Eklavya University Damoh MP

M.Sc. III Semester

Biotechnology

Session 2020 onwards

School of Basic & Applied Science

EKLAVYA UNIVERSITY, DAMOH (M.P.)

Scheme of Examination M.Sc. (Biotechnology) III Semester

For batch admitted in Academic Session 2023-24

Subject wise distribution of marks and corresponding credits

S. No.	Subject Name	Subject Code	Paper Name	Maximum Marks Allotted											Total Marks	Contact Periods Per week			Total Credits
				Theory Slot									Practical Slot						
				End Semester				Mid term Examination				Quiz/ Assignment/ Attendance	End Sem	Lab Work/ Sessional		L	T	P	
				P1	P2	P3	P4	P1	P2	P3	P4								
1	Common	MCOVI20S301	Comprehensive Viva											50	50	0	0	4	4
		MPRES20S301	Presentation											50	50	0	0	4	4
2	Biotechnology	MBIOT20S301	Animal Cell And Tissue Culture (Paper - I)	30				15				5			50	3			3
		MBIOT20S302	Genetic Engineering (Paper - II)		30				15			5			50	3			3
		MBIOT20S303	Applied Biotechnology (Paper - III)			30				15		5			50	3			3
		MBIOT20S304	Biostatistics, Computers & Bioinformatics (Paper - IV)				30				15	5			50	3			3
		MBIOT20S305	Paper- I and II, Practical, I-Sitting (Practical - I)										30	20	50			2	2
		MBIOT20S306	Paper- III and IV, Practical, II-Sitting (Practical - II)										30	20	50			2	2

Induction programme of three weeks (MC): Physical activity, Creative Arts, Universal Human Values, Literary, Proficiencey Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations.

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Class			M.Sc. (Biotechnology)
Semester/Year			III Semester
Subject & Subject Code			Biotechnology- MBIOT20S301
Paper			Animal Cell And Tissue Culture – 301
Max. Marks			30
Credit			Total Credits
L	T	P	3
3	0	0	

Course Objectives:

The goal of "Animal Cell Culture Techniques" is for students to acquire the necessary practical skills for the isolation of animals cells for in vitro studies, maintenance of animal cells in vitro, manipulation of animal cells in vitro, and application of molecular techniques to in vitro situations.

Course Outcome:

1. Successfully maintain cultures of animal cells and established cell lines with good viability, minimal contamination and appropriate documentation.
2. Perform supportive or episodic tasks relevant to cell culture, including preparation and evaluation of media, cryopreservation and recovery, and assessment of cell growth/health.
3. Recognize and troubleshoot problems common to routine cell culture.
4. Knowing and understanding the principles of cell culture techniques
5. Managing to manipulate with cell cultures.

Student Learning Outcomes (SLO):

1. Knowing the principles of cell culture techniques, importance of sterility and good aseptic technique
2. Manipulations with cell cultures, student's aseptic technique during these manipulations, student's accuracy and awareness during manipulations and subculturing of animal cells in vitro.
3. Ability to characterize cell culture problems, present possibilities, applications and future perspectives.
4. Knowing the required conditions for cell cultures, required media and the equipment
5. Demonstrate an understanding of the concepts of mammalian cell culture.
6. Utilize lab protocols to carry out common mammalian cell culture techniques.

Unit	Syllabus	Periods
UNIT - I	Equipment and materials used for animal culture technology. Balanced salt solution and simple growth medium. Role of carbon dioxide serum and supplements. Serum & protein free defind media and their applications.	12
UNIT - II	Basic technique of manmalian cell culture in vitro disaggregation of tissue and primary culture, maintenance of cell culture, cell separation. Primary and established cell line. Measurement of viability and cytotoxicity. Biology and characterization of the cultured cells, measuring parameters of growth.	12

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Unit	Syllabus	Periods
NIT - III	Scaling up of animal cell culture. Cell synchronization Cell cloning and micromanipulation Cell transformation.	12
UNIT - IV	Application of animal cell culture. Stem cell culture, embryonic stem cells and their application Cell culture based vaccines. Somatic cell genetics	12
UNIT - V	Organ and histotypic cultures Measurement of cell death Apoptosis Three dimensional culture and tissue engineering.	12

REFERENCE BOOKS –

1. Culture of Animal Cells (3rd Edition), R Ian Freshney Wilcy - Liss
2. Animal Cell culture - Practical Approach Ed. John R.W. Masters, OXFORD
3. Cell Growth and Division; A Practical Approach, Ed. Basega, IRL Press.
4. Cell Culture Lab Fax Eds. M Butler & M Dawson, Bios Scientific Publications Ltd. Oxford
5. Animal cell Culture Techniques Ed. Clynes Springer
6. Methods in cell Biology Vol 57 Animal Cell Culture Methods Ed. Jenni P Mather and David Barnes Academic Press.

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EKLAVYA UNIVERSITY
ज्ञान प्राप्तये लक्ष्य संधानम्

School of Basic and Applied Sciences

Class				M.Sc. (Biotechnology)
Semester/Year				III Semester
Subject & Subject Code				Biotechnology- MBIOT20S302
Paper				Genetic Engineering – 302
Max. Marks				30
Credit			Total Credits	
L	T	P	3	
3	0	0		

Course Objectives:

After this lesson, students should be able to: List several present day applications of genetic engineering. Describe general techniques used by genetic engineers to modify DNA. Analyze the benefits and drawbacks of manipulating an organism's DNA.

Course Outcome:

The students will have knowledge of

1. Tools and strategies used in genetic engineering.
2. Applications of recombinant DNA technology and genetic engineering. from academic and industrial perspective
3. Genetic engineering in problem solving and in practice.
4. Tools and techniques of genetic engineering DNA manipulation enzymes, genome and transcriptome analysis and manipulation tools,
gene expression regulation, production and characterization of recombinant proteins.
5. Genetic engineering in biological research.

Student Learning Outcomes (SLO):

At the end of the course, a successful student will be able to

1. Understand and explain the concept of genetic engineering including the techniques, applications and limitations.
2. Demonstrate the ability to design recombinant molecules and apply information extracted from a variety of sources including journal articles, technical bulletins, product manuals, and drug information sheet to solve problems.
3. Apply learned knowledge to their future research.
4. Perform basic genetic engineering experiments at the end of course.
5. Acquire knowledge of advances in biotechnology- healthcare, agriculture and environment clean-up via recombinant DNA technology.

Unit	Syllabus	Periods
UNIT - I	**Molecular Tools and Their Applications**: Restriction enzymes modification enzymes, DNA and RNA markers Prokaryotic host vectors system, characteristics of E. coli in host, vectors for cloning in E. coli (Plasmid, bacteriophage and plasmid - phage) Eukaryotic host vector system: SV 40, bovine papilloma virus, adenovirus, vaccinia virus baculovirus and retrovirus vectors, Tiplasmid, caulinovirus and germinini virus as cloning vector, Isolation of enzyme DNA sequencing, synthesis and mutation, detection and separation cloning, gene expression.	12

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Unit	Syllabus	Periods
UNIT - II	**Nucleic Acid:** Purification. Nucleic Acid Amplification and its Application. 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.	12
UNIT - III	Construction, cloning and selection, vector, insert ligation, infection, transfection, cloning, methods for screening and selection of recombinant clones. DNA libraries, types, advantages and disadvantages of different types of libraries, construction of genomic and full length cDNA libraries. Expression strategies for Heterologous genes: Vector engineering and codon optimization host engineering, in vitro transcription and translation, expression in bacteria, yeast insects and insect cells, mammalian cells and plants. T-DNA and transposon tagging : Role of gene tagging in gene analysis. T- DNA and transposon tagging, identification and isolation of genes through T-DNA of transposons.	12
UNIT - IV	**Gene therapy:** vector engineering strategy of gene delivery, gene replacement/ augmentation, gene correction, gene editing, gene regulation and silencing. Site directed mutagenesis, and protein engineering. Principle and applications of blotting techniques (Southern Northern and Western blotting Gel mobility shift assay, DNA finger printing and foot printing restriction fragment length polymorphism (RFLP), Random Amplified Polymorphism (RAPD) and chromosome mapping. Patenting Regulating the use of Biotechnology Patenting biotechnological invention.	12
UNIT - V	**Application of recombinant DNA** technology in medicine and industry. Transgenic animals: Methodology and applications. Transgenic plants: Methodology and application. Gene therapy: Prospects of human somatic cell gene therapy, antisense therapy.	12

REFERENCE BOOKS –

1 Molecular cloning a Laboratory Manual, J Sambrook E.F. Fritsch and T Maniatis, Cold Spring Harbor Laboratory Press, New York 2000

2 DNA Cloning a Practical Approach, DM Glove and BD Hames, IRI Press, Oxford 1995

3 Molecular and Cellular Methods in Biology and Medicine P.B. Kaurman, W. Wt. D Kim and L.I. Cseko, CRC Press Florida 1995

4 Route Maps in Gene Technology M.R. Walker and R Rapley Black Well Science Ltd. Oxford 1997

5 Genetic Engineering An Introduction to gene analysis and exploitation in eukaryotes S.M. Kingsman and A.J. Kingsman Blackwell Scientific Publication Oxford 1998.

6 Molecular Biotechnology - Glick

7 Recombinant DNA (2nd Ed 1992) Watson et al.

8 Principles of Gene Manipulation (5th Ed1994) Old and Primros.

9 Gene Cloning An Introduction (3rd Ed 1995) T.A. Brown.

10 Molecular Cloning (Vol.I, II & III 2001) Sambrook and Russell.

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EKLAVYA UNIVERSITY
उत्तम शासने लक्ष्य संधानम्

School of Basic and Applied Sciences

Class				M.Sc. (Biotechnology)
Semester/Year				III Semester
Subject & Subject Code				Biotechnology- MBIOT20S303
Paper				Applied Biotechnology – 303
Max. Marks				30
Credit			Total Credits	
L	T	P	3	
3	0	0		

Course Objectives:

This program will expose the students to basic and applied aspects of molecular basis of human diseases, animal modelling of human diseases, and the allied subjects like molecular biology and developmental biology.

Course Outcome:

Students will be able to:

1. Demonstrate professional and scientific communication appropriate for biotechnology settings.
2. Demonstrate comprehensive understanding of organizational processes and product development pipelines.
3. Distinguish among diverse methods and technologies and their applications in biotechnology.
4. Demonstrate strategic leadership and decision-making skills necessary in biotechnology.
5. Appraise the current regulatory, quality control, and legal frameworks that impact biotechnology.
6. Demonstrate professional and ethical behaviours that foster positive and productive interactions in diverse biotechnology settings.

Student Learning Outcomes (SLO):

1. Select the most appropriate modalities, methodologies, tools, and practices to communicate complex ideas effectively across diverse audiences.
2. Demonstrate effective listening, written, verbal, and nonverbal communication skills.
3. Construct and deliver effective professional presentations.
4. Demonstrate understanding of relevant domestic and global regulatory agencies, laws, policies, and guidance.
5. Assess intellectual property considerations in biotechnology.
6. Justify the importance of quality and risk management in biotechnology and explain current good practices.

Unit	Syllabus	Periods
UNIT - I	**Transfection methods and transgenic animal**- objectives of Gene transfer, vectors gene construct (Promoters, Repoters of maker genes - Thymidien, dihydrofolate reductase, CDA protein, XGPRT, neomycin phosphotransferese) Transfections methods (calcium phosphate precipitation, DEAE- Dextran mediated transfection, Lipofection. Electroporation, retroviral vector method, DNA micro injection method. Transgenic animal cattle, Sheep, Goats and Pigs, Birds and Fish.	12

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Unit	Syllabus	Periods
UNIT - II	**In-vitro fertilization in humans** (collection of oocytes and sperms, in vitro fertilization and embryo transfer.) Embryo transfer in farm animals and cattle. Applications of embryo transfer technology and Limitation. Ethical issues related to transgenic animals.	12
UNIT - III	**Microbial production** of antibiotics Penicillin, streptomycin's and tetracycline . Microbial production of vitamin B 12 ,Riboflaving, Vitamin A and Gibberellins. Microbial production of amino acids : Lysine and Glutamin acid . Microbial production of alcoholic beverages: undistilled alcoholic beverages (beer and wine distilled alcoholic beverages (whiskey, brandy and fenny) microbiological production of vinegar.	12
UNIT - IV	**Microbial production of enzymes:** Amylases, Proteases, Invertase, Pectinase and Lipases. Microbial production of organic acids: citric acid, fumaric acid acetic acid and gluconic acid. Microbial production of solvent (Glycerol, Acetone and Butanol) and Food (Mushroom) Microbial production of fat, interferon , vaccine and diary products.	12
UNIT - V	**Production management:** Plant location, lay out process, planning, quality control , Patenting. Principle of management : management function, planning, decision making, MBO motivation, leadership, organization conflict, organizational development. Marketing and sales management : Building customer satisfaction, analyzing industries and competition estimating future demands, Developing, testing and Launching new product, designing marketing strategies, Price designing, packaging. Personnel Management : Function, Recruitment, Selection Process, Psychological testing Interview, Placemen and Induction Promotion. Demotion. Transfer, Separation, Employee Training, Performance appraisal Job evaluation, Wage, Salary Industrial earth and Industrial elations.	12

REFERENCE BOOKS –

1 Microbiology by M.J. Pelzar, E.S.N. Cfan and N.R. Kreig, McGraw Hill Publ.

2 Comprehensive Biotechnology (All volumes) Ed. Young, M.Y. Pub: Pergmon Press

3 Introductory Microbiology by J. Heritage, E.G.V. Erans, R.A. Killington, Cambridge University Press.

4 General Microbiology by H.G. Schlegel Cambridge University Press.

5 General Microbiology by Stanier, R.Y, J.L. Ingrahm, M.L. Wheel is & P.R. Painter.

6 Microbiology – concepts and Application. John Wiley and Sons, New York, 1988.

7 Introduction to Human Molecular Genetics – J.J Pasternak, John Wiley Publishers.

8 Human Molecular Genetics –Tom Strachen and A P Read, Bios Scientific Publishers

9 Human Genetics Molecular Evolution, Mc Conkey.

10 Recombinant DNA Technology , AEH Emery

11 Principles and Practice of Medical Genetics, I, II, III Volumes by AEH Edts. Emery

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School of Basic and Applied Sciences

Class				M.Sc. (Biotechnology)
Semester/Year				III Semester
Subject & Subject Code				Biotechnology- MBIOT20S304
Paper	English			Biostatistics, Computers & Bioinformatics – 304
Max. Marks				30
Credit			Total Credits	
L	T	P	3	
3	0	0		

Course Objectives:

The course is aimed at introducing the students to the field of Bioinformatics and enable them understand the concepts of statistics in biology. - To impart practical exposure upon Bioinformatics tools and databases.

Course Outcome:

Students will be able to:

1. Apply suitable statistical methods to research studies
2. Execute sampling, collection and preservation techniques
3. Use of microscope and scientific instruments
4. Compute statistical problems using computer and graphical means
5. Identifying repetitive elements.

Student Learning Outcomes (SLO):

Students will :

1. Know the theory behind fundamental bioinformatics analysis methods.
2. Be familiar with widely used bioinformatics databases.
3. Know basic concepts of probability and statistics.
4. Be able to describe statistical methods and probability distributions relevant for molecular biology data.
5. Know the applications and limitations of different bioinformatics and statistical methods.
6. Be able to perform and interpret bioinformatics and statistical analyses with real molecular biology data.

Unit	Syllabus	Periods
UNIT - I	Sampling and data representation, measurement of central tendency: Mean, median, model . Measurement of dispersion , standard deviation and standard error. Probability and distribution, correlation , linear Regression. Tests of significance, students t-test, chi- square test and analysis of variance.	12

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Unit	Syllabus	Periods
UNIT - II	**Fundamentals of computers:** Introduction, definition , characteristics and applications. Anatomy of digital computers . Computer architecture . Input devices and output devices ,operating system .	12
UNIT - III	**Computer software** Office applications: MS-Office ,MS-Word ,MS-Power point. Statistical analysis using MS Excel. Web development and E-Mail (PINE, EDORA, NETSCAPE MAIL).	12
UNIT - IV	**Internet** World Wide Web resources. similarity searching BLAST/ FASTA, PSI-BLAST. Installing a program (Tree tool), multiple sequence alignment (CLUSTAL W and bee) Searching MEDLINE on the PubMed system from the National Centre for Biotechnology information (NCBI). Searching the Science Citation Index and Current Contents Connect from the Institute for Scientific information. Accessing full -text journals on the internet and printing articles, Finding grant and funding resources on the Internet.	12

UNIT - V	Higher order sequence analysis searching for simple repeat sequences restriction site analysis MAR inder Identifying repetitive elements; Identifying Transfactor Binding site candidates .
	GCP sequence analysis or other comparable suite .
	(a) introduction to GCG; sequence analysis
	(b) GCP manual http;// emmg biosei.wayne.edu/gcg/gcg/menual.html
	Seq. web the X Interface to GCG; Basic, sequens analysis, Multiple Sequence analysis Multiple Sequence analysis.
	Protemics
		12

REFERENCE BOOKS –

1 Developmental Biology, 6th Edition, Scott F. Gilbert

2 Haematology, William J. Williams, Ernest Beutler, Allan JU. Erslev, Marshall A. Lichtman

3 Molecular Biology of the Cell, 3rd Edition, Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts, James D. Watson Stem Cell Biology by Marshak, 2001.

4 Human Embryonic Stem Cells: An Introduction to the Science and Therapeutic Potential, Ann A.Kiessling, Jones and Bartett, 2003.

5 Essential of Stem Cell Biology, Robert Lanza, 2nd Edition, academic Press, 2006.

6 Stem Cell Transplantation Biology Processes Therapy, A. D. Ho., R. Hoffiman, Willy-VCH, 2006.

7 C. S. Potten, Stem Cells, Elsevier, 2006.

Some useful sites on the Internet.

a . Database and search tools

i NCBI: http//ncbi.nlm.nhl.gov/

ii EMBL SERVER: http://www2/ebi/ac.uk/services/html

iii Genome Navigator: Saccharomyces cerevisiace Genome Index htpp://www.mpimg-belin-dahlem.mpg.de/-andy/GN/S.cervisiae

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Class			M.Sc. (Biotechnology)
Semester/Year			III Semester
Subject & Subject Code			Practical Biotechnology- MBIOT20S305
Paper			Paper- I and II, Practical I Sitting
Max. Marks			50= (30+20)
Credit			Total Credits
L	T	P	2
0	0	2	

PRACTICALS

1 Preparation of tissue culture medium and membrane filtration.
2 Preparation of single cell suspension from spleen and thymus.
3 Cell counting and I Cell viability.
4 Macrophage monolayer from PEC and measurement of phagocytic activity.
5 Trypsinization of monolayer and subculturing.
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
13 Bacterial culture and antibiotic selection media Preparation of competent cells.
14 Isolation of plasmid DNA
15 Isolation of Lambda phage DNA
16 Quantitation of nucleic acids
17 Agarose gel electrophoresis and restriction mapping of DNA
18 Construction of restriction map of plasmid DNA
19 Cloning in plasmid/phagemid vectors
20 Preparation of helper phage and its titration
21 Preparation of single stranded DNA template
22 DNA sequencing
23 Gene expression in E Coli and analysis of gene product
24 Polymerase Chain Reaction (PCR)

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EKLAVYA UNIVERSITY

ज्ञान सदैव लक्ष्य संधानम्

School of Basic and Applied Sciences

<table>
<tr><td colspan="3">Class</td><td>M.Sc. (Biotechnology)</td></tr>
<tr><td colspan="3">Semester/Year</td><td>III Semester</td></tr>
<tr><td colspan="3">Subject & Subject Code</td><td>Practical Biotechnology- MBIOT20S306</td></tr>
<tr><td colspan="2">Paper</td><td>English</td><td>Paper- III and IV, Practical II Sitting</td></tr>
<tr><td colspan="3">Max. Marks</td><td>50= (30+20)</td></tr>
<tr><td colspan="2">Credit</td><td>Total Credits</td><td rowspan="4"></td></tr>
<tr><td>L</td><td>T</td><td>P</td><td rowspan="2">2</td></tr>
<tr><td>0</td><td>0</td><td>2</td></tr>
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PRACTICALS

1. Study of alcohol fermentation-alcohol from different substrates-estimation of percentage of alcohol, total acidity and volatile acidity.
2. Microbial production of citric acid using Aspergillus Niger.
3. Microbial production of pectinase by Aspergillus Niger by agro waste.
4. Microbial production and assay of vitamins and amino acids.
5. Microbial production of Penicillin and product recovery.
6. Citric acid production by Aspergillus Niger and Penicillium citrianum
7. Production of amylase, cellulose, pectinase.
8. Production and Estimation of Alkaline Phosphatase.
9. Downstream process –purification of any one protein / enzyme from fermented broth.
10. Statistical problems
11. Demonstration of digital computer and its devices.
12. Operating system commands.
13. Document preparation and formatting.
14. Power point presentation
15. Statistical analysis : Using MS Excel
16. Web development using front page.

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Eklavya University Damoh MP

M.Sc. IV Semester

Biotechnology

Session 2020 onwards

School of Basic & Applied Science

EKLAVYA UNIVERSITY, DAMOH (M.P.)

Scheme of Examination M.Sc. (Biotechnology) IV Semester

For batch admitted in Academic Session 2023-24

Subject wise distribution of marks and corresponding credits

S. No.	Subject Name	Subject Code	Paper Name	Maximum Marks Allotted		Total Marks	Contact Periods Per week			Total Credits
				Fourth Semester			L	T	P	
				Thesis	Presentation					
1	Biotechnology	MBIOT20S401	Dissertation	300	200	500	0	0	0	16

Induction programme of three weeks (MC): Physical activity, Creative Arts, Universal Human Values, Literary, Proficiencey Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations.

EKLAVYA UNIVERSITY
ज्ञान प्रज्ञाये तक्ष चंदानम्

School of Basic and Applied Sciences

Class			M.Sc. (Biotechnology)
Semester/Year			IV Semester
Subject & Subject Code			Dissertation Biotechnology- MBIOT20S401
Paper	English		Dissertation Work
Max. Marks			500= (300+200)
Credit		Total Credits	
L	T	P	16
0	0	16	

Course Objectives:

M. Sc. Dissertation is designed in a way to teach and train the students with practical knowledge in the different areas of Biotechnology in order to become efficient researchers to start their carrier in research through Ph.D. and R & D programmes.

Course Outcome:

At the end of the Dissertation the students will be trained in:
1.Theoretical and practical knowledge in the different area of biotechnology to start their carrier in research through Ph.D. and other R & D programmes.
2. Research topics selected from different fields like animal biotechnology, microbiology, environmental biotechnology, genetic engineering, plant biotechnology,
parasitology, virology, nanotechnology and in-silico identification and validation of novel proteins.
3. Students developed understanding about the literature reading and dissertation writing.
4. Students trained to find the resources needed to perform the research process and presented their findings.

Student Learning Outcomes (SLO):

1. Students would gain train in the research areas selected from different fields of biotechnology like animal biotechnology, microbiology, environmental biotechnology,
2.genetic engineering, plant biotechnology, parasitology, virology, nanotechnology and in-silico identification and validation of novel proteins.
3.Students can develop understanding about the literature and dissertation writing required to carry out a good research during their Ph.D.
4. Find the different resources needed to perform the research.
5. Statistical analysis, presentation and documentation of research findings.

DISSERTATION WORK (Project Work + Technical Writing)

1 Dissertation thesis will be examined by internal and external at the time of presentation.

2 There will be weekly seminars and continuous internal assessment throughout the course.

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