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

Tiruchengode - 637 215

Department of Biotechnology

Elective courses

- Elective I: Nanobiotechnology
- Elective I: Bioinformatics
- Elective II: Medical Biotechnology
- Elective II: Food Biotechnology
- Elective I: Cell communication and Signaling
- Elective I: Bioinstrumentation and Bioinformatics
- Elective II: Environmental Biotechnology
- Elective II: Evolution and Biodiversity

Enclosures:

i. Copy of Scheme of Examination
ii. Syllabus copy of the courses highlighting the Elective courses

HOD

CONTROLLER OF EXAMINATIONS

CoE

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Tiruchengode - 637 215, Tamilnadu, India.

SCHEME OF EXAMINATION

Subject code	Subject	Hours of instruction	Exam duration	Maximum marks			Credit points
				CA	CE	Total	
First semester							
		Part I					
18UTALA101/ 18UHILA101/ 18UFRLA101	Tamil I/Hindi I/ French I	5	3	25	75	100	3
		Part II					
18UENLA101	Foundation English I	5	3	25	75	100	3
		Part III					
18UBTM101	Core I: Concepts of Cell Biology	6	3	25	75	100	5
18UBTMP101	Core Practical – I	4	3	40	60	100	2
18UCSBTA101	Allied I: Computer fundamentals and office automation	5	3	25	75	100	2
18UCSBTAP101	Allied Practical I: Office automation techniques	3	3	40	60	100	2
		Part IV					
18UVE101	Value Education I: Yoga	2	3	25	75	100	2
	Total	30				700	19
Second semester							
		Part I					
18UTALA201/ 18UHILA201/ 18UFRLA201	Tamil II/Hindi II/ French II	5	3	25	75	100	3

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Part II							
18UENLA201	Foundation English II	5	3	25	75	100	3
Part III							
18UBTM201	Core II : Principles of Genetics	6	3	25	75	100	5
18UBTMP201	Core Practical – II	5	6	40	60	100	2
18UCHBTA201	Allied II: Chemistry	4	3	25	75	100	2
18UCHBTAP201	Allied Practical II: Chemistry	3	3	40	60	100	2
Part IV							
18UVE201	Value Education II: Environmental Studies	2	3	25	75	100	2
	Total	30				700	19
Third Semester							
Part I							
18UTALA301/ 18UHILA301/ 18UFRLA301	Tamil III/Hindi III/ French III	5	3	25	75	100	3
Part II							
18UENLA301	Foundation English III	5	3	25	75	100	3
Part III							
18UBTM301	Core III: Microbiology	5	3	25	75	100	5
18UBTMP301	Core Practical – III	3	6	40	60	100	2
18UBCBTA301	Allied III: Biochemistry (Biomolecules)	3	3	25	75	100	2
18UBCBTAP301	Allied Practical III: Biochemistry (Biomolecules)	3	3	40	60	100	2
Part IV							
18UBTSB301	SBC I: Calculations for Biologist (100% Internal Evaluation)	2	3	100	-	100	2
	NMEC -I	2	3	25	75	100	2

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Non Credit							
18ULS301	Career competency Skills I	1	-	-	-	-	-
	Add on course	1					
	Total	30				800	21
Fourth Semester							
Part I							
18UTALA401/ 18UHILA401/ 18UFRLA401	Tamil IV/ Hindi IV/ French IV	5	3	25	75	100	3
Part II							
18UENLA401	Foundation English IV	5	3	25	75	100	3
Part III							
18UBTM401	Core IV: Biophysics and Bioinstrumentation	5	3	25	75	100	5
18UBTMP401	Core Practical - IV	3	6	40	60	100	3
18UMABTA401	Allied IV: Biostatistics	4	3	25	75	100	2
18UMABTAP401	Allied Practical IV: Statistics (Using MS-Excel)	2	3	40	60	100	2
Part IV							
18UBTSB401	SBC II: Biosafety and Bioethics (100% Internal Evaluation)	2	3	100	-	100	2
	NMEC -II	2	3	25	75	100	2
Non Credit							
18ULS401	Career competency Skills II	1	-	-	-	-	-
	Add on course	1					
	Total	30				800	22
Fifth Semester							
Part III							
18UBTM501	Core V: Molecular Biology	5	3	25	75	100	5
18UBTM502	Core VI: Inmunology	5	3	25	75	100	5
18UBTM503	Core VII: Industrial Biotechnology	5	3	25	75	100	5

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18UBTM504	Core VIII: Plant tissue culture	5	3	25	75	100	5
	Elective I	4	3	25	75	100	4
18UBTMP501	Core Practical -V	3	6	40	60	100	3
	Part IV						
18UBTSB501	SBC III: IPR for Life science (100% Internal Evaluation)	2	3	100	-	100	2
18ULS501	Career competency skills III	1	-	-	-	-	-
	Part V						
18UBTE501	Extension Activity	-	-	-	-	-	2
	Total	30				700	31
Sixth Semester							
	Part III						
18UBTM601	Core IX: Recombinant DNA Technology	5	3	25	75	100	5
18UBTM602	Core X : Environmental Biotechnology	5	3	25	75	100	5
18UBTM603	Core XI: Basics of Animal Cell culture	5	3	25	75	100	5
	Elective II	4	3	25	75	100	4
18UBTMP601	Core Practical-VI	3	6	40	60	100	3
18UBTPR601	Internship	5	-	40	60	100	4
	Part IV						
18UBTSB601	SBC IV: Basics of Research	2	3	25	75	100	2
18ULS601	Career competency Skills IV	1	-	-	-	-	-
	Total	30				700	28
				Grand Total		4400	140

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NON-MAJOR ELECTIVE COURSE (NMEC)

The Department offers the following two subjects during III and I semesters as Non Major Elective Courses for the students of other departments.

S.No	Subject Code	Semester	Subject
1.	18UBTNM301	III	Medicinal herbs
2.	18UBTNM401	IV	Fundamentals of Biotechnology

ELECTIVE COURSES

The Department offers the following subjects during V and VI semesters as Elective Courses. The students can opt any one subject as their Elective course in the respective semester.

S.No	Semester	Elective	Subject code	Subject
1.	V	Elective I	18UBTEL501	Nanobiotechnology/
			18UBTEL502	Bioinformatics/
2.	VI	Elective II	18UBTEL601	Medical Biotechnology /
			18UBTEL602	Food Biotechnology/

Add-on Course & Advanced Learners courses: (Career Oriented Courses)

The Department offers the following subjects during III, IV and V semesters as Add-on Course and ALC. The students can opt any one subject in the respective semester.

S.No	Semester	Course	Subject code	Subject
1.	III & IV	Add-on Course	18UBTAC301	Medical transcription
			18UBTAC302	Electrophoresis
			18UBTAC401	Corporate Biotechnology
			18UBTAC402	Animal physiology
2.	IV & V	ALC	18UBTAL401	DNA Science and Drug discovery
			18UBTAL402	Stem cell Biology
			18UBTAL501	Genes and Humans
			18UBTAL502	Omics- Science

CONTROLLER OF EXAMINATIONS

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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 Bioprocess technology and Immunology	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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ELECTIVE COURSES

The department offers the following four subjects as Elective courses for second and fourth semesters.

S.No	Subject Code	Semester	Subject
1.	18PBTEL201	II	Cell communication and Signaling
2.	18PBTEL202		Bioinstrumentation and Bioinformatics
3.	18PBTEL401	IV	Environmental Biotechnology
4.	18PBTEL402		Evolution and Biodiversity

TOTAL CREDIT DISTRIBUTION

S.NO	PART	COMPONENTS	TOTAL NUMBER OF SUBJECTS	MAXIMUM MARKS	TOTAL MARKS	CREDIT POINTS
1.	PART - A	Core Subjects	11	100	1100	55
		Core Practical	4	100	400	11
		IDC Paper	2	100	200	04
		IDC Practical	2	100	200	04
		Elective Subject	2	100	200	08
		Project	1	200	200	06
2.	PART - B	Value Education	1	100	100	02
				Total	2400	90

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18UBTEL501	ELECTIVE I: NANOBIOTECHNOLOGY	SEMESTER - V

Course Objectives:

The Course aims

- To know the basis of nanobiotechnology and to obtain knowledge about various applications.

Credits: 4 Total Hours: 40

UNIT	CONTENTS	Hrs	CO
I	Nanobiology – concepts, definitions, prospects; nanoparticles – size, shape, properties. Bionanoparticles – nanostarch, nano composites – dendrimers.. Hot – Dot nanoparticles. Types of biomaterials. Biodegradable polymers.	08	CO1
II	Methods of nanobiotechnology – Analysis of bimolecular nanostructures by Atomic Force Microscopy, Scanning Probe Electron Microscopy. Nanofabrication – lithography. Drug nanoparticles - structure and preparation, Liposomes, Cubosomes and hexosomes. Lipid based nanoparticles- liquid nano dispersion, solid liquid nanoparticles	08	CO2
III	Nanotubes, Nanorods, Nanofibers and Fullerenes for nanoscaledrug. Bionanoelectronics. Applications of nanobiotechnology in medicine, drug designing and cancer treatment. Medical, social and ethical considerations of nanobiotechnology.	08	CO3
IV	Nanopores, Applications of NanoMolecules in Biosystems - Nanoscale Elements for Delivery of Materials into Cells: Peptides Coupled Nanoparticles. DNA Based Artificial Nanostructure. Proteins as Components in Nanodevices- Nanoparticle synthesis in plants, bacteria, and yeast.	08	CO4
V	Nanotechnology for Cancer Diagnostics and Treatment: Cancer Biology; Clinical Aspects, Current Approaches and Challenges. Nanotechnology for Cancer Research and Therapy.. siRNA. Tumor-targeted Drug Delivery Systems. Nanotechnology for Imaging and Detection	08	CO5

Reference Books

1 *Christof M. Niemayer, Chad A. Mirkin,* 2004. Nanobiotechnology: Concepts, applications and perspectives. Wiley VCH publishers

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2	*David S. Goodsell., 2006. Bionanotechnology: Lessons from Nature. John Wiley & Sons, New Jersey.*
3	*Jain K.K., 2005. Nanobiotechnology in Molecular Diagnostics: Current Techniques and Applications. Tailor L. Francis Group.*
4	*Tuan Vo-Dinh, 2007. Nanotechnology in Biology and Medicine: Methods, Devices and Applications. CRC Press, Taylor and Francis Inc., London.*
5	*Torchilin Vladimir P. 2006. Nanoparticulates as Drug Carriers. World Scientific. Imperial College Press, World Scientific Publishing Co. Pt. Ltd, London.*

COURSE OUTCOMES (CO)

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

CO1	Understand the basic concepts and biomaterials
CO2	Gain knowledge about the methods and drug nanoparticles
CO3	Apply the applications of nanoparticles in medicine
CO4	Synthesize nanoparticles using biological materials
CO5	Diagnose and treat cancer and improve their Current Approaches and Challenges in nanotechnology

MAPPING

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

H-High; M-Medium; L-Low

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18UBTEL502	ELECTIVE I: BIOINFORMATICS	SEMESTER - V

Course Objectives:

The Course aims

- To understand and gain both the theoretical and practical concepts in Bioinformatics.

Credits: 4 Total Hours: 40

UNIT	CONTENTS	Hrs	CO
I	Basic computer components - Hardware, software, operating systems, computer networks, programming, internet, browsers, search engines, email, databases. Basic concepts of biomolecules and computers: Basic concepts of biomolecules – Protein and amino acid, DNA and RNA - Sequence, Structure and function.	08	CO1
II	Introduction: Definitions, Objectives, Scope, Applications of Bioinformatics, History and milestones of bioinformatics, Genome sequencing projects – Steps, Human Genome Project and other genome projects.	08	CO2
III	Biological Database– classification and Properties, Data Formats (FASTA, GENBANK, PDB), Format conversion. Sequence Database: GENBANK and EMBL – divisions, retrieval system, and depositing system, PIR and SWISSPROT – Features, Sequence retrieval and depositing system, Structural databases (PDB, SCOP, CATH), Literature Database: OMIM, Pubmed and Medline.	08	CO3
IV	Database searching and Sequence Alignment: Similarity searching programs-BLAST, Sequence alignment - Pair-wise and Multiple-sequence alignment (Methods and Algorithms), CLUSTAL-W, Protein structure alignment (Methods, algorithms- DALI) Phylogenetic analysis (Methods, algorithms).	08	CO4
V	Gene prediction: Gene prediction in prokaryote and eukaryotes. Extrinsic approaches and Ab initio approaches. Predicting the protein secondary structure (Domain, blocks, motifs), Predicting protein tertiary	08	CO5

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	structure (Homology, Ab-initio, threading and fold recognition) and visualization of predicted structure.		

Text Books

1	*Jin Xiong*, 2006. Essential Bioinformatics. Cambridge University Press. UK.
2	*Attwood, K.* and *Smith J. P.* 2003. Introduction to Bioinformatics. Pearson Education, Singapore.

Reference Books

1	*Rajaraman V.*, 2003. Introduction to information technology. Prentice Hall of India Pvt. Ltd, New Delhi.
2	*Lesk, A. M.*, 2002. Introduction to Bioinformatics. Oxford University Press, London.
3	*Attwood T. K.* and *Parry-Smith D J.* 2005. Introduction to Bioinformatics. [First Edition]. Pearson Education, UK.
4	*Kothekar V.* and *Nandi T*, 2007. An Introduction to Bioinformatics. [Second Edition]. Duckworth press- Bioscience Publishers, New Delhi.
5	*David W Mount*, 2004. Bioinformatics: Sequence and Genome Analysis. CSHL Press, New York.

COURSE OUTCOMES (CO)

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

CO1	Gain knowledge about basic computer components and concepts of biomolecules in computer
CO2	Understand the basic concepts and applications of Bioinformatics
CO3	Apply the ideas in deposition & retrieval of data's in biological database
CO4	Compare several data's for analyzing evolutionary relationship
CO5	Do the prediction of protein structure by several methods

MAPPING

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

H-High; M-Medium; L-Low

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18UBTEL601	ELECTIVE II: MEDICAL BIOTECHNOLOGY	SEMESTER-VI

Course Objectives:

The course aims

- To understand the application of Biotechnology in the field of medicine.

Credits: 4 Total Hours: 40

UNIT	CONTENTS	Hrs	CO
I	Medical Biotechnology- Need and Scope, Genetic disease and its classification, Molecular basis of single gene disorder, lysosomal storage disease, single gene disorder with non classical patterns of inheritance-mutation in mitochondrial genes, trinucleotide repeat expansion disorder.	08	CO1
II	DNA in disease diagnosis and medical forensics – Detecting infectious disease: detection and identification of microorganisms – sample preparation, bacterial targets of molecular based tests. Antimicrobial agents, Molecular epidemiology, virus – nucleic acid blotting technique for virus detection. Molecular detecting of inherited disease – Molecular diagnosis of single gene disorders i) Factor V ii) Cystic fibrosis.	08	CO2
III	Molecular oncology: Classification of neoplasms, molecular basis of cancer, Analytical targets for molecular testing, Gene rearrangements in Leukemia and lymphoma. DNA based tissue typing: HLA polymorphism.	08	CO3
IV	Pharmaceutical products from recombinant DNA technology. Human protein replacements – Insulin and Human growth hormone. Therapeutic agents – tissue plasminogen activator and interferons. Recombinant vaccines – Subunit vaccine, attenuated recombinant vaccine and vector recombinant vaccine.	08	CO4
V	Stem Cells therapy and tissue engineering strategies in regenerative medicine – Introduction, Basic component of tissue engineering –Native cells, embryonic stem cells, placental and amniotic fluid stem cells. Tissue	08	CO5

	engineering for specific tissues and organ		

Text Book	
1	*Lela Buckingham* and *Maribeth L. Flaws.* 2007. Molecular diagnostics-Fundamentals, methods and clinical applications. FA Davis Company. Philadelphia.
Reference Books	
1	*Jean-Louis Sersa.* 2002. Diagnostic techniques in genetics. John wiley and sons, Ltd.
2	*Danny L. Wiedbrauk* and *Daniel H. Farka.,* 1995. Molecular Methods for virus detection. Academic press.
3	*Brown.T.A.* 2005. Genomes. [Third Edition]. New York : Garland Science Pub.
4	*Primrose ,S.B.* and *Twyman,R.M.* 2006. Principles of gene manipulation and genomics. [Seventh Edition]. Blackwell Publication.
5	*Sathyanarayana, U.* 2009. Biotechnology. Books and Allied Private Ltd, Kolkatta.

COURSE OUTCOMES (CO)

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

CO1	Explain about genetic disease.
CO2	Demonstrate DNA in disease diagnosis
CO3	Describe the molecular basis of cancer, Gene rearrangements in Leukemia and lymphoma and DNA based tissue typing
CO4	Explain about pharmaceutical products.
CO5	Illustrate about stem Cells therapy and tissue engineering.

MAPPING

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

H-High; M-Medium; L-Low

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18UBTEL601	ELECTIVE II: FOOD BIOTECHNOLOGY	SEMESTER - VI

Course Objectives:

The Course aims

- To get knowledge in the field of food processing and its application.

Credits: 4 Total Hours: 40

UNIT	CONTENTS	Hrs	CO
I	Constituents of food and dietary sources of food – Carbohydrates, Lipids, Proteins, Water, Vitamins and Minerals. Intrinsic and extrinsic factors of food that affect microbial growth.	08	CO1
II	Role of microbes in food industry – Production of culture for food fermentation, Food fermentation- Bread, fermented vegetables, pickles, cheese, Soy Sauce, Idli	08	CO2
III	Principles and methods of food preservation: Asepsis removal, Anaerobic conditions, Preservation by temperature, evaporation and drying, food additives, radiation, Pasteurization.	08	CO3
IV	Food microbiology: Role of microbes in food spoilage, Food Borne disease, Microbial toxins. Detection of microbes in food sample.	08	CO4
V	Food Safety, Quality and Regulatory issues: Definition of food safety, Characterization of food hazards – Physical, chemical and biological. Food aduit.	08	CO5

Text Book

1. *Frazier, W.S. and Weshoff, D.C.*, 1988. **Food Microbiology.** [Fourth Edition]. McGraw Hill Book Co., New York.
2. *Toledo, R.T.*, 2000. **Fundamentals of Food Processing.** [Third Edition]. AVI Publishing Company, USA.

Reference Books

1. *Khetarpaul, Neela*, 2006. *Food Microbiolgy*, Daya Publishing.
2. *Singh,R.Paul and D.R.Heldman.* 2009. **Introduction to Food Engineering.** [Fourth Edition] Scademic Press.

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COURSE OUTCOMES (CO)

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

CO1	Find the knowledge about constituents of food
CO2	Understand about production of food fermentation and food processing
CO3	Demonstrate the principles and various methods of food preservation
CO4	Describe the role of food pathogens
CO5	Gain knowledge about different types of food hazards in food industry

MAPPING

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

H-High; M-Medium; L-Low

K.S. RANGASAMY COLLEGE OF ARTS & SCIENCE (AUTONOMOUS) CONTROLLER OF EXAMINATIONS TIRUCHENGODE-637 215

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Tiruchengode - 637 215. Tamilnadu. India.

18PBTEL201	ELECTIVE I: CELL COMMUNICATION AND SIGNALING	SEMESTER - II

Course Objectives:

The Course aims

- To gain knowledge about basics about the Cell signaling and cell communication.
- To learn about the pharmaceutical biotechnology and cancer immunology.

Credits: 4 Total Hours: 50

UNIT	CONTENTS	Hrs	CO
I	Host parasite interaction: Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells, alteration of host cell behavior by pathogens, virus-induced cell transformation, pathogen-induced diseases in animals and plants, cell-cell fusion in both normal and abnormal cells.	10	CO1
II	Cell signaling: Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two component systems, light signaling in plants, bacterial chemo taxis and quorum sensing.	10	CO2
III	Cellular communication: Regulation of hematopoiesis, general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation.	10	CO3
IV	Toll-like receptors, Cytokines receptors, Leukocyte migration - Cell adhesion molecules, Neutrophil extravasation, Lymphocyte extravasation. Cell-mediated	10	CO4

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	effector functions, immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections.		
V	Cancer: Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth.	10	CO5

Reference Books

1. *Gerald Karp.*, 2010. Cell Biology. [Sixth Edition]. John wiley and Sons (Asia) Pvt. Ltd.
2. *Geoffrey M. Cooper and Hausman, R.E.*, 2007. The Cell - A Molecular Approach. [Fourth Edition]. ASM Press, Washington, D.C.
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.
5. *Kuby Richard. A. Goldsby, Thomas. J. Kint.* and *Barbara. A. Osborne.* 2000. Immunology [Fourth Edition]. W.H. Freeman and Company, New York.
6. *Kalus D. Elgert.* 2009. Immunology - Understanding the Immune System. [Second Edition]. Wiley-Blackwell Publication.
7. *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)

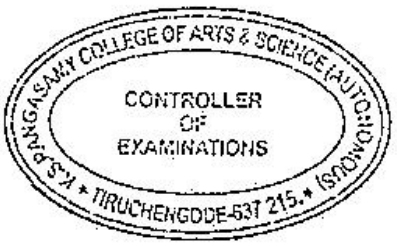
After completion of the course, the students will be able to

CO1	Apply the basic knowledge of Host parasite interaction.
CO2	Explain about cell signaling.
CO3	Describe about cell communication.
CO4	Demonstrate the types of receptors and immune response during microbial infection.
CO5	Explain about cancer.

MAPPING

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

H-High; M-Medium; L-Low



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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 Alignment: Principle, methods and Alignment with BLAST.	10	CO4

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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.

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.

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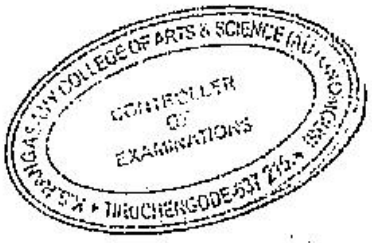
CO4	Interpret the biological data in computational methods & tools for solving research problems easily.
CO5	Predict the gene structure and also construct phylogenetic tree for studying the similarity and evolutionary relationship within the organism.

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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18PBTEL401	ELECTIVE II: ENVIRONMENTAL BIOTECHNOLOGY	SEMESTER - IV

Course Objectives:

The Course aims

- To know about environment and to get knowledge about applications of biotechnology to protect and to develop our environment.

Credits: 4 Total Hours:50

UNIT	CONTENTS	Hrs	CO
I	EIA, Basic concepts and issues, Environmental pollution – air, water and soil, its control measures. Ozone depletion, UV-B, green-house effect and acid rain, their impact and biotechnological approaches for management.	10	CO1
II	Aerobic System -Biological processes for domestic and industrial waste water treatments; Activated sludge process, Trickling filters, Biological filters, Rotating biological contractors, Fluidized bed reactor, Expanded bed reactor, Inverse fluidized bed biofilm reactor, Packed bed reactors, Air- sparged reactors, Anaerobic System- Anaerobic biological treatment - Contact digesters, Packed column reactors, UASB.	10	CO2
III	Introduction, constraints and priorities of Bioremediation, Biostimulation of Naturally occurring microbial activities, Bioaugmentation, *in situ, ex situ,* intrinsic & engineered bioremediation, Phytoremediation. Composting, Bioventing & Biosparging; Liquid phase bioremediation - Suspended bioreactors, Fixed biofilm reactors. Bioremediation of oil contaminated soil and water.	10	CO3

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IV	Microbial transformation, accumulation and concentration of metals, metal leaching, extraction and future prospects. Microorganisms and energy requirements of mankind; Production of nonconventional fuels - Methane (Biogas), Hydrogen, Fuel cells, Alcohols and algal hydrocarbons,Use of microorganisms in augmentation of petroleum recovery. CO_2 sequestration through plant.	10	CO4
V	Introduction - Xenobiotic compounds, Biodegradation of Xenobiotics. Biological detoxification- hazardous waste management, cyanide detoxification - detoxification of oxalate, urea and toxic organics like phenols. Polyhydroxy Butyrate, Natural Biopolymers.	10	CO5

Reference Books

1. *Wesley, W. and Eckenfelder, J.R.* 2000. **Industrial Water Pollution Control.** [Third Edition]. Mc Grow – Hill Higher Education.
2. *Martin Alexander,* 1999. **Biodegradation & Bioremediation.** Academic Press.
3. *Ronald. L. Crawford and Don L. Crawford,* 1998. **Bioremediation Principles and Application.** [First Edition]. Cambridge University Press.
4. *Rao, C.S.* 1999. **Environmental Pollution Control Engineering.** [First Edition].New Age International (P) Limited, New Delhi.
5. *Atlas and Bartha.* 1998. **Microbial ecology.** [Fourth Edition]. Benjamin Science Publishing (P) Ltd.
6. *Indu Shekhar Thakur.* 2011. **Environmental Biotechnology- Basic concepts and applications** [Second Edition]. I.K. International Publishing House Pvt Ltd.

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COURSE OUTCOMES (CO)

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

CO1	Solve the environmental issue through biotechnological approaches.
CO2	Treat the industrial waste water by biological treatment.
CO3	Apply bioremediation to the contaminated soil and water.
CO4	Use microbes to leach metals and to produce biogas.
CO5	Manage the hazardous waste and to detoxify them.

MAPPING

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

H-High; M-Medium; L-Low

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18PBTEL402	ELECTIVE II: EVOLUTION AND BIODIVERSITY	SEMESTER - IV

Course Objectives:

The Course aims

- To understand the evolutionary concept and biodiversity.

Credits: 4 Total Hours:50

UNIT	CONTENTS	Hrs	CO
I	Lamarckism; Darwin-concepts of variation, adaptation, Speciation, struggle, fitness and natural selection. Major groups of plants and animals (Evolutionary tree).	08	CO1
II	Origin of cells and unicellular evolution: Origin of basic biological molecules; Abiotic synthesis of organic monomers and polymers; Concept of Oparin and Haldane; Experiment of Miller; The first cell; Evolution of prokaryotes; Origin and evolution of eukaryotic cells, Anaerobic metabolism, photosynthesis and aerobic metabolism.	12	CO2
III	Paleontology and Evolutionary History: The evolutionary time scale - Era, period and epoch; Major events in the evolutionary time scale; Stages in primate evolution including Homo.	10	CO3
IV	**Principles & methods of taxonomy:** Concepts of species and hierarchical taxa, biological nomenclature, classical & quantitative methods of taxonomy of plants, animals and microorganisms. Levels of structural organization: Unicellular, colonial and multicellular forms. Levels of organization of tissues, organs & systems.	08	CO4

CONTROLLER OF EXAMINATIONS

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V	Major habitat types of Indian subcontinent, Common Indian mammals, birds. Organisms of conservation concern: Rare, endangered threatened and endemic species. Red data Book, Conservation strategies. Biodiversity types, Loss of biodiversity, Climate change and its impacts, Kyoto protocol, Geneva convention, Indian Biodiversity Acts.	12	CO5

Text Book	
1	Veer Bala Rastogi. 12th Edition. Organic evolution. Kedarnat Ramnath, Meerut, Delhi.
2	Jha AP, 1997. Genes and Evolution. Mac Millan India Limited.

COURSE OUTCOMES (CO)

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

CO1	Explain about Lamarckism, Darwin concepts and evolutionary tree.
CO2	Attain knowledge about evolution, photosynthesis and metabolism.
CO3	Explain about Paleontology and Evolutionary History.
CO4	Describe about taxonomy.
CO5	Attain knowledge about Conservation strategies and Biodiversity.

MAPPING

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

H-H igh; M-Medium; L-Low

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