K.S.Rangasamy College of Arts and Science (Autonomous)

Tiruchengode – 637 215

Department of Biotechnology

Courses focus on Employability/Entrepreneurship

Programme: PG Biotechnology

EMPLOYABILITY:

18PBTM104	-	Core IV-Biochemistry
18PBTM105	-	Core V-Developmental Biology
18PBTM201	-	Core VI - Immunology
18PBTM202	-	Core VII- Bioprocess Technology
18PBTEL202	-	Elective I-Bioinstrumentation and Bioinformatics
18PBTM301	-	Core VIII-Plant Tissue and Animal cell Culture Technology
18PBTM302	-	Core IX-Genetic Engineering

ENTREPRENEURSHIP:

18PBTM401	-	Core XI-Food and Pharmaceutical Biotechnology

HOD

HEAD, DEPARTMENT OF BIOTECHNOLOGY
K S Rangasamy College of Arts and Science
K S R Kalvi Nagar, Tiruchengode-637 215. India

COE

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SCHEME OF EXAMINATION

Subject Code	Subject	Hours of Instruction	Exam Duration (Hours)	Maximum Marks			Credit Points
				CA	CE	Total	
FIRST SEMESTER							
		Part-A					
18PBTM101	Core I: Cell Biology	5	3	25	75	100	5
18PBTM102	Core II: Molecular biology	5	3	25	75	100	5
18PBTM103	Core III: Microbiology & Genetics	5	3	25	75	100	5
18PBTM104	Core IV: Biochemistry	5	3	25	75	100	5
18PBTM105	Core V:Developmental Biology	5	3	25	75	100	5
18PBTMP101	Core Practical I: Lab in Cell biology, Molecular biology, Genetics and Biochemistry	4	6	40	60	100	3
		Non Credit					
18PLS101	Career competency Skills I	1	-	-	-	-	-
	Total	**30**				**600**	**28**
SECOND SEMESTER							
		Part-A					
18PBTM201	Core VI: Immunology	5	3	25	75	100	5
18PBTM202	Core VII: Bioprocess Technology	5	3	25	75	100	5
	Elective I	5	3	25	75	100	4
18PBTMP201	Core Practical II: Lab in Immunology and Bioprocess technology	5	6	40	60	100	3

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Optional Subjects							
18PBCBTI201	IDC I: Diagnostic Biochemistry	4	3	25	75	100	2
18PBCBTIP201	IDC Practical I: Diagnostic Biochemistry	3	3	40	60	100	2
18PMBBTI201	IDC I: Clinical Microbiology	4	3	25	75	100	2
18PMBBTIP201	IDC Practical I: Clinical Microbiology	3	3	40	60	100	2
Part- B							
18PVE201	Value Education: Human Rights	2	3	25	75	100	2
Non Credit							
18PLS201	Career competency Skills II	1	-	-	-	-	-
	Total	**30**				**700**	**23**

THIRD SEMESTER

Part –A							
18PBTM301	Core VIII: Plant tissue and Animal cell culture technology	6	3	25	75	100	5
18PBTM302	Core IX: Genetic engineering	6	3	25	75	100	5
18PBTM303	Core X: Biostatistics and Research Methodology	5	3	25	75	100	4
18PBTMP301	Core Practical III: Lab in Plant tissue and Animal cell culture technology and Genetic Engineering	5	6	40	60	100	4

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18PBTMP302	Core Practical IV: Statistical software	2	3	40	60	100	2
Optional Subjects							
18PBCBTI301	IDC II: Pharmaceutical Biochemistry	3	3	25	75	100	2
18PBCBTIP301	IDC Practical II: Pharmaceutical Biochemistry	3	3	40	60	100	2
18PMBBTI301	IDC II: Industrial Microbiology	3	3	25	75	100	2
18PMBBTIP301	IDC Practical II: Industrial Microbiology	3	3	40	60	100	2
	Total	**30**				**700**	**24**

FOURTH SEMESTER

Part – A							
18PBTM401	Core XI: Food and Pharmaceutical Biotechnology	5	3	25	75	100	5
	Elective II	5	3	25	75	100	4
18PBTPR401	Project & Viva-Voce	4	-	50	150	200	6
	Total	**14**				**400**	**15**
					Grand Total	**2400**	**90**

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18PBTM104	CORE IV: BIOCHEMISTRY	SEMESTER- I

Course Objectives:

The Course aims

- To learn the fundamentals of biomolecules and its function in living system.

Total Hours: 60

Credits: 5			
UNIT	**CONTENTS**	**Hrs**	**CO**
I	Biochemistry – Definition, Carbohydrate – Monosaccharides, Disaccharides and Polysaccharides, structure and properties, Isomers, Epimers, Enantiomers and Anomers. Base and Buffers.	**12**	**CO1**
II	Amino acids – Classification and structure. Proteins – Structure and Classification, Lipids – Classification, Nucleic acids – Structures of nitrogenous base – Nucleotides and Nucleosides.	**12**	**CO2**
III	Concept of Metabolism and Catabolism: Glycolysis – reaction and energy yield of glycolysis, Beta oxidation of fatty acids, TCA cycle, Electron transport chain and Oxidative phosphorylation. Anabolism: Gluconeogenesis, Cholestrol biosysntesis, De novo and Salvage pathway of Purine and Pyrimidine biosynthesis.	**12**	**CO3**
IV	Enzymes- Nomenclature, Classification, properties, factors affecting enzyme activity – Substrate concentration, temperature and pH, Inhibition of enzyme activity – Competitive, noncompetitive and uncompetitive. Michaclis – Menten equation.	**12**	**CO4**

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COURSE OUTCOMES (CO)

After completion of the course, the students will be to

CO1	Demonstrate the carbohydrates and its types.
CO2	Explain about classification of protein, lipids and nucleic acid.
CO3	Explain the concept of metabolism and catabolism
CO4	Illustrate the different structure, classification and function of the activity of enzymes
CO5	Describe the types and biological function of vitamins and hormones.

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	H	H	H
CO2	M	M	H	M	M
CO3	M	H	H	M	H
CO4	M	M	M	M	H
CO5	H	H	H	M	H

H-High; M-Medium; L-Low

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18PBTM105	**CORE V: DEVELOPMENTAL BIOLOGY**	**SEMESTER - I**

Course Objectives:

The Course aims

- To study the basics of Developmental biology.

Credits:5 **Total Hours:50**

UNIT	CONTENTS	Hrs	CO
I	**Foundation of developmental Biology:** History of developmental biology, types of development, strategies in developmental biology, phase of animal development. Major molecular and cellular component of development: genes and proteins, and transcription factors and signal molecule.	10	CO1
II	**Basic mechanism of development:** Cell division – molecular view, Morphogenetic movement – morphogenesis, cellular process, cell – cell adhesion molecules, cell migration. Cell to cell interaction - induction, signal, competency. Growth – mechanism, dynamic and factors. Differentiation: Potency, specification, differentiation.	10	CO2
III	**Early embryonic development:** Fertilization – structure of gametes – sperm, the egg, - recognition of egg and sperm. External fertilization in sea urchin, internal fertilization in mammals, gastrulation in snails, development of tetrapod.	10	CO3
IV	**Organogenesis in plants:** Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in *Arabidopsis* and *Antirrhinum*.	10	CO4
V	**Sex determination and development:** chromosomal sex	10	CO5

	determination - sex determination in mammals, sex determination in drosophila. Post embryonic development - metamorphosis - amphibian and insect metamorphosis, regeneration, types of regeneration. Aging and senescence. Evolution - developmental repatterning - heterochrony, heterotopy, heterometry and heterotypy.		

Reference Books

1. *Chattopadhyay S.* 2016. **An Introduction to Developmental Biology.** [First Edition].Books and Allied (P) Ltd. Kolkata.
2. *Gilbert S.F.* 2015. **Developmental Biology**. [revised edition]. Tata McGraw publishing House.
3. *Lodish Berk, Kaiser Krieger, Scott Bretscher, Ploegh* and *Matsudair.* 2011. **Molecular cell Biology**. [Fifth Edition]. W. H. Freeman and Company, New York.
4. *Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts and Peter Walter.* 2008. **Molecular Biology of the Cell.** [Fifth Edition]. Garland Science, Taylor and Francis Group.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Explain historical perspective of Developmental biology.
CO2	Demonstrate the fundamentals of Development biology.
CO3	Differentiate gametogenesis, fertilization and early development.
CO4	Illustrate the organogenesis in plants.
CO5	Illustrate the sex determination and evolution.

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MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	M	H
CO2	H	H	M	M	H
CO3	H	M	L	M	M
CO4	H	H	M	H	L
CO5	M	H	M	M	M

H-High; M-Medium; L-Low

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18PBTM201	CORE VI: IMMUNOLOGY	SEMESTER- II

Course Objectives:

The Course aims

- To study the basic principles of immunology and molecular mechanisms.

Credits:5 **Total Hours:50**

UNIT	CONTENTS	Hrs	CO
I	History and scope of immunology, Immune response - types & mechanisms, haematopoiesis. Cells & Organs of immune system and their role in immunity. Antigens – Antigenicity & Immunogenicity, Haptens, Adjuvants, Epitope.	10	CO1
II	Immunoglobulins: Basic structure, classes and biological activities. Antigenic determinants on immunoglobulin. Organization and expression of immunoglobulin genes - variable gene rearrangements, mechanism of rearrangements. Generation of Antibody diversity. MHC organization and structure, Antigen Processing and presentation; Cytosolic and Endocytic pathway.	10	CO2
III	Complement proteins and pathways. Cell mediated immune response - T cell maturation, activation and differentiation, Cytokines; properties, types. Humoral immune response - B cell generation, activation & differentiation. Primary and Secondary humoral immune response.	10	CO3

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IV	Hypersensitivity reactions, Immunodeficiency - Primary and Secondary immunodeficiency. Autoimmunity - Organ specific and Systemic autoimmunity. Transplantation-Immunological aspects of graft rejection Vaccines, types and vaccination.	**10**	**CO4**
V	Antigen – antibody interaction; Agglutination, Precipitation, Immunoelectrophoresis, ELISA, Western blot, Immunofluorescence. Hybridoma technology, FACs, HLA typing.	**10**	**CO5**

Reference Books

1. *Kuby Richard. A. Goldsby, Thomas. J. Kint* and *Barbara. A. Osborne.* 2000. **Immunology** [Fourth Edition]. W.H. Freeman and Company, New York.
2. *Peter J. Delves, Seamus J. Martin, Dennis R. Burton and Ivan M. Roitt.* 2006. **Roitt's Essential Immunology**. [Eleventh Edition]. Blackwell Publication.
3. *Tristram G. Parslow, Daniel P. Stites, Abba I.Terr and John B. Imboden*. 2001. **Medical Immunology.** [Tenth Edition]. Tata Mc Graw Hill Publication.
4. *Ian Tizard, K.* 1995. **Immunology: An Introduction.** [Fourth Edition] Saunders College Publication.
5. *Kalus D. Elgert,* 2009. **Immunology - Understanding the Immune System.** [Second Edition]. Wiley-Blackwell Publication.
6. *Kenneth Murphy, Paul Travers and Mark Walport,* 2008. **Janeway's Immunobiology.** [Seventh Edition]. Garland Science Taylor and Francis Group, New York.

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COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Describe the features of cells and tissues of the immune system and differentiate immunogens, antigens, haptens and adjuvants with respect to immunological functions.
CO2	Explain about the structure of immunoglobulin and apply the mechanism of biology of antigen processing and presentation.
CO3	Illustrate the developmental behaviors of B cells and study antigen and antibody interaction.
CO4	Describe the injury and inflammation and the broad education necessary to understand AIDS. And understand the mechanism of immune responses with respect to transplantation and graft rejection.
CO5	Identify modern techniques to analyze tumor antigens and study autoimmune diseases. And to develop the monoclonal antibodies through hybridoma technology for humoral immunity.

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	M	L
CO2	M	M	H	L	L
CO3	M	L	L	M	H
CO4	L	M	H	M	H
CO5	L	M	L	H	M

H-High; M-Medium; L-Low

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18PBTM202	CORE VII: BIOPROCESS TECHNOLOGY	SEMESTER - II

Course Objectives:

The Course aims

- To learn about the various bioprocess and engineering technology and to implement in industries.

Credits: 5 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	Isolation of industrially important microbes, Primary and Secondary Screening and Assay of fermentation products. Preservation of important strain for increased yield and other desirable characters. An overview of aerobic and anaerobic fermentation process. Fermentation: Submerged and solid state fermentation and immobilization.	10	CO1
II	Medium for industrial fermentations: Medium formulation, Optimization, Growth kinetics, Thermal death kinetics, Batch and continuous sterilization system, Sterilization of air. Reactor engineering – Bioreactor configuration – Stirred tank, Airlift, Bubble column, packed bed.	10	CO2
III	Mass Transfer – Introduction to mass transfer between phases, Gas – liquid mass transfer in cellular system, liquid – Solid mass transfer, liquid mass transfer. Oxygen transfer – Introduction, Oxygen transfer process and oxygen uptake. Determination of oxygen transfer co-efficient. Biological heat transfer. Heat transfer co-efficient.	10	CO3
IV	Bioprocess control and monitoring Methods of measuring process variables such as Temperature, Agitation,	10	CO4

	Pressure, pH and foam. Online measurement, Control system: manual and automatic control, On/Off controls and PID control. Computer application in fermentation technology.		
V	Separation of microbial cells and suspended solids. Intra cellular product recovery: Cell distruption – Physical and Chemical method, Ultrasonication, Centrifugation, membrane process, Chromatography, Electrophoresis, Solvent extraction, Distillation, Crystallization, Evaporation and drying.	10	CO5

Text Book

1. *Stanbury. P.R and Whitaker*, 2002.**Principles of fermentation technology**. Elsevier Science Ltd.

Reference Books

1. *Pauline M Doran*.1995.**Bioprocess Engineering Principles**. Academic press.
2. *Shuler M.L. and Kargi F.* 2004. **Bioprocess Engineering**: Basic concept [Second Edition].Prentice Hall. Pvt. Ltd., New Delhi.
3. *Patel A.H.* 2005. **Industrial Microbiology**. [Fifth edition].MacMillan Indian Ltd. New Delhi.
4. *Crueger, W.* and *Crueger, A.* 2002. **A Text book of Industrial Microbiology**.[Second Edition]. Science tech Publishers, USA

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COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Apply the basic knowledge of fermentation process.
CO2	Explain about Overview of the medium for industrial fermentation and Growth kinetics.
CO3	Demonstrate the different phases of mass transfer.
CO4	Describe about the different bioprocess control and monitoring methods.
CO5	Explain the separation process of microbial cells from various techniques.

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	M	M
CO2	M	H	M	M	M
CO3	M	H	H	H	M
CO4	M	M	H	M	H
CO5	M	H	H	H	H

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18PBTEL202	ELECTIVE I: BIOINSTRUMENTATION AND BIOINFORMATICS	SEMESTER - II

Course Objectives:

The Course aims

- To gain knowledge about basic concept and analytical techniques in Bioinstrumentation and Bioinformatics

Credits: 4 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	Microscopy: principle, working and application - Light Microscope - Bright Field, Dark field, phase contrast, fluorescent and confocal scanning laser. Electron Microscope – Transmission Electron Microscope, Scanning Electron Microscope, Sample preparation for electron microscopy. Microscopic measurement of microorganisms – Micrometry. Centrifuges - low and high speed, ultra centrifuges.	10	CO1
II	Principles, Techniques and applications of Paper, AGE and SDS PAGE. Separation Techniques - Principles, Techniques and applications of Paper Chromatography, TLC, Ion exchange Chromatography, Affinity Chromatography,LC-MS, GC-MS/MS, NMR, Isoelectric focusing	10	CO2
III	Beer Lambert's law - Principles, working and biological applications of Colorimeter, UV – VIS Spectroscopy, IR And Raman Spectroscopy, Atomic Absorption Spectroscopy, Spectrofluorometer, XRD.	10	CO3
IV	Bioinformatics – Basics, Applications. Biological Database – Classification, scheme, GENBANK, SwissProt and PDB. Sequence Alignment – Concept of Alignment, Pairwise	10	CO4

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	Alignment: Principle, methods and Alignment with BLAST.		
V	Gene Prediction – Overview, Prokaryotic features for gene prediction, prediction with GENSCAN. Molecular Phylogeny – Molecular Clock Hypothesis, Neighbour Joining method, mechanism and representation of Phylogeny, tree types.	**10**	**CO5**

Reference books

1. *Boyer.R.F.* 1993. **Modern Experiments in Biochemistry**. [Second Edition]. Benjamin/ Cummings Publishing Company, Red wood City, California.
2. *Upadhyay*, 2005. **Biophysical Chemistry**, Himalaya Publications.
3. *Wilson. K. and Walker*. 2003, **Practical Biochemistry**. [First Edition]. Cambridge University Press.
4. *David, J.H. and Hazel Peck.* 1998. **Analytical Biochemistry**. [Third Edition]. Prentice Hall an Imprint of Pearson Education.
5. *Zhumur Gosh and Bibekanand Mallick. 2008.* **Bioinformatics Principles and Applications.** Oxford University Press.
6. *David W. Mount.* 2004. **Bioinformatics: Sequence and Genome Analysis**. Cold Spring Harbor laboratory.
7. *Rickwood D.* and *Hames B. D.* 1990. **Gel electrophoresis of Nucleic acids.** [Second Edition]. Oxford university press.

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COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Maintain the instruments with care and know the working principles of each basic laboratory instruments.
CO2	Gain knowledge about the separation process using electrophoresis and chromatographic techniques.
CO3	Handle the instruments and measure OD value, Absorbance and concentration of specific constituents present in the unknown sample.
CO4	Interpret the biological data in computational methods & tools for solving research problems easily.
CO5	Predict the gene structure and also construct phylogenetic tree for studying the similarity and evolutionary relationship within the organism.

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	L	L
CO2	H	H	L	M	L
CO3	H	M	L	M	H
CO4	L	L	H	M	M
CO5	L	L	M	H	L

H-High; M-Medium; L-Low

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18PBTM301	CORE VIII: PLANT TISSUE AND ANIMAL CELL CULTURE TECHNOLOGY	SEMESTER - III

Course Objectives:

The Course aims

- To acquire the knowledge about physiology, stress response and secondary metabolites by the plants.
- To apply the knowledge of Plant tissue and Animal cell culture techniques.

Credits: 5 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	Architecture of Plants – tissues and organs, Plant response to abiotic stress (Flood, drought and high salinity) and biotic stress (insect), absorption and transportation of water and nutrients by the plants, Transpiration, Seed storage proteins, cytoplasmic male sterility.	10	CO1
II	Principles of plant tissue culture, PTC laboratory organization, Plant tissue culture media, sterilization of Explant Callus and suspension culture, Micropropagation, Somaclonal variation, Somatic embryogenesis, Haploid plant production, Isolation and culture of protoplast, Somatic hybridization and Cybridization, Viral free plant production – Meristem culture, Hardening.	10	CO2
III	Biosynthesis of Alkaloids, flavanoids, anthocyanins, phenols and their medical applications. Physiological effects and mechanism	10	CO3

	of action of the auxins, cytokinins, gibberllins and abscissic acid. Biosynthesis and function of ethylene.		
IV	An Introduction about animal cell culture, Planning and Construction of Lab layout, Equipments - Laminar-flow hood, CO_2 Incubators, Inverted microscope, Cryostorage containers, Aseptic concepts and Cell culture vessel. Preparation of Media- defined media and supplements, Types of cell culture media; Physical and chemical property of Medium, Balanced salts, Antibiotics, growth supplements; Fetal bovine serum; Serum free media.	**12**	**CO4**
V	Primary culture - Isolation of tissues and disaggregation methods, Subculture and Cell lines. Types of primary culture; separation; Continuous cell lines; Suspension culture; Application of Animal cell culture, MTT, cytotoxicity and cell viability assays.	**08**	**CO5**

Reference Books

1 *Bhojwani, S.S. and Razdan, M.K.* 2008. **Plant Tissue Culture - Theory and Practice**. Elsevier Publishers, New Delhi.

2 *Chawla, H.S.* 1998. **Biotechnology in Crop Improvement**. International Book Distribution Co., New Delhi.

3 *Slater, A., Scott, N. and Fowler. M. 2008.* **Plant Biotechnology - The Genetic Manipulation of Plants.** [Second Edition]. Oxford Publications, Oxford, UK.

4	*Hopkins, W.G., and Hiiner, N.P.A.* 2004. **Introduction to Plant Physiology**. [Third Edition]. John Wiley and Sons, New Jersey, USA.
5	*Jain, V.K.* 2013. **Fundamentals of Plant Physiology**. [Fifth Edition]. S. Chand and Company, NewYork.
6	*Trivedi, P.C.* 2004. **Advances in Plant Physiology**. [Third Edition]. I.K. International Publications Pvt Ltd, New Delhi.
7	*Freshney, R.I.,* 2005. **Culture of Animal Cells: A Manual of Basic Technique.** [Fifth Edition]. John Wiley and Sons, New Jersey.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Distinguish the cells and organs of the plants and stress management by the plants.
CO2	Explain about different types of culture techniques and to experiment with them.
CO3	Differentiate the functions of phytohormones and phytochemicals.
CO4	Handle the equipments used in Animal Cell culture technology.
CO5	Attain the knowledge on culturing of animal cell lines.

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	L	L
CO2	H	M	H	L	M
CO3	H	M	H	M	H
CO4	M	L	H	L	L
CO5	H	L	H	L	M

H-High; M-Medium; L-Low

18PBTM302	CORE IX: GENETIC ENGINEERING	SEMESTER - III

Course Objectives:

The Course aims

- To know about the advances in rDNA technology and its importance in various fields.

Credits:5 **Total Hours:50**

UNIT	CONTENTS	Hrs	CO
I	History and scope of genetic engineering. Enzymes in Genetic engineering - DNA modifying enzymes - i) Restriction enzymes, ii) DNA polymerase -Klenow, DNA polymerase I, T4 DNA Polymerase, iii) Reverse transcriptase, iv) Terminal transferase, v) T4 polynucleotide kinases, vi) Alkaline phosphatase, vii) DNA ligase, viii) Nucleases -Bal 31, S1 nucleases, DNase I, Mungbean nucleases, Ribonucleases, EXO III, RNA polymerase, Thermostable enzymes.	10	CO1
II	Bacterial vectors- pBR322 and pUC vectors. Phage vectors - Lambda, M13 and Cosmid. Artificial chromosomes - YAC, BAC, PAC and HAC, Expression vectors and Shuttle vectors. Host cell types and transformation.	10	CO2
III	Cloning strategies - Gene library construction - Genomic and cDNA libraries. DNA cloning - Homopolymer tailing and use of adapters and linkers with ligase. Screening and analysis of recombinants - radiolabeled and non-radiolabeled probes. Blotting techniques - Southern/Northern/Western.	10	CO3

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	Immunological screening of expressed genes.		
IV	His tag biotin- avidin and Gene Expression in *E. coli, Saccharomyces cerevisiae,* Expression in insect cells, higher eukaryotic system – Tet On/Off systems, Phage display.	**10**	**CO4**
V	DNA sequencing - Chemical, enzymatic and automated DNA sequencing, Pyro sequencing and NGS sequencing methods. Microarrays – Principles and applications. PCR – Principle, types and applications, Real time PCR, Site directed mutagenesis and Protein engineering. Gene therapy, Gene knockout technologies	**10**	**CO5**

Reference Books

1. *Primrose S.B and Twyman, R.M.* 2006. **Principles of Gene Manipulation and Genomics**. [Seventh Edition]. Blackwell Publishing Co., USA.
2. *Ernst-L.Winnacker.* 2003. **From Genes to Clones**. Panima Publishing Co., Bangalore.
3. *Reece, R.J.* 2004. **Analysis of Genes and Genomes**. John Wiley and Sons Ltd., USA.
4. *Brown, T.A* .2007. **Genomes**. [Third Edition]. Garland Science, USA.
5. *Joseph Sambrook and David W. Russell,* 2001. **Molecular cloning – A laboratory manual Volume 1 to 3**. [Third Edition]. Cold Spring Harbor Laboratory Press, New York.
6. *James D. Watson, Richard M. Myers, Amy A. Caudy, Jan A. Witkowski.* 2006. **Recombinant DNA.** [Third Edition]. W.H Freeman & Company, New York.
7. *Micklos, D.A., Freyer, G.A. and Crotty, D.A.* 2003. **DNA science**. [Second Edition]. Cold Spring Harbor Laboratory Press, New York.

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COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Describe the types of enzymes used in genetic engineering.
CO2	Demonstrate the types of vectors used in genetic engineering and different strains used.
CO3	Explain about the construction of gene libraries and screen the recombinants.
CO4	Apply the various strategies involved in gene cloning.
CO5	Apply their knowledge in the genetic engineering application.

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H`	L	L	M
CO2	H	M	M	L	H
CO3	M	H	M	M	L
CO4	H	H	M	M	H
CO5	H	H	L	M	H

H-High; M-Medium; L-Low

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18PBTM401	CORE XI: FOOD AND PHARMACEUTICAL BIOTECHNOLOGY	SEMESTER - IV

Course Objectives:

The Course aims

- To learn the basics about the food and food products.
- To study the basics about the pharmaceutical biotechnology.

Credits:5 **Total Hours:50**

UNIT	CONTENTS	Hrs	CO
I	Constituents and dietary sources of food – Carbohydrates, Lipids, Proteins, Water, Vitamins and Minerals, Fermented Cereals food: Soy Sauce, Miso, Idli. Fermented fish products. Fermentation of vegetables: Sauerkraut Pickles.	10	CO1
II	Production of bread, distilled beverages- wine and beer. Production of food flavourant and colorants, Production of baker's yeast, Food spoilage – Factors responsible for spoilage.	10	CO2
III	Principles and methods of food preservation: Asepsis removal, Anaerobic conditions, Preservation by use of high temperature, low temperature, drying, food additives, radiation, Pasteurization, Blanching, Canning.	10	CO3
IV	History and scope of Pharmaceutical biotechnology, Production of antibiotics from the microbes- penicillin, streptomycin, Biomimicry and Bioprospecting, enzymes responsible for biotransformation.	10	CO4
V	Quality assurance and control – concept of good manufacturing practices, role of FSSAI and HACCP, test marketing and release into the market, Hormones. Quality	10	CO5

	assurance, Drug metabolism – biotransformation of drugs, microsomal and non-microsomal mechanisms, Pharmacology - pharmacodynamics pharmacokinetics.		

Reference Books

1. *Daan, J., Crommelin, A., Robert D. Sindelar, Bernd Meibohm,* 2008. **Pharmaceutical Biotechnology – Fundamentals and Applications.** Informa Healthcare USA, Inc.
2. *Toledo, R.T.* 1980. **Fundamentals of Food Processing.** [Third Edition]. AVI Publishing Company, USA.
3. *Coultate, T.P.* 1992. **Food – The Chemistry of Its Components**. [Second Edition].Royal Society, London.
4. *Jay, J.M.* 1987. **Modern Food Microbiology**. [Third Edition]. CBS Publications, New Delhi.
5. *Kayser. O. and Müller, R. H.* 2004. **Pharmaceutical Biotechnology: Drug Discovery and Clinical Applications.** Wiley Publications.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Explain dietary sources and fermented food products.
CO2	Illustrate the production of beverages, food colorants as well as factors responsible for food spoilage.
CO3	Demonstrate the principles and methods of food preservation.
CO4	Know the production, manufacturing of antibiotics and drugs and tablet packaging.
CO5	Learn the role of FDA, drug metabolism and pharmacology.

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H`	L	L	M
CO2	H	M	M	L	H
CO3	M	H	M	M	L
CO4	H	H	M	M	H
CO5	H	H	L	M	H

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