

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

Tiruchengode – 637 215

Department of Biotechnology

Courses focus on Employability/Entrepreneurship/Skill development

Programme: UG Biotechnology

EMPLOYABILITY:

- 18UBTM301 - Core III-Microbiology
- 18UBTAC301 - Add On Course I-Medical Transcription
- 18UBTAL401 - Advanced Learners Course I-DNA Science and Drug Discovery
- 18UBTAL402 - Advanced Learners Course I-Stem Cell Biology
- 18UBTNM401 - NMEC II-Fundamental Biotechnology
- 18UBTM502 - Core VI-Immunology
- 18UBTM503 - Core VII - Industrial Biotechnology
- 18UBTM504 - Core VIII- Plant Tissue Culture
- 18UBTM601 - Core IX-Recombinant DNA Technology
- 18UBTEL601 - Elective II - Medical Biotechnology

ENTREPRENEURSHIP:

- 18UBTAC401 - Add On Course II-Corporate Biotechnology
- 18UBTEL601 - Elective II-Food Biotechnology

SKILL DEVELOPMENT:

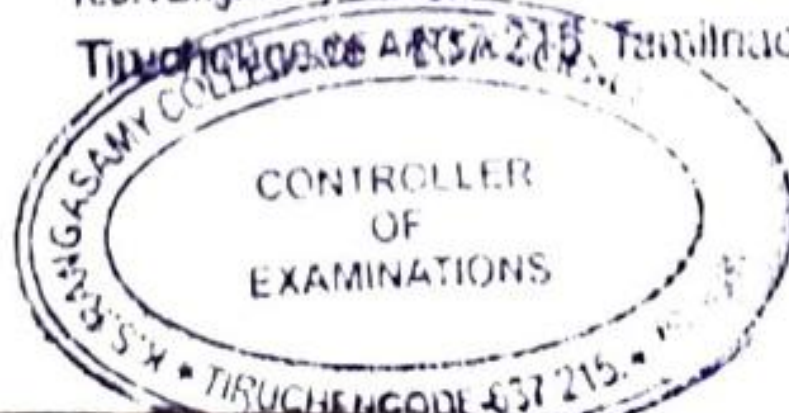
- 18UBTSB301 - SBC I - Calculations for biologist
- 18UBTSB401 - SBC II- Biosafety and Bioethics
- 18UBTSB501 - SBC III - IPR for life science
- 18UBTSB601 - SBC IV - Basics of research


HOD

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


COE

Mr. M. PRASAD, M.Sc., M.A., M.Phil.,
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B.Sc., Biotechnology (Students admitted from 2018-2019 onwards)

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: Lab in Cell Biology	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							
18SUBTM201	Core II : Principles of Genetics	6	3	25	75	100	5
18SUBTMP201	Core Practical II: Lab in Genetics	5	6	40	60	100	2
18UCHBTA201	Allied II: Chemistry	4	3	25	75	100	2
18UCHBTAP201	Allied Practical II: Volumetric and Organic analysis	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: Lab in Microbiology	3	6	40	60	100	2
18UBCBTA301	Allied III: Biochemistry	3	3	25	75	100	2




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18UBCBTAP301	Allied Practical III: Biochemistry	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
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: Lab in Biophysics and Bioinstrumentation	3	6	40	60	100	3
18UMABTA401	Allied IV: Biostatistics	4	3	25	75	100	2
18UMABTAP401	Allied Practical IV:	2	3	40	60	100	2




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	Statistics (Using MS - Excel)						
Part IV							
18UBTBSB401	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




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NON-MAJOR ELECTIVE COURSE (NMEC)

The Department offers the following two subjects during III and IV 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

ADD-ON COURSE

The department offers the following two subjects as Add-on courses for third and fourth semesters.


S.No	Subject Code	Semester	Subject
1.	18UBTAC301	III	Medical transcription
2.	18UBTAC302		Electrophoresis
3.	18UBTAC401	IV	Corporate Biotechnology
4.	18UBTAC402		Animal physiology


ADVANCED LEARNER COURSE

The department offers the following two subjects as Advanced Learners courses for fourth semester.

S.No	Subject Code	Semester	Subject
1.	18UBTAL401	IV	DNA Science and Drug discovery
2.	18UBTAL402		Stem cell Biology




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B.Sc., Biotechnology (Students admitted from 2018-2019 onwards)

18UBTM301	CORE III: MICROBIOLOGY	SEMESTER- III	
Course Objectives:			
The Course aims			
<ul style="list-style-type: none"> To learn the basics of Microbiology. To acquire the basic knowledge on staining, sterilization and antimicrobial chemotherapy. 			
Credits:5		Total Hours:50	
UNIT	CONTENTS	Hrs	CO
I	Definition of Microbiology- Scope and Branches of Microbiology- Contributions- Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Alexander Fleming. Classification of microorganisms - Three kingdom concept and Whittaker's five kingdom concept and Molecular taxonomy.	10	CO1
II	Microscopy- Simple and compound microscope- Dark field microscope- Phase contrast microscope- Fluorescence microscope- Electron microscope. Principles and types of stain -Simple stain, differential stain - Cell wall of Gram positive and Gram negative bacteria and principle of gram staining and special staining - Endospore & Capsular.	10	CO2
III	Media preparation- Liquid media, Solid Media, Selective Media, enriched, enrichment and Differential Media; Isolation of pure culture- Pour, Spread plate and Streak plate methods.	10	CO3
IV	Sterilization- Principles- dry heat- moist heat- Radiation - UV rays- gamma rays Filtration-Depth, membrane and HEPA filters. Disinfection and disinfective agents. Chemicals-Alcohol, Aldehydes, Phenol.	10	CO4

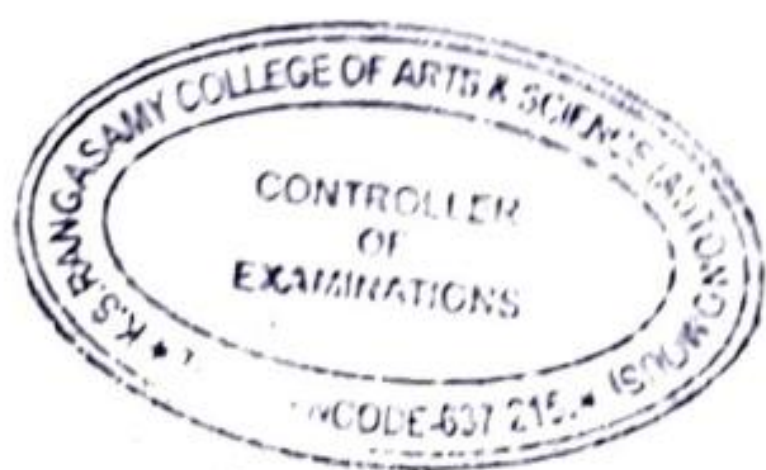


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V	Bacterial Growth curve, bacteriostatic, bactericidal and fourth generation antibiotics, Antimicrobial chemotherapy- Antibiotics-mode of action of cell wall, Protein and nucleic acid synthesis inhibitors -antibiotic susceptibility test-Kirby-Bauer & Stokes methods.	10	CO5
Text Book			
1	<i>Pelczar Jr. M. J. Chan, E.C.S and N.R. Kreig.1995. Microbiology. Tata McGraw Hill New Delhi.</i>		
Reference Book			
1	<i>Christopher, J. Woolveerton, Joanne Wiley and Linda Sherwood.2007. Prescott's Microbiology. [Fourth Edition]. Tata McGraw Hill, New Delhi.</i>		



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M.P.
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B.Sc., Biotechnology (Students admitted from 2018-2019 onwards)

COURSE OUTCOMES (CO)

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

CO1	Contrast the contributions made by the Microbiologist.
CO2	Recognizes the parts of microscopy and apply the principles of staining techniques.
CO3	Use the compositions of different media and for isolation of microbes.
CO4	Extend the knowledge on sterilization techniques for practical applications.
CO5	Evaluate the properties of antimicrobial agents.

MAPPING

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

H-High; M-Medium; L-Low



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18UBTAC301	ADD ON COURSE: MEDICAL TRANSCRIPTION	SEMESTER- III	
Course Objectives: The Course aims <ul style="list-style-type: none"> To study about human Anatomy and physiology and its medical terminology To understand the concept of process of medical transcription. 			
Total Hours: 25			
UNIT	CONTENTS	Hrs	CO
I	Introduction: Basics of medical transcription, medical transcription types, process of medical transcription, responsibilities of medical transcriptionist, advantages and disadvantages of medical transcription.	05	CO1
II	Anatomy and physiology: Tissues and Organ Systems, Integumentary System, Musculoskeletal System, Neurological System, Cardiovascular System, Reproductive System	05	CO2
III	Medical Terminology: Definition and Origin of Medical Terms, Components of Medical Terms, Prefixes, Suffixes, Roots and Combining forms, External Anatomy and Internal Anatomy.	05	CO3
IV	Emdat In Scribe software: Transcription Technology, Medical Reports, Medical Transcriptionist's Tool Box, E-mail and Security, Medical Transcription Report Editing,	05	CO4
V	International Classification of Diseases (ICD-10) and Surgical Procedures (ICD-9CM), CPT, HCPCS, Ethics and confidentiality /HIPAA laws.	05	CO5
Reference book			
1	Marcy Otis Diehl. 2011. Medical Transcription: Techniques and Procedures , [Seventh Edition], Kindle Edition.		
2	Alice G. Ettinger, Balanche Ettinger, 2009. Medical Transcription: Techniques, Technologies, and Editing Skills [third revised edition] EMC Paradigm, US.		



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B.Sc., Biotechnology (Students admitted from 2018-2019 onwards)

3	Arnould Taylor W.E. 1988. A Textbook of Anatomy and Physiology [second edition] Nelson Thornes Ltd.
4	Frederic H. Martini, Judi L. Nath, Edwin F. Bartholomew.2017. Fundamentals of Anatomy & Physiology [11th Edition].


COURSE OUTCOMES (CO)

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

CO1	Gain knowledge about the types and process of medical transcription.
CO2	Explain about anatomy and physiology.
CO3	Describe about medical terminology
CO4	Explain about Emdat In Scribe software.
CO5	Describe about various surgical procedures and ethics.



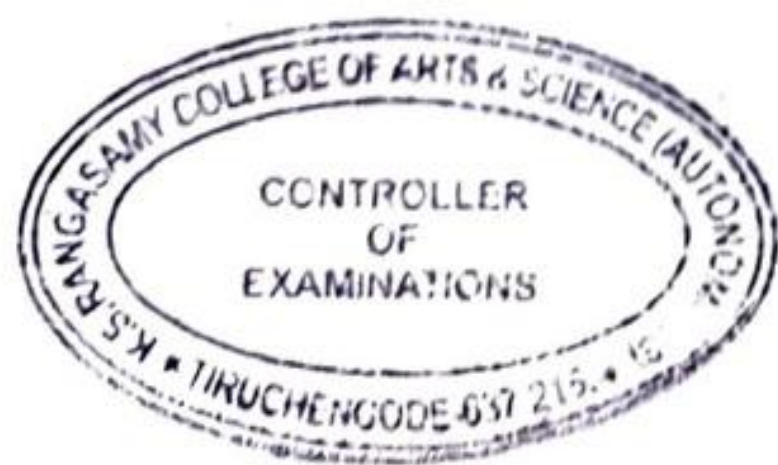

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B.Sc., Biotechnology (Students admitted from 2018-2019 onwards)

1SUBTAC401	ADD ON COURSE : CORPORATE BIOTECHNOLOGY	SEMESTER - IV	
Course Objectives: The Course aims <ul style="list-style-type: none"> To know about the knowledge of standard in the corporate world. To study about the transgenic plants and animals. 			
Total Hours:25			
UNIT	CONTENTS	Hrs	CO
I	Corporate Biotechnology- Introduction, Applications. Intellectual property rights- Copy rights, Patent, Trade mark and Legal aspects. Preparation of Project for loans through government and banking agencies.	05	CO1
II	Genetically modified crops: Transgenic plants - viral resistance plants, pest resistance plants, saline tolerance plants, Bt cotton, Bt brinjal, golden rice, Flavr Savr ^R	05	CO2
III	Animal breeding - Care and maintenance of laboratory animals- mice, rabbit, monkey, guinea pig. Advantages of Transgenic animals. Laboratory animal's ethics - Anesthesia. Ethical guidelines for use of Animals in scientific Research - in-vitro systems to replace animals.	05	CO3
IV	Aquaculture- Transgenic fishes, Silvi culture- Principles and establishment of silvi culture system. Arboriculture- Introduction, Applications. Recent and traditional advances in various types of culture practices.	05	CO4
V	Biofertilizers and Biopesticides - scale up, quality control and marketing. Single cell proteins - spirulina production. Organic farming- Certification procedures, organic certification, annual inspections, feeding the world 21 st century, applications.	05	CO5

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Text Book	
1	G. Rangaswami and D.J. Bagyaraj, 1998. Agricultural Microbiology . [Second Edition]. Prentice, Hall of India Pvt. Ltd., New Delhi.
Reference Books	
1	Purohit, S.S. 2009. Biotechnology: Fundamentals and Applications . [Fourth Edition].
2	Keshav Trehan, 1997. Biotechnology . New age International Pvt. Ltd., Publication.
3	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	Explain about Coporate Biotechnology.
CO2	Recall about genetically modified crops.
CO3	Describe about the animal breeding and ethical guidelines.
CO4	Explain about aquaculture and arboriculture.
CO5	Produce biofertilizers and biopesticides.




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18UBTAL401	ADVANCED LEARNER COURSE : DNA SCIENCE AND DRUG DISCOVERY	SEMESTER - IV
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Course Objectives:

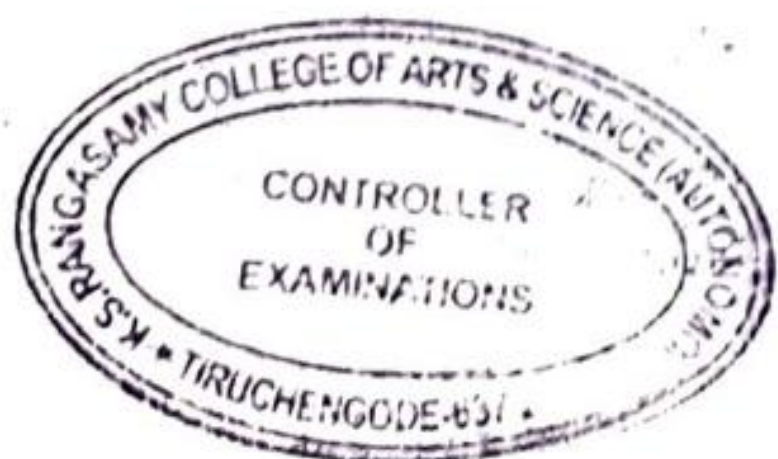
The Course aims

- To acquire the knowledge about basics of DNA and its uses modern research.
- To apply the knowledge of drug discovery in developing novel drugs.

UNIT	CONTENTS	CO
I	History and discovery of DNA. Properties of DNA, DNA double helix structure and features, chemical modifications Replication - types, Proof of DNA as genetic material.	CO1
II	Squeezing into the chromosomes, organization, types of DNA cytoplasmic DNA, Chloroplast DNA, Mitochondrial DNA. Biological functions, Interactions with proteins.	CO2
III	DNA technology- DNA isolation, DNA profiling, Genetic engineering, Restriction enzymes, Nucleic acid electrophoresis, DNA polymorphism.	CO3
IV	Drug Discovery: History, Definition, and Scope of drug discovery. Screening and designing of drugs. Traditional and Alternative System of Medicine	CO4
V	Classification of Crude Drugs, Drug containing secondary metabolites. Plant derived, microbial metabolites, marine invertebrates. Methods of Drug Evaluation; chemical characterization. Screening, structural elucidation.	CO5

Reference books

- 1 Tarek K. 2017. **The DNA molecule Structure and Features.** Cario University press.
- 2 James D. Watson. 1967. **The Double Helix- Personal Account of the Discovery of the Structure of DNA.** Harvard University press. Cambridge.



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3	Kokate C.K, Purohit A.P, Gokhale S.B. 2008. Pharmacognosy . Nirali Prakashan publishers, Pune India.
4	James Swarbrick. 2003. Drugs and the Pharmaceutical Sciences , Marcel Dekker publishers, France.


COURSE OUTCOMES (CO)

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

CO1	Explain about the structure, properties and replication of DNA.
CO2	Describe about the types of DNA and its functions.
CO3	Isolate and amplify the DNA.
CO4	Explain about screening and designing of drugs.
CO5	Illustrate about secondary metabolites and drug evaluation.




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18UBTAL402	ADVANCED LEARNER COURSE : STEM CELL BIOLOGY	SEMESTER - IV
Course Objectives: The Course aims <ul style="list-style-type: none"> To equip students with a solid framework of knowledge in stem cell biology. 		
UNIT	CONTENTS	CO
I	Stem Cells - introduction, properties, Important sources of stem cells, Regulation of stem cells self-renewal and molecular markers, cellular and molecular basis of stem cell differentiation.	CO1
II	<i>In vitro</i> fertilization, Human embryonic stem cells (hES) - Isolation, culturing, identification and characterization of hES cells, Cloning and maintenance of hES; Applications of ES cells.	CO2
III	Adult stem cells-types-Hematopoietic stem cells, Bone marrow stromal stem cells, Liver stem cells, Skeletal muscle stem cells, Bone marrow derived stem cells and its applications, identification and differentiation of adult stem cells.	CO3
IV	Therapeutic need for stem cells, Stem cells and progenitors for drug testing, Genetically engineered stem cells for drug discovery & gene therapy, Common signaling pathways in cancer and Pathways involved in cancer & stem cell renewal, Pathways involved in stem cell differentiation.	CO4
Reference Book		
1	Kaushik D. Deb, Satish M. Totey. 2009. Stem cells: Basics and Applications. Tata McGraw Hill Education Private Limited.	



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COURSE OUTCOMES (CO)

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

CO1	Gain knowledge about properties and sources of stem cells.
CO2	Explain about isolation, culturing, identification and characterization of human embryonic stem cells.
CO3	Describe about the types of stem cells and its applications.
CO4	Explain about therapeutic need for stem cells.
CO5	Illustrate about stem cell therapy and preservation of stem cells.

MAPPING

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

H-High; M-Medium; L-Low



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1SUBTNM401	NMEC II: FUNDAMENTALS OF BIOTECHNOLOGY	SEMESTER- IV	
Course Objectives: The Course aims <ul style="list-style-type: none"> To understand the basics about Biotechnology and its day to day application in daily life. 			
Credits:2		Total Hours: 30	
UNIT	Contents	Hrs	CO
I	Introduction to Biotechnology - Origin and Evolution of Biotechnology, Old biotechnology and New biotechnology.	06	CO1
II	Food Biotechnology - Introduction, products, curd, idly, pickles, cheese, wine.	06	CO2
III	Pharmaceutical Biotechnology - Introduction to antibiotics, uses and abuses of antibiotics. Vaccines - introduction, vaccine against common disease, vaccination schedule, edible vaccine, Transgenic animals-fish and chicken.	06	CO3
IV	Agricultural Biotechnology-Genetically modified crops, pros and cons-Bt cotton and Bt brinjal, Golden rice, Aloe vera gel, SCP Spirulina, Spirulina pickle, mushroom cultivation, Azolla, composting, and Biofertilizer.	06	CO4
V	Proposal to bank for loan, MSME, Quality control- FSSAI, AGMARK, and ISO.	06	CO5
Reference book			
1	Daan J.A. Crommelin, Robert D. Sindelar, and Bernd Meibohm, 2008. Pharmaceutical Biotechnology- Fundamentals and applications. Informa healthcare USA, Inc.		
2	Glick R. Bernard and Pasternak] Jack.2007. Molecular Biotechnology. [Third Edition]. ASM press, Washington D.C.		




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COURSE OUTCOMES (CO)

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

CO1	Gain knowledge about the basics of Biotechnology.
CO2	Explain about various food products.
CO3	Describe about the types of vaccines.
CO4	Illustrate about GMO and its products.
CO5	Explain about quality control.



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B.Sc., Biotechnology (Students admitted from 2018-2019 onwards)

18UBTM502	CORE VI: IMMUNOLOGY	SEMESTER - V	
Course Objectives:			
The Course aims			
<ul style="list-style-type: none"> To understand the basic principles of immune system and its response. 			
Credits: 5			Total Hours: 50
UNIT	CONTENTS	Hrs	CO
I	Milestones in Immunology, Immunity: Types - innate and acquired immunity, Cells of immune system, Primary and secondary lymphoid organs.	10	CO1
II	Antigens - antigenicity and immunogenicity. Immunoglobulin - basic structure, function and classes, Hybridoma technology - Production of Monoclonal antibody, Complement systems.	10	CO2
III	Antigen - Antibody interaction, Precipitation - Mancini method and Ouchterlony method, Immuno-electrophoresis, Agglutination - Haemagglutination and Bacterial agglutination, Immunofluorescence, ELISA.	10	CO3
IV	MHC complex - structure and function of MHC, Antigen processing and presentation- Cytosolic pathway and Endocytic pathway, Cytokines - types and functions.	10	CO4
V	Hypersensitivity - definition and its types, Autoimmunity - Organ specific and systemic autoimmune disease, Transplantation immunology - immunologic basis of graft rejection, Vaccines - Live vaccine, killed vaccine, whole organism vaccine and purified macromolecule vaccine.	10	CO5
Text Book			
1	<i>Nandhini Shetty.</i> 2007. Immunology - Introductory text book. New Age International Pvt. Ltd., New Delhi.		
2	<i>Kindt, Goldsby and Osborne.</i> 2006 Kuby Immunology. [Sixth Edition]. W.H.Freeman Publication.		
Reference Books			
1	<i>Ian R Tizard,</i> 2006. Immunology an introduction. [Fourth Edition]. Advanced Immunology David male.		
2	<i>Kalus D. Elgert,</i> 2004. Immunology understanding the Immune system. [Second Edition]. Wiley- Blackwell Publication.		



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B.Sc., Biotechnology (Students admitted from 2018-2019 onwards)

3	Tristram G. Parslow, Daniel P. Stites, Abba I.Terr and John B. Imboden, 2007. Medical Immunology. [Tenth Edition].Tata Mc Graw Hill Publication.
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COURSE OUTCOMES (CO)

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


CO1	Describe the types of Immunity and lymphoid organs.
CO2	Illustrate the antigens and antibodies.
CO3	Explain the Antigen -Antibody interaction in the form of Precipitation and Agglutination reaction by electrophoresis and diffusion processes and also by ELISA.
CO4	Demonstrate the MHC complex, Antigen processing and presentation and cytokines.
CO5	Explain the Hypersensitivity, Autoimmunity, Transplantation immunology and vaccines.


MAPPING

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

H-High; M-Medium; L-Low




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B.Sc., Biotechnology (Students admitted from 2018-2019 onwards)

18UBTM504	CORE VIII: PLANT TISSUE CULTURE	SEMESTER - V	
Course Objectives: The Course aims <ul style="list-style-type: none"> To acquire knowledge about principles, technical requirement, scientific and commercial applications of plant tissue culture. 			
Credits: 5			
		Total Hours: 50	
UNIT	CONTENTS	Hrs	CO
I	Introduction to plant tissue culture- Definition, Applications, History and organization of plant tissue culture laboratory, Preparation of media- MS medium, White's medium, Gamborg's medium and Nitsch and Nitsch medium, Growth regulators and sterilization techniques.	10	CO1
II	Micropropagation-Applications, types and stages, Callus and cell culture- Callus induction, Callus culture and cell suspension culture, Transformation- <i>Agrobacterium tumefaciens</i> and <i>A. rhizogens</i> mediated transformation. Direct gene transfer methods- electroporation, microinjection, and particle bombardment.	10	CO2
III	Embryo culture- Introduction, types of embryo culture, applications and embryo culture techniques, Production of haploid plants-Anther and pollen culture, Ovary and ovule culture, Production of resistant plants-Herbicide resistance, Insect resistance, Production of stress tolerant plants-Drought, temperature and salt	10	CO3
IV	Somatic embryogenesis-Developmental stages of embryogenesis, Germplasm preservation and synthetic seed technology, Genetic engineering for improvement of protein, lipids, carbohydrates, and vitamins, Plant genome organization, Role of RFLP in plant breeding. DNA barcoding in plants, Transposable elements in plant.	10	CO4
V	Protoplast culture-Introduction, Protoplast isolation, protoplast culture and Protoplast fusion, Production of virus free plants, Somaclonal variation, Secondary metabolites from plants- Alkaloids, flavonoids and phenolic compounds, Production of therapeutic antibodies, edible vaccine.	10	CO5



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B.Sc., Biotechnology (Students admitted from 2018-2019 onwards)


Text Book	
1	Bhojwani, S.S., and Razdan, M.K. 2008. Plant Tissue Culture- Theory and Practice. Elsevier Publishers, New Delhi.
Reference Books	
1	Chawla, H.S. 1998. Biotechnology in crop improvement. International book distribution co., New Delhi.
2	Jain, V.K., 2013. Fundamentals of plant physiology. (Fifth edition). S. Chand and company, New York.
3	Trivedi, P.C. 2004. Advances in plant physiology. (Third edition). I.K. International publications pvt Ltd, New Delhi.
4	Slater, Scott and Fowler. 2003. Plant Biotechnology (The genetic manipulation of plants), Oxford University, UK.


COURSE OUTCOMES (CO)

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

CO1	Explain the applications, history of plant tissue culture and preparation of various types of plant tissue culture medium
CO2	Illustrate the methods of propagation of plants under <i>in vitro</i> condition and transformation techniques
CO3	Describe the embryo culture, Production of haploid, resistant and stress tolerant plants
CO4	Explain about somatic embryogenesis, Germplasm preservation, plant genome organization, synthetic seed technology and Genetic engineering for improvement of protein, lipids, carbohydrates, and vitamins.
CO5	Explain about Protoplast culture, Production of virus free plants, Somaclonal variation and Plant secondary metabolites.




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B.Sc., Biotechnology (Students admitted from 2018-2019 onwards)

18UBTM601	CORE IX: RECOMBINANT DNA TECHNOLOGY	SEMESTER - VI	
Course Objectives: The Course aims <ul style="list-style-type: none"> To introduce gene cloning and r-DNA techniques to undergraduates. 			
Credits: 5		Total Hours: 50	
UNIT	CONTENTS	Hrs	CO
I	Recombinant DNA technology-history and scope, Enzymes in recombinant DNA technology - DNA manipulative enzymes, DNA Modifying enzymes, Restriction endonucleases and Ligases.	10	CO1
II	Plasmids: Definition, classification. Plasmid vectors - pBR322 & pUC vectors. Vectors for cloning - lambda phage vectors, Phagemids, Cosmids, YAC and BAC vectors.	10	CO2
III	Construction of cDNA library and genomic DNA library, screening of gene libraries - screening by DNA hybridization, immunological assay and protein activity.	10	CO3
IV	Expression of cloned genes in <i>E.coli</i> & yeast. Production of recombinant insulin, somatostatin, TPA and factor VIII.	10	CO4
V	DNA sequencing - types and application, PCR and its variations, Forensic analysis- DNA fingerprinting.	10	CO5
TEXT BOOK			
1	<i>Brown, T.A.</i> 2006. Gene cloning and DNA analysis an Introduction. [Fourth Edition]. Blackwell Publication.		
REFERENCE BOOKS			
1	<i>Brown, T.A.</i> 2005. Genomes. [Third Edition]. Garland Science Pub., New York.		
2	<i>Primrose, S.B.</i> and <i>Twyman, R. M.</i> 2006. Principles of gene manipulation and genomics [Seventh Edition]. Blackwell Publication.		
3	<i>Reece, R.J.</i> 2004. Analysis of Genes and Genomes. John Wiley & Sons. Inc.		




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COURSE OUTCOMES (CO)

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

CO1	Enlist the functions of enzymes used in Recombinant DNA technology
CO2	Extend the usage of DNA cloning vectors
CO3	Produce DNA libraries & use the screening methods
CO4	Express the recombinant proteins.
CO5	Apply the skills for the molecular techniques.


MAPPING

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

H-High; M-Medium; L-Low




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18UBTM603	CORE XI: BASICS OF ANIMAL CELL CULTURE	SEMESTER -VI	
Course Objectives			
The course aims			
<ul style="list-style-type: none"> To learn basic concepts about animal tissue culture. 			
Credits: 5		Total Hours: 50	
UNIT	CONTENTS	Hrs	CO
I	History, Scope and importance of animal cell culture, Types of animal cell culture, Animal cell culture Laboratory-Design and layout, Equipment and materials.	10	CO1
II	Types of culture media, composition, preparation and metabolic functions, Culture vessels and substrate, Serum, supplements, growth factors (EGF, PDGF, NGF, and Gap-43), Serum and protein free defined media, Aseptic practices in animal cell culture.	10	CO2
III	Basic techniques of animal cell culture <i>in vitro</i> , disaggregation of tissue and primary culture, subculture and establishment of cell line, Cloning and selection, Cell separation, Characterization, Differentiation, Transformation and immortalization, Quantification of cell culture. Scale-up and cell synchronization	12	CO3
IV	Cytotoxicity: Viability, toxicity and survival assay, Cryopreservation and cell banks, Organotypic culture and histotypic culture, Stem cells and Tissue Engineering: Scope, embryonic and adult stem cells, properties, identification, stem cells culture, techniques and their applications in modern clinical sciences. Tissue engineering - skin, bone and neuronal tissues.	08	CO4
V	Gametogenesis- Spermatogenesis and Oogenesis, Mechanism of fertilization, <i>In vitro</i> fertilization (IVF), Embryo transfer and test tube babies. Transgenic Animals: Production of fish, cattle, pig and chicken.	10	CO5
Text Book			
1	<i>Brown, T.A.</i> 2010. Gene cloning and DNA analysis an Introduction. [Sixth Edition]. Wiley Blackwell Publication, UK.		



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B.Sc., Biotechnology (Students admitted from 2018-2019 onwards)

Reference Books

1	<i>Freshney, R.I., 2005. Culture of animal cells: A Manual of Basic Technique. [5th Edition]. John Wiley and Sons, New Jersey.</i>
2	<i>John R.W. Masters., 2000. Animal cell culture. 3rd Edition, Oxford University Press.</i>
3	<i>Nigel Jenkins, 2005. Animal cell Biotechnology - Methods and Protocols. Humana press.</i>
4	<i>Florence PR. 2006. Animal Biotechnology. Dominant Publishers and Distributors, Delhi.</i>
5	<i>Sandy Primrose, Richard Twyman and Bob Old, 2001. Principles of Gene Manipulation. [Sixth Edition]. Blackwell Science Ltd.</i>

COURSE OUTCOMES (CO)

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


CO1	Explain the history and types of animal tissue culture.
CO2	Describe the preparation of animal tissue culture medium and growth factors.
CO3	Illustrate the basic techniques of animal cell culture.
CO4	Depicts the cytotoxicity, tissue engineering and stem cells.
CO5	Explain about IVF and transgenic animals.


MAPPING

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

H-High; M-Medium; L-Low




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B.Sc., Biotechnology (Students admitted from 2018-2019 onwards)

1SUBTM503	CORE VII: INDUSTRIAL BIOTECHNOLOGY	SEMESTER - V	
Course Objectives: The Course aims <ul style="list-style-type: none"> To learn about the various bioprocess and engineering technology and to implement in industries. 			
Credits: 5		Total Hours: 50	
UNIT	CONTENTS	Hrs	CO
I	History and scope of Industrial Biotechnology, Isolation and Screening of industrially important microorganism, Strain development, Substrates for industrial fermentation.	10	CO1
II	Industrial sterilization methods, Design of bioreactor, Parts and their functions. Types of bioreactor. Methods of fermentation-- Batch, fed batch, continuous fermentation, Growth kinetics.	10	CO2
III	Fermentors operations and applications--common measurements and control systems--speed, temperature, gas supply, pH, Dissolved oxygen and foam control.	10	CO3
IV	Production of Organic acids- Citric acid and Lactic acid, Amino acids--Glutamic acid and Lysine, Enzymes--Amylase, and Protease, Antibiotics -- β lactam antibiotics.	10	CO4
V	Separation of microbial cells and suspended solids, Intracellular product recovery, Cell disruption, Centrifugation, Chromatography, Solvent extraction, distillation, crystallization, Evaporation and drying.	10	CO5
Text Book			
1	Crueger, W, and Crueger, A. 2002. A Text Book of Industrial Microbiology. [Second Edition]. Science Tech Publishers, USA.		
Reference Books			
1	Shuler, M.L. and Kargi, F. 2004. Bioprocess Engineering: Basic Concepts. [Second Edition]. Prentice Hall. Pvt. Ltd., New Delhi.		
2	Aiba, S, Humphrey, A.E and Millis, N.F, 1973, Biochemical Engineering [Second Edition], Academic Press, New York.		
3	Stanbury, P.F, Hall, S, and Whitaker, A. 1995. Principles of Fermentation Technology [Second Edition], Elsevier Science Ltd		



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B.Sc., Biotechnology (Students admitted from 2018-2019 onwards)

4	El- Mansi E.M.T., Bryce C.F.A., Demain A. L. Allman A.R., 2007. Fermentation Microbiology and Biotechnology . [Second Edition]. CRC Press.
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COURSE OUTCOMES (CO)

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

CO1	Explain the isolation, screening and improvement of industrially important microorganisms
CO2	Demonstrate the design, functions and types of bioreactor as well as various fermentation methods.
CO3	Explain about the operations and applications of bioreactor.
CO4	Illustrate about the production of an organic acids, amino acids, enzymes and antibiotics at an industrial level.
CO5	Describe about downstream processing.

MAPPING

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

H-High; M-Medium; L-Low



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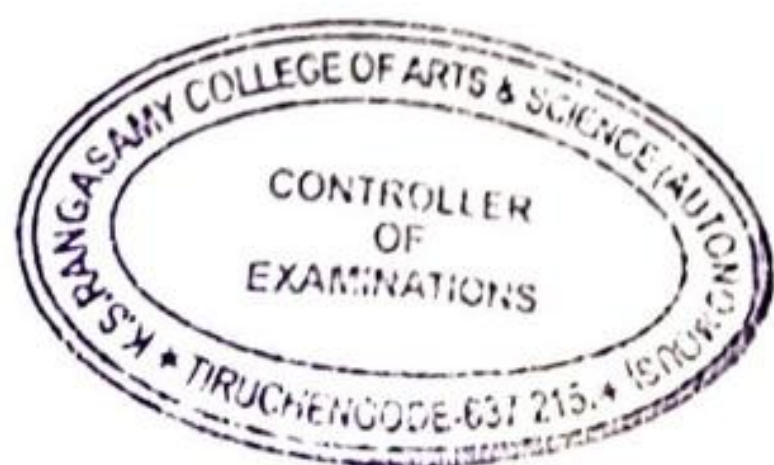
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18SUBTEL601	ELECTIVE II: FOOD BIOTECHNOLOGY	SEMESTER - VI	
Course Objectives: The Course aims <ul style="list-style-type: none"> To get knowledge in the field of food processing and its application. 			
Credits: 4		Total Hours: 40	
UNIT	CONTENTS	Hrs	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 adulteration.	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 Microbiology , 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



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18SUBTEL601	ELECTIVE II: MEDICAL BIOTECHNOLOGY	SEMESTER-VI	
Course Objectives: The course aims <ul style="list-style-type: none"> 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



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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	Sathyannarayana, 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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