existing challenges in the field of biotechnology. This course structure also motivates and assist students to pursue careers in related disciplines especially in research field, pharmaceuticals, food industries etc.

Students will acquire a *Certificate* after completion of a year, a *Diploma* after completion of two years, *Degree (with Major/Minor)* after 3 years and *Degree (with Honours/by Research)* after 4 years.

6. Teaching Learning Process -

The Department of Biotechnology at Nowgong College (Autonomous) is responsible for organizing the Bachelor of Science course, Biotechnology. Theoretical and practical instructions are given to the learners following the course of study provided in the syllabi. 90 classes are arranged for instructions and practical excluding examination in a semester.

7. Teaching Pedagogy -

Teaching Pedagogy involves classroom interaction, discussion, lectures, course based practical work, viva-voce, demonstration, presentation, classroom tests, assignments and online courses (MOOCs etc.). The achievement of course is described in each papers as learning outcomes in details.

8. Assessment Methods/ Evaluation Scheme -

i. English shall be the medium of instruction and examination for the Biotechnology subject.

ii. Examinations shall be conducted at the end of each semester as per the academic calendar notified by the Nowgong College (Autonomous).

iii. The assessment broadly comprises of internal assessment (Sessional Examination, attendance, Assignments and Seminar presentation) and End semester examination.

iv. 4 credit papers = 100 marks (60T+20IA+20P)
2 credit papers = 50 marks (30T+10IA+10P) &
AEC**:** 50 marks (40T+10IA)

v. Internal assessment of 20 marks is comprises with 06 marks from assignment, 10 marks from sessional examination and 4 marks from attendance.

vi. Each practical paper will carry 20 marks including 15 marks for continuous evaluation and 2 marks for practical note book and 3 marks for the oral test or viva voce. Hardcopy of practical file has to be maintained by the students for each practical paper and has to be submitted in the concerned department at the time of examination.

Question pattern:

- For 100 marks papers [1 marks x 7 (no options) , 2 marks x 4 (no options, 5 marks x 3 (5 options), 10 marks x 3 (5 options)]
- For 50 marks papers [1 marks x 4 (no options) , 2 marks x 3 (no options, 5 marks x 2 (4 options), 10 marks x 1 (2 options)]
- For AEC 50 marks papers [1 marks x 4 (no options), 2 marks x 3 (no options, 5 marks x 2 (4 options), 10 marks x 2 (4 options)]

Course structure

Semester	Major (Maj)	Minor (Min)	Inter-Disciplinary	AEC	SEC	VAC (Any Two)	Summer Internship	Research Project/Dissertation	Total
I	BIOT-MAJ-1014 - Introduction to Biotechnology, Cell Biology & Genetics	BIOT-MIN-1014- Basic Cell Biology	BIOT-IDC-1014 - Basic Cell Biology	ASSA/HIND/BENG-AEC-1012 Jugajogmulok Axomiya/ Vyakaran Evam Vyavaharik Hindi/Byowoharic Bangla – I	XXXX-SEC-1014	UNIN-VAC-1012 (Understanding India) ENSC-VAC-1012 (Environmental Science) NASS-VAC-1012 (National Service Scheme)	---	---	22
II	BIOT-MAJ-2014- Introductory Microbiology, Tools and Techniques	BIOT-MIN-2014- Recombinant DNA technology and Instrumentation	BIOT-IDC-2014- Recombinant DNA technology and Instrumentation	ASSA/HIND/BENG -AEC-2012 Byowoharic Axomiya/ Karyalayi Hindi /Byowoharic Bangla – II	XXXX-SEC-2014	DITS-VAC-2012 (Digital Technological Solutions) YOMH-VAC-2012 (Yoga and Mental Health) NACC-VAC-2012 (National Cadet Corps)	---	---	22
Certificate after 1 year									
III	BIOT-MAJ-3014- Elementary	BIOT-MIN-3014-	BIOT-IDC-3014-	ENGL-AEC-3012 (English and	XXXX-SEC-3014	------	-----	--------	22

	Molecular Biology BIOT-MAJ-3024-General Microbiology	Application of Biotechnology	Application of Biotechnology	Mass Communication)					
IV	BIOT-MAJ-4014-Fundamentals of Biochemistry BIOT-MAJ-4024-Genetics, Phylogeny and Evolution BIOT-MAJ-4034-IPR, Bioethics and Biosafety BIOT-MAJ-4044 – Biotechnology in Human Welfare	BIOT-MIN-4014-Entrepreneurship Development	-------	ENGL-AEC-4012 (Academic Writing)	------	-	-	------	22

Diploma after 2 years									
V	BIOT-MAJ-5014-Genomics and Molecular Breeding BIOT-MAJ-5024-Proteomics and Enzymology BIOT-MAJ-5034-Application of Biotechnology in Agriculture BIOT-MAJ-5044-Medical Biotechnology	BIOT-MIN-5014-Environmental Biotechnology	-------	------	-------	-------	BIOT-INTE-5012 (Internship)	-------	22
VI	BIOT-MAJ-6014-Recombinant DNA Technology BIOT-MAJ-6024-Bioinformatics and Biostatistics BIOT-MAJ-6034-	BIOT-MIN-6014- Food Biotechnology and Bioprocessing	-------	----	-----		----	------	22

	Environmental Biotechnology BIOT-MAJ-6044-Entrepreneurship Development BIOT-MAJ-6052-Dissertation / Project								
Degree after 3 years (with Major/Minor)									
VII	BIOT-MAJ-7014-Tissue Culture and Transgenic Technologies in Biotechnology BIOT-MAJ-7024-Immunology BIOT-MAJ-7034-Bio Analytical Tools	BIOT-MIN-7014- IPR, Bioethics and Biosafety	---------	--------	---------	REET-VAC-7012 (Research Ethics)	-------	REME-MAJ-7044 (Research Methodology)	22

VIII	BIOT-MAJ-8014-Biodiversity and Conservation Genetics	BIOT-MIN-8014-Biodiversity and Conservation Genetics				INPR-VAC-8012 (Intellectual Property Right)		BIOT-DISS-80112 (Dissertation) (Those who are undertaking Research Project or Dissertation) OR BIOT-MAJ-8024- Genetic Engineering BIOT-MAJ-8034-Industrial Biotechnology BIOT-MAJ-8044- Food Biotechnology and Bioprocessing (Those who	22

								are not undertaking Research Project or Dissertation)	
Degree after 4 years (with Honours/by Research)									176

N.B.: 1. 4 credit papers = 100 marks (60T+20IA+20P)

2. 2 credit papers = 50 marks (30T+10IA+10P) & AEC: 50 marks (40T+10IA)

Question Pattern:

- For 100 marks papers [1 marks x 7 (no option) , 2 marks x 4(no option) , 5 marks x 3 (5 options), 10 marks x 3 (5 options)]
- For 50 marks papers [1marks x 4 (no option), 2 marks x 3 (no option), 5 marks x 2 (4 options), 10 marks x 1 (2 options)]
- For AEC 50 marks papers [1 marks x 4 (no options) , 2 marks x 3 (no options), 5 marks x 2 (4 options), 10 marks x 2 (4 options)]

Undergraduate Biotechnology Courses

Major Courses:

BIOT-MAJ-1014 - Introduction to Biotechnology, Cell Biology & Genetics

BIOT-MAJ-2014- Introductory Microbiology, Tools and Techniques

BIOT-MAJ-3014- Elementary Molecular Biology

BIOT-MAJ-3024- General Microbiology

BIOT-MAJ-4014- Fundamentals of Biochemistry

BIOT-MAJ-4024- Genetics, Phylogeny and Evolution.

BIOT-MAJ-4034- IPR, Bioethics and Biosafety

BIOT-MAJ-4044 – Biotechnology in Human Welfare

BIOT-MAJ-5014- Genomics and Molecular Breeding

BIOT-MAJ-5024- Proteomics and Enzymology

BIOT-MAJ-5034- Application of Biotechnology in Agriculture

BIOT-MAJ-5044- Medical Biotechnology

BIOT-MAJ-6014- Recombinant DNA Technology

BIOT-MAJ-6024- Bioinformatics and Biostatistics

BIOT-MAJ-6034- Environmental Biotechnology

BIOT-MAJ-6044- Entrepreneurship Development

BIOT-MAJ-6052- Dissertation

BIOT-MAJ-7014- Tissue Culture and Transgenic Technologies in Biotechnology

BIOT-MAJ-7024- Immunology

BIOT-MAJ-7034- Bio Analytical Tools

BIOT-MAJ-7044- Research Methodology

BIOT-MAJ-8014- Biodiversity and Conservation Genetics

BIOT-MAJ-8024- Genetic Engineering (Those who not undertaking Research Project or Dissertation)

BIOT-MAJ-8034- Industrial Biotechnology (Those who not undertaking Research Project or Dissertation)

BIOT-MAJ-8044- Food Biotechnology and Bioprocessing (Those who not undertaking Research Project or Dissertation)

BIOT-MAJ-80112- Dissertation

Minor Courses:

BIOT-MIN-1014- Basic Cell Biology

BIOT-MIN-2014- Recombinant DNA technology and Instrumentation

BIOT-MIN-3014- Application of Biotechnology

BIOT-MIN-4014- Entrepreneurship Development

BIOT-MIN-5014- Environmental Biotechnology

BIOT-MIN-6014- Food Biotechnology and Bioprocessing

BIOT-MIN-7014- IPR, Bioethics and Biosafety

BIOT-MIN-8014- Biodiversity and Conservation Genetics

Interdisciplinary Courses:

BIOT-IDC-1014 - Basic Cell Biology

BIOT-IDC-2014- Recombinant DNA technology and Instrumentation

BIOT-IDC-3014- Application of Biotechnology

Semester I
Course Code: BIOT-MAJ-1014
Course Paper: Introduction to Biotechnology, Cell Biology & Genetics
Credit: 4 (Lecture–45 Practical-15) Total: 100 (60T+20P+20IA)

Objective:

- To impart knowledge on the basics of biotechnology and the biological system.

Learning Outcomes:

- Understanding the historical perspectives and various scopes of Biotechnology.
- Getting an insight into the cell and its structural organization and functional roles of important cell organelles.
- Ability to understand the laws governing the inheritance of characters in biological system.
- Delineating the cell division abnormalities and agents underlying gene mutation.

CONTENTS

Theory

UNIT I:

Introductory concept, Development and Scope of Biotechnology. Historical perspectives.
Cell as a Basic unit of Living Systems, Discovery of cell, the Cell Theory, Organisation of structure and functions of prokaryotic and eukaryotic cells of plant and animals – cell wall & plasma membrane of bacteria and plants.
Structural organization and functions of cell organelles: nucleus, mitochondria, golgi bodies, endoplasmic reticulum, chloroplast, ribosomes, lysosomes, peroxisomes, vacuoles, cytosol, Cytoskeletons structures (Microtubules, Microfilaments and Intermediate filaments) and motility function.

UNIT II:

Chromosome - General Introduction, Discovery, Morphology and structural organization – Centromere, Secondary constriction, Telomere, Chromonema, Euchromatin and Heterochromatin, Chemical composition and Karyotype. Single-stranded and multi- stranded hypothesis
Cell Division Cell cycle, phases of cell cycle, Regulation of cell cycle-, checkpoints and enzymes involved. Significance of cell cycle, interphase nucleus, stages of mitosis and meiosis, programmed cell death.

UNIT III:

Gene interaction: Deviations to Mendelian inheritance, Complementary genes- Flower colour in sweet peas, Multiple factors–Skin colour in human beings, Epistasis, Multiple allelism: Blood groups in Humans- ABO and Rh.
Sex-linked inheritance- Colour blindness, hemophilia, Y-linked traits.

UNIT IV:

Introduction to linkage and crossing over: Chromosome theory of inheritance, Linkage in maize and Drosophila, Mechanism of crossing over and its importance, chromosome mapping.

Chromosomal variations: A general account of structural and numerical aberrations, chromosomal evolution of wheat and cotton.
Mutations: Types of mutations, Spontaneous and induced, Mutagens: Physical and chemical, Mutation at the molecular level, Applications of mutations- plants, animals and microbes.
Sex Determination in Plants and animals: Concept of allosomes and autosomes, XX- XY, XX-XO, ZW-ZZ, ZO-ZZ types.
Human Genetics: Karyotype in man, inherited disorders – Allosomal (Klinefelter syndrome and Turner's syndrome), Autosomal (Down syndrome and Cri-Du-Chat Syndrome).
Epigenetics: Plant and humans.

Practical/ Presentation:

1. Study and maintenance of simple and compound microscope
2. Use of Micrometer and calibration, measurement of onion epidermal cells and yeast
3. Study of stages in mitosis and meiosis from onion root tips and Tradescantia flower buds.
4. Mounting of polytene chromosomes
5. RBC cell count by Haemocytometer
6. Study of simple genetic problems based on theory.

Suggested Readings:

1. Karp G., Cell and Molecular Biology: Concepts and Experiments, 7th Edition (John Wiley & Sons, Inc., 2013).
2. Scott, M. P. et al, Molecular Cell Biology, 6th Edition (W. H. Freeman, 2007).
3. Alberts, B. et al., Molecular Biology of the Cell, 5th Edition (Garland Publishing, 2008).
4. Principles of Genetics (V edition) -Snustad, D.P. and Simmons, M.J. John Wiley &Sons; 2008.

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Semester I
Course Code: BIOT-MIN-1014
Course Paper: Basic Cell Biology
Credit: 4 (Lecture–45 Practical-15) Total: 100 (60T+20P+20IA)

Objective:

- To give exposure on the basics of cell biology and its related aspects.

Learning Outcomes:

- Understanding the concept of cell theory; structural organization and functions of prokaryotic and eukaryotic cells as well as their comparative account.
- Getting an insight into the structural organization and functional roles of important cell organelles.
- Understanding the structural organization and functional role of nucleus, the controlling centre of a cell.

CONTENTS

Theory

UNIT I: Introduction to cell

Sub unit I:

Cell theory, Structural organization of prokaryotic cell, eukaryotic cells and their function.

Sub unit II

Comparative characters of prokaryotes and eukaryotes.

UNIT II: Plasma membrane

Sub unit I:

Structural organization of cell membrane, plasma membrane and their function

Sub unit II:

Mechanism of transport across the plasma membrane, Sodium Potassium pump, Glucose transport

UNIT III: Cell organelles; structure & function

Sub unit I:

Endoplasmic reticulum, golgi complex, lysosome, peroxisome and vacuoles

Sub unit II:

Mitochondria; role of mitochondria in oxidative reactions and electron transport chain. Chloroplast and its role in photosynthesis.

UNIT IV: Nucleus

Nucleus- Structure, organization and function, Nuclear envelope, role of nuclear pore in transport across the envelope, nucleoplasm and nucleolus,

Practical/ Presentation:

1. Study of prokaryotic and eukaryotic cell
2. Cell division in onion root tip
3. Demonstration of Dialysis
4. Study of plasmolysis and de-plasmolysis
5. Study of morphological variations in cell nuclei

Suggested Readings:

1. Bruce Alberts et al. Molecular Biology of cell. Garland Publications
2. Daniel. Molecular Cell Biology.Sceintific American Books.
3. Jack D. Bruke. Cell Biology.The William Twilkins Company.
4. Old and Primrose. Principles of Gene Manipulations.Black Well Scientific Publications.
5. Ambrose and Dorouthy M Hasty. Cell Biology.ELBS Publications.
6. Sharp. Fundamentals of Cytology. Mc Graw Hill Company.

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Semester I
Course Code: BIOT-IDC-1014
Course Paper: Basic Cell Biology
Credit: 4 (Lecture–45 Practical-15) Total: 100 (60T+20P+20IA)

Objective:

- To give exposure on the basics of cell biology and and its related aspects.

Learning Outcomes:

- Understanding the concept of cell theory; structural organization and functions of prokaryotic and eukaryotic cells as well as their comparative account.
- Getting an insight into the structural organization and functional roles of important cell organelles.
- Understanding the structural organization and functional role of nucleus, the controlling centre of a cell.

CONTENTS

Theory

UNIT I: Introduction to cell

Sub unit I:

Cell theory, Structural organization of prokaryotic cell, eukaryotic cells and their function.

Sub unit II

Comparative characters of prokaryotes and eukaryotes.

UNIT II: Plasma membrane

Sub unit I:

Structural organization of cell membrane, plasma membrane and their function

Sub unit II:

Mechanism of transport across the plasma membrane, Sodium Potassium pump, Glucose transport

UNIT III: Cell organelles; structure & function

Sub unit I:

Endoplasmic reticulum, golgi complex, lysosome, peroxisome and vacuoles

Sub unit II:

Mitochondria; role of mitochondria in oxidative reactions and electron transport chain.Chloroplast and its role in photosynthesis.

UNIT IV: Nucleus

Nucleus- Structure, organization and function, Nuclear envelope, role of nuclear pore in transport across the envelope, nucleoplasm and nucleolus,

Practical/ Presentation:

1. Study of prokaryotic and eukaryotic cell
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3. Jack D. Bruke. Cell Biology.The William Twilkins Company.
4. Old and Primrose. Principles of Gene Manipulations.Black Well Scientific Publications.
5. Ambrose and Dorouthy M Hasty. Cell Biology.ELBS Publications.
6. Sharp. Fundamentals of Cytology. Mc Graw Hill Company.

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Semester II
Course Code: BIOT-MAJ-2014
Course Paper: Introductory Microbiology, Tools and Techniques
Credit: 4 (Lecture–45 Practical-15) Total: 100 (60T+20P+20IA)

Objective:

- To introduce the wide microbiological world and the various tools and techniques used in this field.

Learning Outcomes:

- Understanding the historical discoveries made in the field of microbiology and the evolution of microbiology.
- Learning the basic concepts of microbial control, microbial nutrition, growth and genetics.
- Knowing about various diseases caused in humans by microbial pathogens.

CONTENT

Theory

UNIT I

Definition, History, Importance and Scope of microbiology; Classification and nomenclature of Microbes; Characteristics and examples of *Archaebacteria,*eubacteria, viruses, viroids and prions; Bacteriophage – lytic and lysogenic cycle;

UNIT II

Control of microorganisms – Methods of sterilization, disinfection, sanitation, pasteurization, physical andchemical methods of control.
Staining techniques – simple (Monochrome and negative) anddifferential (Gram and acidfast).

UNIT III

Bacterial nutrition – Nutritional classes of microorganisms; Microbial media and its types; Isolation of pure culture from natural sources and its maintenance; Batch and continuous culture; Measurement of bacterial growth; Growth curve, conditions affectinggrowth.

UNIT IV

Introduction to microbial pathogens and diseases of human being (Cholera, Dysentery, Tuberculosis, Tetanus, Measles, Pox, Mumps, Influenza, Rabies,Poliomyelitis, Toxoplasmosis, Candidiasis, HIV etc.)

Practical/ Presentation:

1. Preparation of nutrient agar slants, plates and nutrient broth and their Sterilization
2. Inoculation of agar slants, agar plate and nutrient broth.
3. Culture of micro-organism using various techniques for soil and water.
4. Simple (monochrome and negative) and Differential (gram and acid fast) staining procedures; Staining of endospore, flagellar, cell wall, Capsul and negative staining.
5. Colony counting and growth curve of *E. coli*.

Suggested Readings:

1 Microbiology: An Introduction (9th edition)- Tortora, G.J., Funke, B.R. and Case, C.L. Pearson Education; 2008.

2. Prescott, Harley and Klein's Microbiology (7th edition)- Willey, J.M., Sherwood, L.M., Woolverton, C.J. and Prescott, L.M. McGraw Hill Higher Education; 2008.
3. Brock Biology of Microorganisms (12th edition)- Madigan, M.T., Martinko, J.M. and Parker, J. Pearson/Benjamin Cummings; 2009. 4. General Microbiology (5th edition)- Stanier, R.Y., Ingraham, J.L., Wheelis, M.L. and Painter, P.R. McMillan; 2005.

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Semester II
Course Code: BIOT-MIN-2014
Course Paper: Recombinant DNA technology and Instrumentation
Credit: 4 (Lecture–45 Practical-15) Total: 100 (60T+20P+20IA)

Objectives:

- To give exposure on the rDNA technology used in Biotechnology, its importance in the field of medical science and microbiology.
- To understand the working and principles of various instruments used in biotechnology.

Learning Outcomes:

- Understanding the basic concept of rDNA technology as the basis of genetic modification of cellular organisms.
- Getting an insight into one of the most versatile molecular technique of Polymerized Chain Reaction (PCR), process of DNA fingerprinting and the use of rDNA technologies in the production of therapeutic products.
- Familiarizing with the important techniques necessary for the study and prediction of different processes occurring in microbes and other cellular organisms.

CONTENTS
Theory
UNIT I
Sub unit I :
Molecular tools and applications -restriction enzymes, ligases, polymerases
Sub unit II :
Gene Recombination and Gene transfer: Plasmids and other cloning vectors ,Microinjection, Electroporation, Ultrasonication,
Sub unit III
Principle and applications of Polymerase chain reaction (PCR)
UNIT II
Sub unit I
DNA fingerprinting, use and application.
Sub unit II
Therapeutic products produced by genetic engineering- human hormones, vaccines (one example each)
UNIT III
Genetic engineering in plants: Use of Agrobacterium tumefaciens, Tiplasmids;Strategies for gene transfer to plant cells, Direct DNA transfer to plants
UNIT IV
Principle and use of microscopy, centrifugation, chromatography, spectrophotometry.

Practical/ Presentation:
1. Isolation of chromosomal DNA from plant tissues/ E.coli.

2. Qualitative and quantitative analysis of DNA using spectrophotometer.
3. Restriction digestion of DNA.
4. PCR amplification of gene.

Suggested Readings:

1. Gene Cloning and DNA Analysis- Brown, T.A. Blackwell Publishing, Oxford, UK; 2006.
2. Biotechnology-Applying the Genetic Revolution- Clark, D.P. and Pazdernik, N.J. Elsevier Academic Press, USA; 2009.
3. Molecular Biotechnology- Principles and Applications of recombinant DNA- Glick, B.R. and Pasternak, J. J.ASM Press, Washington; 2003.
4. Principles of Gene Manipulation and Genomics- Primrose, S.B. and Twyman, R.M. Blackwell Publishing, Oxford, U.K.; 2006.
5. Molecular Cloning-A Laboratory Manual- Sambrook, J., Fritsch, E.F. and Maniatis, T. Cold Spring Harbor Laboratory Press; 2001.

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Semester II
Course Code: BIOT-IDC-2014
Course Paper: Recombinant DNA technology and Instrumentation
Credit: 4 (Lecture–45 Practical-15) Total: 100 (60T+20P+20IA)

Objectives:

- To give exposure on the rDNA technology used in Biotechnology, its importance in the field of medical science and microbiology.
- To understand the working and principles of various instruments used in biotechnology.

Learning Outcomes:

- Understanding the basic concept of rDNA technology as the basis of genetic modification of cellular organisms.
- Getting an insight into one of the most versatile molecular technique of Polymerized Chain Reaction (PCR), process of DNA fingerprinting and the use of rDNA technologies in the production of therapeutic products.
- Familiarizing with the important techniques necessary for the study and prediction of different processes occurring in microbes and other cellular organisms.

CONTENTS
Theory
UNIT I
Sub unit I:
Molecular tools and applications -restriction enzymes, ligases, polymerases
Sub unit II:
Gene Recombination and Gene transfer: Plasmids and other cloning vectors ,Microinjection, Electroporation, Ultrasonication,
Sub unit III:
Principle and applications of Polymerase chain reaction (PCR)
UNIT II
Sub unit I
DNA fingerprinting, use and application.
Sub unit II
Therapeutic products produced by genetic engineering- human hormones, vaccines (one example each)
UNIT III
Genetic engineering in plants: Use of Agrobacterium tumefaciens, Tiplasmids; Strategies for gene transfer to plant cells, Direct DNA transfer to plants
UNIT IV
Principle and use of microscopy, centrifugation, chromatography, spectrophotometry.

Practical/ Presentation:
1. Isolation of chromosomal DNA from plant tissues/ E.coli.

2. Qualitative and quantitative analysis of DNA using spectrophotometer.
3. Restriction digestion of DNA.
4. PCR amplification of gene.

Suggested Readings:

1. Gene Cloning and DNA Analysis- Brown, T.A. Blackwell Publishing, Oxford, UK; 2006.
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3. Molecular Biotechnology- Principles and Applications of recombinant DNA- Glick, B.R. and Pasternak, J. J.ASM Press, Washington; 2003.
4. Principles of Gene Manipulation and Genomics- Primrose, S.B. and Twyman, R.M. Blackwell Publishing, Oxford, U.K.; 2006.
5. Molecular Cloning-A Laboratory Manual- Sambrook, J., Fritsch, E.F. and Maniatis, T. Cold Spring Harbor Laboratory Press; 2001.

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ONE YEAR CERTIFICATE COURSE COMPLETED