



**Maharashtra Education Society's  
Abasaheb Garware College, Pune  
(Autonomous)**

**(Affiliated to Savitribai Phule Pune University, Pune)**

**Syllabus**

**In Three Year B.Sc. Degree Program**

**In**

**Microbiology with Industrial Microbiology  
(Faculty of Science & Technology)**

**Syllabi under Autonomy**

**T. Y. B. Sc. Microbiology (Industrial Microbiology)**

**Choice Based Credit System Syllabus**

**To be implemented from Academic Year 2024-2025**

## Titles of courses in T. Y. B. Sc. Industrial Microbiology Semester V and VI

Semester	Theory/ Practical/ Skill Enhancement	Paper Code	Paper Number	Paper Titles
V	Discipline Specific Elective Course (DSEC) Theory	USMR-351	I	Medical Microbiology-I
		USMR-352	II	Immunology-I
		USMR-353	III	Enzymology
		USMR-354	IV	Genetics
		<b>USIMR-355</b>	<b>V</b>	<b>Applications of Microbial Systems</b>
		<b>USIMR-356</b>	<b>VI</b>	<b>Cell culture technology</b>
		USMRP-357	VII	Practical course-I based on: Medical Microbiology-I & Immunology I
		USMRP-358	VIII	Practical course-II based on: Enzymology Genetics
		<b>USIMRP-359</b>	<b>IX</b>	<b>Practical course-III based on: Applications of Microbial Systems and Cell culture technology</b>
	Skill Enhancement course	<b>USIMRSEC-3510</b>	<b>SEC-I</b>	<b>Plant Tissue Culture</b>
		USMRSEC-3511	SEC-II	Dairy Microbiology
VI	Discipline Specific Elective Course (DSEC) Theory	USMR-361	I	Medical Microbiology II
		USMR-362	II	Immunology II
		USMR-363	III	Metabolism
		USMR-364	IV	Molecular Biology
		<b>USIMR-365</b>	<b>V</b>	<b>Bio-entrepreneurship and Intellectual Property Rights</b>
		<b>USIMR-366</b>	<b>VI</b>	<b>Recombinant DNA Technology</b>
		USMRP-367	VII	Practical course-I. Based on: Medical Microbiology II And Immunology II
		USMRP-368	VIII	Practical course-II. Based on: Metabolism and Molecular Biology
		<b>USMRP-369</b>	<b>IX</b>	<b>Practical course III. Based on: Bio-entrepreneurship and Intellectual Property Rights and Recombinant</b>

				<b>DNA Technology</b>
	Skill Enhancement course	<b>USIMRSEC-3610</b>	<b>SEC-I</b>	<b>Introduction to Bioinformatics</b>
		USMRSEC-3611	SEC-II	Nano biotechnology

T.Y. B. Sc. Industrial Microbiology Structure								
Subject /Paper Code	Subject/Paper Title	Subject type(theory/practical/other)	Credits	Type Optional/compulsory	Medium Description (English/Hindi/Marathi)	FY/SY/TYBA/BSc MA/MSc part1/part2 Mlib/Blib	Semester (I/II/I/IV/V/VI)	Lectures allotted
USMR-351	Medical Microbiology-I	Theory	2	Compulsory	English	TYBSc	V	36
USMR-352	Immunology-I	Theory	2	Compulsory	English	TYBSc	V	36
USMR-353	Enzymology	Theory	2	Compulsory	English	TYBSc	V	36
USMR-354	Genetics	Theory	2	Compulsory	English	TYBSc	V	36
USIMR-355	Applications of Microbial Systems	Theory	2	Compulsory	English	TYBSc	V	36
USIMR-356	Cell culture technology	Theory	2	Compulsory	English	TYBSc	V	36
USMR P-357	Practical course-I based on: Medical Microbiology-I & Immunology I	Practical	2	Compulsory	English	TYBSc	V	78
USMR P-358	Practical course-II based on Enzymology Genetics	Practical	2	Compulsory	English	TYBSc	V	78
USIMR P-359	Practical course-III based on: Applications of Microbial Systems and Cell culture technology	Practical	2	Compulsory	English	TYBSc	V	78

USIMR SEC- 3510	Plant Tissue Culture	Theory	2	Compulsory	English	TYBSc	V	36
USMR SEC- 3511	Dairy Microbiology	Theory	2	Compulsory	English	TYBSc	V	36
USMR- 361	Medical Microbiology II	Theory	2	Compulsory	English	TYBSc	VI	36
USMR- 362	Immunology II	Theory	2	Compulsory	English	TYBSc	VI	36
USMR- 363	Metabolism	Theory	2	Compulsory	English	TYBSc	VI	36
USMR- 364	Molecular Biology	Theory	2	Compulsory	English	TYBSc	VI	36
UISMR -365	Bio-entrepreneurship and Intellectual Property Rights	Theory	2	Compulsory	English	TYBSc	VI	36
USIMR -366	Recombinant DNA Technology	Theory	2	Compulsory	English	TYBSc	VI	36
USMR P-367	Practical course-I. Based on: Medical Microbiology II and Immunology II	Practical	2	Compulsory	English	TYBSc	VI	78
USMR P-368	Practical course-II. Based on: Metabolism  and Molecular Biology	Practical	2	Compulsory	English	TYBSc	VI	78
USIMR P-369	Practical course III. Based on: Bio- entrepreneurship and Intellectual Property Rights and Recombinant DNA Technology	Practical	2	Compulsory	English	TYBSc	VI	78

USIMR SEC- 3610	Introduction to Bioinformatics	Theory	2	Compulsory	English	TYBSc	VI	36
USMRS EC- 3611	Nano biotechnology	Theory	2	Compulsory	English	TYBSc	VI	36

## Evaluation Semester V

Semester	Paper Code	Paper No.	Paper Titles	Credits	Lectures/week		Evaluation		
					Th	Pr	Int	Ex t	Total
V	USMR-351	I	Medical Microbiology-I	2	3		15	35	50
	USMR-352	II	Immunology-I	2	3		15	35	50
	USMR-353	III	Enzymology	2	3		15	35	50
	USMR-354	IV	Genetics	2	3		15	35	50
	USIMR-355	V	Applications of Microbial Systems	2	3		15	35	50
	USIMR-356	VI	Cell culture technology	2	3		15	35	50
	USMRP-357	VII	Practical course-I based on: Medical Microbiology-I & Immunology I	2		4	15	35	50
	USMRP-358	VIII	Practical course-II based on: Enzymology Genetics	2		4	15	35	50
	USIMRP-359	IX	Practical course-III based on: Applications of Microbial Systems and Cell culture technology	2		4	15	35	50
	USIMRSEC-3510	SEC-I	Plant Tissue Culture	2	3		15	35	50
USMRSEC-3511	SEC-II	Dairy Microbiology	2	3		15	35	50	

**Evaluation Semester VI**

Semester	Paper Code	Paper No.	Paper Titles	Credits	Lectures/ week		Evaluation		
					Th	Pr	Int	Ex t	Total
VI	USMR-361	I	Medical Microbiology II	2	3		15	35	50
	USMR-362	II	Immunology II	2	3		15	35	50
	USMR-363	III	Metabolism	2	3		15	35	50
	USMR-364	IV	Molecular Biology	2	3		15	35	50
	USIMR-365	V	Bio-entrepreneurship and Intellectual Property Rights	2	3		15	35	50
	USIMR-366	VI	Recombinant DNA Technology	2	3		15	35	50
	USMRP-367	VII	Practical course-I. Based on: Medical Microbiology II and Immunology II	2		4	15	35	50
	USMRP-368	VIII	Practical course-II. Based on: Metabolism and Molecular Biology	2		4	15	35	50
	USIMRP-369	IX	Practical course III. Based on: Bio-entrepreneurship and Intellectual Property Rights and Recombinant DNA Technology	2		4	15	35	50
	USIMRSEC-3610	SEC-I	Introduction to Bioinformatics	2	3		15	35	50
	USMRSEC-3611	SEC-II	Nano biotechnology	2	3		15	35	50



**SEMESTER-V****Course code and title: USIMR -355: Applications of Microbial Systems****Lectures: 36 (Credits- 2)****[1credit=15hrsx60mins=900mins/50mins=18lectures]****Course Outcomes:***The student will,*

- understand techniques involved in wastewater treatment
- be able to understand the role of microorganism in wastewater treatment
- understand role of sustainable agriculture
- be able to acknowledge role of microbes in dairy and agriculture industry
- understand significance of dairy fermented product in human health

	<b>Pollution Control</b>	<b>(18)</b>
<b>Credit I</b>	1) Waste water characterization and treatment	<b>1</b>
	a) Wastewater characteristics and wastewater analysis	<b>2</b>
	b) Physical treatment methods	<b>2</b>
	c) Chemical treatment methods	<b>2</b>
	d) Biological treatment methods	<b>2</b>
	e) Sludge characterization and treatment	
	2) Advanced treatment methods and ETP design	
	a) Tertiary waste water treatment methods	<b>2</b>
	b) In situ Bio-remediation	<b>2</b>
	c) Removal of ROC	<b>3</b>
	d) ETP design	
	Student activity: Construct a flowchart for Effluent treatment plant	
	<b>Dairy and Agricultural Microbiology</b>	
<b>2</b>	3) Dairy Microbiology	<b>1</b>
	a) Basics of Dairy Microbiology- microbiology of starter cultures and dairy products	<b>1</b>
	b) Nutritional and therapeutic importance of fermented dairy products	<b>1</b>
	c) Probiotics, prebiotics, postbiotics, synbiotics and functional dairy foods	<b>4</b>
	d) Detail study including definition, process and microbial culture/consortium of Functional Dairy Products: Fermented milk products, functional dairy products, and therapeutic applications	

	e) Health benefits of functional fermented dairy products: such as Dahi, lassi, yoghurt, kefir, cheese, fermented whey drinks.	2
	4) Agricultural Microbiology	
	a) Microbes in soil and Nutrient recycling by microbes, Agro-wastes	
	b) Sustainable agriculture using microorganisms	3
	c) Biofertilizers, Biopesticides and Biofuel (Definition, Examples, Production process in short)	3
	Student activity- Product based layout of Industry, Guest lectures by Industry	3

**References:**

1. George T and Metcalf & Eddy (2003) Wastewater Engineering Treatment Disposal Reuse McGraw Hill Company
2. Marth, Elmer H and James L Steele eds. Applied Dairy Microbiology, 2<sup>nd</sup> Edition (2018), T&F publisher India, ISBN-10 : 9781138367609
3. Prescott, S.C. and Dunn, C.G., 1983, Industrial Microbiology, Reed G. (Ed.). AVI Tech books.
4. Nduka Okafor(2007), Modern Industrial Microbiology and Biotechnology Science Publisher, Edenbridge Ltd, ISBN 978-1-57808-434-0

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**SEMESTER-V**

**Course code and title: USIMR -356: Cell culture technology**

**Lectures: 36 (Credits- 2)**

**[1credit=15hrsx60mins=900mins/50mins=18lectures]**

Course Outcomes: *Students will:*

- Understand basic knowledge on mammalian cell culture.
- Appreciate techniques like IVF
- Understand gene transfer in mammalian system
- Acknowledge cell culture to make products required for human health
- Be able to grasp topics like stem cell technology and understand its application

Credit	Topic	No. of Lectures
	<b>Basics of Cell Culture</b> Introduction, Definition of terms – Tissue culture, Organ culture, Primary, Secondary, Continuous and Established cell lines	3

I	Organ culture  Scope and techniques e.g. plasma clot, agar gel. Grid method etc. Advantages, limitations, applications	2
	Cell culture –  a) Monolayers-anchorage dependency, types of substrate b) Suspension culture- types  c) Nutrient requirements, growth media, sterilization, growth conditions.  d) Culture techniques- explants disaggregation, subculture, primary and continuous cell lines, maintenance of cell lines e) Large scale culture of animal cells – types of reactors, immobilization, hollow fibre reactor	3  2  4
	Applications of ATC  Somatic cell fusion and hybridoma technology,  cell culture products -viral vaccines, recombination proteins, growth factors, cytokines, Interferons, monoclonal and hybrid antibodies  <i>Student activity: To visit and study the ATCC website</i>	4
II	<b>Advances in animal tissue culture</b> In vitro fertilization and embryo transfer – test tube babies	2
	Gene transfer to animal cells and transgenic animals - their economic importance	3
	Stem cell culture and application- Introduction to stem cells - Definition, properties, proliferation, culture of stem cells  Medical applications of stem cells Ethical and legal issues in use of stem cells	2  4
	Types of stem cells:  Stem Cell biology and therapy, types embryonic stem cell, Adult stem cell, Stem Cell Biology and Therapy, Embryonic Stem Cells, culture and the potential benefits of stem cell technology	3
	Therapeutic applications of stem cells	2

## References:

1. Adams, R.L.P., 1980, Cell culture for Biochemists, Laboratory techniques in Biochemistry and Molecular Biology, Elsevier, Amsterdam
2. Freshney, R. I. (ed), 1992, Animal cell culture : a Practical approach (2nd ed.) Oxford University Press, New York

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**SEMESTER-V****Course code and title: USIMRP -359: Practical course III****Practical course-III based on: Applications of Microbial Systems and Cell culture technology****Lectures: 36 (Credits- 2)****[1credit=15hrsx60mins=900mins/50mins=18lectures]****Course Learning Outcomes:**

- Skills to perform wastewater analysis with respect to BOD and COD
- Understand design of Effluent treatment plant
- Microbiological Analysis of fermented product and Bio-fertilizer.
- Isolating and Culturing lymphocyte
- Observation and estimation of lymphocytes

Sr. No.	Practical based on Applications of Microbial Systems	Number of practical
1	Estimation of solid contents in wastewater	1
2	Biological oxygen demand	1
3	Chemical oxygen demand	1
4	Designing of Effluent treatment plant	1
5	Estimation of total viable cells in fermented product	1
6	Estimation of total viable cells in biofertilizer	1
<b>Practical based on Cell culture Technology</b>		
7	Lymphocyte culture – medium preparation and sterility check	1
8	Isolation of Lymphocytes using HiSep	1
9	Observing growth of lymphocytes Observe for contamination Counting lymphocytes	2
10	Sub-culturing of Lymphocytes	1
11	Demonstration – Fibroblast culture	1

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**SEMESTER-V****Course code and title: USIMRSEC -3510: Plant Tissue Culture****Lectures: 36 (Credits- 2)****2 credit course: 1.5 credit Theory+0.5 credit Practical**

Course Learning Outcomes:

- Know the technique of preparation of plant tissue culture media.
- Knowledge about various techniques for plant tissue culture.
- Knowledge about laboratory setup for plant tissue culture.
- Hands on exposure to plant tissue culture.
- Employment skill in commercial plant tissue culture laboratory.

<b>Credit</b>	<b>Topic</b>	<b>No. of Lectures</b>
<b>SEC</b>	<b>Plant Tissue Culture (Theory)</b>	
<b>1.5</b>	Introduction to Plant tissue culture-	2
	Potency of plant calls/differentiation and de-differentiation	1
	Growth factor requirements	6
	Nutrient media	
	Propagation and preservation of plant tissues, Role of growth hormones	
	Types of cell cultures – Callus culture-	
	a) Anther culture – Concept of Haploid plants	2
	b) Ovary culture	2
	c) Meristem culture	2
	d) Embryo culture	2
	Stages of Micropropagation (I-VI) –	4
	Selection of plant, Explant preparations, Surface sterilization, Inoculation and incubation, Sub-culturing and Hardening	
	Applications of PTC:	
	Transgenic plants - GMPs	3
	Syn-seeds	
	Virus free plants	2
	Plantibodies	2

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**SEMESTER-V**  
**USIMRSECP -3510 Plant Tissue Culture**  
**Practicals based on Skill Enhancement Course**

Course Learning Outcomes:

- *Know the technique of preparation of plant tissue culture media.*
- *Knowledge about various techniques for plant tissue culture.*
- *Knowledge about laboratory setup for plant tissue culture.*
- *Hands on exposure to plant tissue culture.*
- *Employment skill in commercial plant tissue culture laboratory.*

Sr No	Practical	No of Practicals
1	a) Preparation of Plant Tissue Culture Media, Plant selection, Explant preparation and preparation of explant for culturing  b) Callus culture – inoculation of explant. Observation for growth of callus.	2
2	Studying different characteristics of callus or Differentiation of Callus – Shooting/Rooting	1

**References:**

- 1) Razdan, M. K. 2002. Introduction to plant tissue culture. 2nd ed. Science, India, USA
- 2) Trigiano, R. N. and D. J. Gray. 2000. Plant tissue culture concepts and laboratory 2nd ed. CRC press, USA
- 3) Bhojwani, S. S. and M. K. Razdan. 1996. Plant tissue culture: theory and practice, a revised edition. Elsevier Science, Netherlands
- 4) Chawla, H. S. 2002. Introduction to plant biotechnology, 2nd ed. Science, India, USA.
- 5) Thorpe, T. A. 1981. Plant tissue culture: methods and applications in agriculture. Academic Press, New York, USA.
- 6) Dodds, J. H. and L. W. Roberts. 1985. Experiments in plant tissue culture. 2nd ed. Cambridge University, New York, USA.

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**SEMESTER-VI****Course code and title: USIMR -365: Bio-entrepreneurship and Intellectual Property Rights****Lectures: 36 (Credits- 2)****[1credit=15hrsx60mins=900mins/50mins=18lectures]**

Course Learning Outcomes:

- Provides students with the necessary knowledge on how to bridge science and business.
- Development of the interdisciplinary skills required to produce business plan.
- Knowledge on Business forms, model and funding
- Analyse different types of intellectual property rights
- Protection of products derived from industrial microbiology research

<b>Credits</b>	<b>Topics</b>	<b>Number of lectures</b>
<b>1</b>	<b>Bio entrepreneurship</b>	
	1. Concept of entrepreneurship, Historical background, need and scope of entrepreneurship in modern society, Entrepreneurial behavior, attributes and skills.	<b>1</b>
	2. Key elements of entrepreneur, Entrepreneurial process, Entrepreneurial culture, Environment of Entrepreneurship, Socio economic origins of Entrepreneurship, Barriers of Entrepreneurship and means to reduce those, types of Entrepreneurs, Characteristics of Entrepreneur.	<b>2</b>
	3. Introduction and Overview of the Biotechnology Industry : translational biotechnology industry overview (include the commercialization pathways for drug, medical device, diagnostic companies)	<b>3</b>
	4. Forms of business organizations such as sole proprietorship, partnership, Joint Stock Company, cooperative organization etc. Meaning and definition, Relative merits and demerits of each form, , Types of Small Scale Industry, LLP etc.	<b>4</b>
	5. How to startup a Startup- Biotechnology business models, corporate structure (LLC, LLP, C-Corp, S-Corp, etc.) Meaning, scope and importance of marketing, Marketing strategy, Market segmentation, marketing channels. Marketing mix and its effect. Digital marketing	<b>2</b>

	<p>6. Funding process - organizations promoting Entrepreneurship, Banks- Government and Commercial, Co-operative societies, Govt/Public sources of finance Sources of finance, Role of Funding agencies, government and commercial</p> <p>7. Role of various funding corporations and funding institutes</p> <p><i>Student activity- Pitch an idea in front of panel of venture capitalist</i></p>	<b>6</b>
<b>2</b>	<p><b>Intellectual Property Rights</b></p> <p>1. Basic concept of intellectual properties (patents, Trademarks, Copyrights),</p>	<b>4</b>
	<p>2. Theories of Intellectual Property Rights, Need for Protecting Intellectual Property- Policy Consideration- National Perspectives and International demands,</p>	<b>6</b>
	<p>3. Types of Intellectual Property- Origin and Development, Role of International Institutions</p> <p>(a) World Intellectual Property Organisation (WIPO)</p> <p>(b) Function of WIPO</p> <p>(c) Membership of WIPO</p> <p>(d) Agreement between the WIPO and the WTO</p>	<b>4</b>
	<p>4. Dispute Settlement- New Treaties, Commercialization of Intellectual Property Rights by Licensing</p> <p>5. Determining Financial Value of Intellectual Property Rights.</p> <p><i>Student activity- Read and discuss a patent application</i></p>	<b>4</b>

## References-

1. Dynamics of Entrepreneurial development & management; Vasant Desai, Himalay.Publications.
2. Putting Biotechnology to Work: Bioprocess Engineering (1992) Commission on Life Sciences, The National Academy Press.
3. Entrepreneurship: New Venture Creation Holt
4. An Introduction to Intellectual Property Rights M. Venkataraman

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**SEMESTER-VI****Course code and title: USIMR -366: Recombinant DNA technology****Lectures: 36 (Credits- 2)****[1credit=15hrsx60mins=900mins/50mins=18lectures]****Course Learning Outcomes:**

- Understanding the basic steps of gene cloning and the role of enzymes and vectors responsible for gene manipulation, transformation and genetic engineering.
- At the end of the course, the students will have sufficient scientific understanding of the techniques in Recombinant DNA technology.
- Summarize various applications of rDNA technology in human health care
- Describes the impact of Recombinant DNA technology on Medicine
- Understand, advances in Recombinant DNA technology

Credit	Topic	No of Lectures
1	<b>Techniques in Recombinant DNA Technology:</b>	
	Basic in molecular cloning – basic concepts	2
	Types of Plasmids, Cosmids, Bacteriophages, Artificial chromosomes- PAC, BAC, YAC, Megaplasmids	3
	Screening and selection of transformants, Blue and white screening, Replica plate method	2
	PCR– primers, cloning, PCR products, RT-PCR and other modifications, Types of heat resistant enzymes used,	3
2	DNA sequencing - types DNA fingerprinting- process and application Microarray-technique and its applications Site-directed mutagenesis- protein engineering	8
	<b>Advances in Recombinant DNA Technology:</b> Advances in Genomics and Proteomics	2
	Introduction to metagenomics (Omics) Metagenomics in Microbiology-, overview of metagenomic library construction advantages and applications,	5
	Human Genome Project	2
	Impact of RDT on Medicine- New diagnostics, Detection of pathogens, genetic disorders, fetal DNA analysis	4

	Novel routes to vaccines	1
	Industrial applications – generation of novel proteins, production of cells, proteins, small molecules.	4
	<i>Student activity: Designing an entire experiment for cloning the gene of interest in desired host</i>	

## References:

1. Old, S. B. Primrose (1994) Principles of gene Manipulations., Blackwell Scientific Publications.
2. Technique in genetic engineering- Maniatis and Sambrook (3 volumes)
3. Brown T. A. Gene Cloning and DNA Analysis: An Introduction, 7th Edition (2013), WileyBlackwell.
4. Sambrook and Green , Molecular Cloning: A Laboratory Manual (*Fourth Edition*), (2012), Cold Spring Harbour Laboratory, ISBN :0879693096
5. Russel P.J., iGenetics: A molecular Approach 3rd edition (2010) Pearson
6. Primrose, S. B. and Twyman, R. M. (2006). Principles of Gene Manipulation and Genomics, 7th Ed. Blackwell Publishing: U.S.A.
7. Lewin's GENES X (2011). Jocelyn Krebs, Stephen T. Kilpatrick, Elliott S. Goldstein Editors. Jones & Bartlett Learning, USA

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### Semester VI

#### Course code and Title: USIMRP-369 Practical course III: Based on: Bio-entrepreneurship and Intellectual Property

##### Course Learning Outcomes:

Upon successfully completing this course the students could be able to:

- *Develop Bio-based business idea and business plan.*
- *Critically review/analyse patent*
- *To get expertise in isolation and separation of DNA.*
- *To perform gene amplification experiments and primer designing*

Sr. No.	Practicals based on Applications of Bio-entrepreneurship and IPR	Number of practicals
1	Presentation of two entrepreneurial ideas	2
2	Design business plan	1
3	Write claims for a patent to be filed for a novel product/process	1
4	Critical review of a patent application	1
5	Visit a start-up/ venture centre	1
<b>Practical's based on Recombinant DNA Technology</b>		
6	Isolation of Genomic DNA from yeast	1

7	Performing Agarose/ Poly-acrylamide Gel electrophoresis for DNA sample	1
8	Demonstration – Polymerase Chain Reaction	1
9	Using a primer designing software	1
10	Using UV as a mutagenic agent to transform bacteria	1
11	Demonstration of DNA fingerprinting	1

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### SEMESTER-VI

**Course code and title: USIMRSEC-3610: Introduction to Bioinformatics**

**Lectures: 36 (Credits- 2)**

**[1credit=15hrsx60mins=900mins/50mins=18lectures]**

**Course Learning Outcomes: Student will,**

- *To get introduced to the basic concepts of Bioinformatics and its significance in Biological data analysis*
- *Classify different types of Biological Databases*
- *Introduction to the basics of sequence alignment and analysis.*
- *To gain knowledge on various techniques, algorithms and tools employed in DNA sequencing, assembly and its applications*
- *To get exposed to various tools and methodologies used in bioinformatics.*

Credit	Topic	No. of Lectures
SEC	<b>Introduction to Bioinformatics</b>	<b>2</b>
Theory	Basics of bioinformatics	
	Introduction and biological databases Nucleic acid, proteins, genomes	
	Structure databases	<b>3</b>
	Search engines	
	Sequence data forms and submission tools	
Scoring matrices for sequence alignments, algorithms pairwise sequence alignments	<b>4</b>	

	Database similarity searches-BLAST, FASTA, Gene bank sequence database – hands on training	3
	Submitting DNA sequences to databases and database searching;	3
	Sequence alignment; pairwise alignment techniques, Multiple sequence alignment – Hands-on- training	5
	Phylogenetic analysis and tree building methods - MEGA <i>Student activity: Building a phylogenetic tree based on the practical course</i>	5

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### Semester VI

#### USIMRSECP -3610 Introduction to Bioinformatics

##### Practicals based on Skill Enhancement Course

Course Learning Outcomes: Student will,

- To get introduced to the basic concepts of Bioinformatics and its significance in Biological data analysis
- Classify different types of Biological Databases
- Introduction to the basics of sequence alignment and analysis.
- To gain knowledge on various techniques, algorithms and tools employed in DNA sequencing, assembly and its applications
- To get exposed to various tools and methodologies used in bioinformatics.

Sr no	Practical	No of Practicals
1	Study of resources available online – NCBI, PubMed, GenBank	1
2	Searching similarity within nucleotide sequences using BLAST tool	1
3	Alignment of Nucleotide sequences using online software's OR Building a phylogenetic tree using MEGA	1

References:

1. Claverie, J.M. and Notredame C. 2003 Bioinformatics for Dummies. Wiley Editor.
2. Letovsky, S.I. 1999 Bioinformatics. Kluwer Academic Publishers.
3. Baldi, P. and Brunak, S. 2001 Bioinformatics: The machine learning approach, The MIT Press.
4. Setubal, J. and Meidanis, J. 1996 Introduction to Computational Molecular Biology. PWS

5. Lesk, A.M. 2005, 2nd edition, Introduction to Bioinformatics. Oxford University Press.
6. Fogel, G.B. and Corne, D.W., Evolutionary Computation in Bioinformatics.
7. Mount, D.W., Bioinformatics: 2001, Sequence and Genome Analysis. CSHL Press.
8. Durbin R., Eddy S., Krogh A. and Mithchison G. 2007 Biological Sequence Analysis, Cambridge University Press.

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