Dr. N.G.P.ARTS AND SCIENCE COLLEGE (Autonomous)

REGULATIONS 2019-20 for Under Graduate Programme
(Outcome Based Education model with Choice Based Credit System)

B.Sc. Biotechnology

For the students admitted during the academic year 2019-20 and onwards)

Programme: B.Sc. Biotechnology

Eligibility:

A candidate who has passed in Higher Secondary Examination with any Academic Stream or Vocational Stream as one of the subjects under Higher Secondary Board of Examination and as per the norms set by the Government of Tamil Nadu or an Examination accepted as equivalent thereto by the Academic Council, subject to such conditions as may be prescribed thereto are permitted to appear and qualify for the **Bachelor of Science - Biotechnology** of this College after a programme of study of three academic years.

Programme Educational Objectives:

The curriculum is designed to attain the following learning goals which students shall accomplish by the time of their graduation:

1. To demonstrate a substantial understanding of concepts in key areas of Biotechnology and its applications.
2. To supplement the academic input of students by way of seminars, conferences, guest lectures and industrial visits.
3. To describe the common methods and applications of biotechnology with regards to microorganisms, plants, animals and Pharma industries.

PROGRAM OUTCOMES:

On the successful completion of the program, the following are the expected outcomes.

PO Number	PO Statement
PO1	Students will be able to identify, analyze and understand problems related to biotechnology and finding valid conclusions with basic knowledge in biotechnology.
PO2	Graduates will be able to justify societal, health, safety and legal issues and understand his responsibilities in biotechnological practices.
PO3	Provide education that leads to comprehensive understanding of the principles and practices of biotechnology that will help to undertake any responsibility as an individual and as a team in a multidisciplinary environment.
PO4	Graduates will be able to demonstrate knowledge of project management when dealing with Biotechnology problems.
PO5	Students will possess hands-on technical skills necessary for supporting biotechnology research activity and empower students with the ability to think and solve problems in the field of biotechnology.

Guidelines for Programmes offering Part I& Part II for Two Semesters:

Part	Subjects	No.of Papers	Credit	Semester No.
I	Tamil / Hindi / French/Malayalam	2	2 x 3 = 6	I & II
II	English	2	2 x 3 = 6	I & II
III	Core (Credits 2,3,4)	18-20	70	I to VI
	Inter Departmental Course (IDC)		16	I to IV
	Discipline Specific Elective (DSE)	3	3 x 4 =12	V & VI
	Skill Enhancement Course(SEC)	4	4 x 3=12	III ,IV,V& VI
	Generic Elective(GE)	2	2 x 2=4	III & IV
	Lab on Project (LoP)	1	1	III to VI
IV	Environmental Studies(AECC)	1	2	I
	Value Education (VE) (Human Rights, Womens' Rights) (AECC)	2	4	II and III
	General Awareness(On-Line Exam) (AECC)	1	2	IV
	RM (AECC)	1	2	V
	Innovation, IPR, Entrepreneurship (AECC)	1	2	VI
V	Extension Activity NSS / Sports / Department Activity	-	1	I to VI
TOTAL CREDITS			**140**	

CURRICULUM

B.Sc. BIOTECHNOLOGY PROGRAMME (2019-20)

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
First Semester										
Part - I										
191TL1A1TA/ 191HL1A1HA/ 191ML1A1MA/ 191FL1A1FA	Language - I	Tamil-I/ Hindi-I/ Malayalam-I/ French – I	4	1	-	3	25	75	100	3
Part - II										
191EL1A1EA	Language -II	English – I	4	1	-	3	25	75	100	3
Part - III										
193BT1A1CA	Core - I	Cell Biology	4	1	-	3	25	75	100	3
193BT1A1CB	Core- II	Biodiversity	4	1	-	3	25	75	100	3
193BT1A1CP	Core Practical	Cell Biology & Biodiversity	-	-	4	6	40	60	100	2
192CE1A1IB	IDC - I	Chemistry For Biologist's	3	1	-	3	25	75	100	4
Part - IV										
193MB1A1AA	AECC - I	Environmental studies	2	-	-	2	-	50	50	2
		Total	**21**	**5**	**4**	**-**	**-**	**-**	**650**	**20**

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Second Semester										
Part - I										
191TL1A2TA/ 191TL1A2HA/ 191TL1A2MA/ 191TL1A2FA	Language - I	Tamil-II/ Hindi-II/ Malayalam-II/ French – II	4	1	-	3	25	75	100	3
Part – II										
191EL1A2EA	Language - II	English – II	4	1	-	3	25	75	100	3
Part – III										
193BT1A2CA	Core- III	Molecular Biology	4	1	-	3	25	75	100	3
193BT1A2CB	Core - IV	Microbiology	4	1	-	3	25	75	100	3
193BT1A2CP	Core Practical	Molecular Biology & Microbiology	-	-	4	6	40	60	100	2
194CT1A2IC	IDC -II	Computers for Biologists	4	-	-	3	25	75	100	4
Part - IV										
196BM1A2AA	AECC - II	Human Rights	2	-	-	2		50	50	2
		Total	**22**	**4**	**4**	**-**	**-**	**-**	**650**	**20**

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Third Semester										
Part – I										
191TL1A3TA/ 191TL1A3HA/ 191TL1A3MA/ 191TL1A3FA	Language - I	Tamil-III/ Hindi-III/ Malayalam-III/ French – III	3	1	-	3	25	75	100	3
Part – II										
191EL1A3EA	Language - II	English – III	3	1	-	3	25	75	100	3
Part – III										
193BT1A3CA	Core – V	Genetics	3	1	-	3	25	75	100	3
193BT1A3CB	Core VI	Biochemistry	2	1	-	3	25	75	100	3
193BT1A3CP	Core Practical	Genetics & Biochemistry	-	-	4	6	40	60	100	2
192MT1A3ID	IDC - III	Mathematics	3	1	-	3	25	75	100	4
193BT1A3SA	SEC - I	Personality Development	3	-	-	3	25	75	100	3
193BT1A3GA	GE – 1	Mushroom Technology	2	-	-	2	-	50	50	2
	LoP	Lab on Project	-	-	-	-	-	-	-	-
Part -IV										
191TL1A3AA/ 191TL1A3AB/ 195CR1A3AA	AECC - III	Basic Tamil/ Advanced Tamil/ Women's Rights	2	-	-	2	-	50	50	2
		Total	**21**	**5**	**4**	**-**	**-**	**-**	**800**	**25**

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Fourth Semester										
Part - I										
191TL1A4TA/ 191TL1A4HA/ 191TL1A4MA/ 191TL1A4FA	Language - I	Tamil-IV/ Hindi-IV/ Malayalam-IV/ French – IV	3	1	-	3	25	75	100	3
Part – II										
191EL1A4EA	Language - II	English – IV	3	-	1	3	25	75	100	3
Part – III										
193BT1A4CA	Core- VII	Immunology	3	1	-	3	25	75	100	3
193BT1A4CB	Core - VIII	Bioinformatics	3	-	-	3	25	75	100	3
193BT1A4CP	Core Practical	Immunology & Bioinformatics	-	-	4	6	40	60	100	2
192PY1A4IA	IDC - IV	Biophysics	4	-	-	3	25	75	100	4
193BT1A4SA	SEC - II	Biotechniques	3	-	-	3	25	75	100	3
193BT1A4GA	GE - II	Apiculture	2	-	-	3	-	50	50	2
	LoP	Lab on Project	-	-	-	-	-	-	-	-
Part - IV										
191TL1A4AA 191TL1A4AB 192PY1A4AA	AECC - IV	Basic Tamil / Advanced Tamil / General Awareness	2	-	-	3	-	50	50	2
		Total	**23**	**2**	**5**	**-**	**-**	**-**	**800**	**25**

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Fifth Semester										
Part - III										
193BT1A5CA	Core - IX	Recombinant DNA Technology	4	1	-	3	25	75	100	4
193BT1A5CB	Core – X	Plant and Animal Biotechnology	4	1	-	3	25	75	100	4
193BT1A5CC	Core – XI	Bioprocess Technology	4	1	-	3	25	75	100	3
193BT1A5CP	Core Practical	rDNA, Bioprocess, Plant & Animal Biotechnology	-	-	5	6	40	60	100	2
193BT1A5SA	SEC - III	Entrepreneurial Biotechnology	3	1	-	3	25	75	100	3
193BT1A5DA	DSE - I	Clinical Trials	3	1	-	3	25	75	100	4
193BT1A5DB		Biomaterials								
193BT1A5DC		Food Biotechnology								
193BT1A5LA	LoP	Lab on Project	-	-	-	-	50	-	50	1
193BT1A5TA	IT	Industrial Training	**Grade A to C**							
Part - IV										
192MT1A5AA	AECC - V	Research Methodology	2	-	-	2	-	50	50	2
		Total	**20**	**5**	**5**				**700**	**23**

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Sixth Semester										
Part – III										
193BT1A6CA	Core - XII	Bioprospecting	3	1	-	3	25	75	100	4
193BT1A6CB	Core - XIII	Environmental Biotechnology	3	1	-	3	25	75	100	4
193BT1A6CC	Core - XIV	Bionanotechnology	3	1	-	3	25	75	100	3
193BT1A6CP	Core Practical	Bioprospecting, environmental Biotechnology & Bionanotechnology	-	-	5	6	40	60	100	2
193BT1A6SA	SEC - IV	Pharmaceutical Biotechnology	3	-	-	3	25	75	100	3
193BT1A6DA/ 193BT1A6DB/ 193BT1A6DC	DSE - II	Genomics/ Bioethics & Biosafety/ Drug Design & Delivery	3	1	-	3	25	75	100	4
193BT1A6DD / 193BT1A6DE/ 193BT1A6DF	DSE - III	Proteomics/ Biomarker Technology/ Stem Cell Technology	3	1	-	3	25	75	100	4
Part - IV										
193BC1A6AA	AECC - VI	Innovation, IPR and Entrepreneurship	2	-	-	-	-	-	50	2
Part V										
193BT1A6XA		Extension Activity	-	-	-	-	-	-	50	1
		Total	**20**	**5**	**5**				**800**	**27**
								Grand Total		**4400**	**140**

DISCIPLINE SPECIFIC ELECTIVE

Students shall select the desired course of their choice in the listed elective course during Semesters V & VI

Semester V (Elective I)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	193BT1A5DA	Clinical Trials
2.	193BT1A5DB	Biomaterials
3.	193BT1A5DC	Food biotechnology

Semester VI (Elective II)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	193BT1A6DA	Genomics
2.	193BT1A6DB	Bioethics & Biosafety
3.	193BT1A6DC	Drug Design & Delivery

Semester VI (Elective III)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	193BT1A6DD	Proteomics
2.	193BT1A6DE	Biomarker Technology
3.	193BT1A6DF	Stem Cell Technology

GENERIC ELECTIVE COURSES (GE)

The following are the courses offered under Generic Elective Course

Semester III (GE-I)

S. No.	Course Code	Course Name
1	193BT1A3GA	Mushroom Technology

Semester IV (GE-II)

S. No.	Course Code	Course Name
1	193BT1A4GA	Apiculture

EXTRA CREDIT COURSES

The following are the courses offered under self study to earn extra credits:

S. No.	Course Code	Course Name
1	193BT1ASSA	Environmental Management
2	193BT1ASSB	Biofertilizer Technology

CERTIFICATE PROGRAMMES

The following are the programme offered to earn extra credits:

S. No.	Programme Code and Name	Course Code	Course Name
1	3BT5A Plant Tissue Culture	193BT5A1CA	Plant Tissue Culture
2	3BT5B Protein Purification & Characterization Techniques	193BT5B1CA	Protein Purification and Characterization Techniques

COURSE CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
193BT1A1CA	CELL BIOLOGY	THEORY	4	1	0	3

Total Credits: 3
Total Instruction Hours: 60

Preamble:

1. To study the basic components and functions of cell organelles.
2. To learn cell signaling, cycle, progression and its regulation.
3. To comprehend he pathological progressions of a cell.

Course outcomes

On successful completion of the course, students will be able to:

CO Number	CO Statement	Knowledge Level
CO1	Review the process of cell architecture and composition	K1, K2
CO2	Understand the membrane organization for nutrient uptake	K1, ,K2
CO3	Imparts knowledge on the mode of transport relating to inter and intracellular mechanisms	K2, K3
CO4	Provide in-depth understanding of signaling events within cells	K2,K3
CO5	Focus on cell cycle events and pathological progressions • Documentation, Inspection and certification	K2,K3

Mapping with Programme Outcomes

COs/Pos	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	S	S	S	M	S
CO3	S	S	S	M	S
CO4	S	S	S	S	M
CO5	S	S	S	S	M

S-Strong; M-Medium; L-Low

193BT1A1CA	CELL BIOLOGY	SEMESTER - I Total Credits: 3

Total Instruction Hours: 60

UNIT I

Cell Overview and organelles 13 h

History - cell theory – scope – types and shapes - organization of prokaryotic and eukaryotic cell and their differences. Cytoskeleton – microtubules. Nucleus, endoplasmic reticulum (rough and smooth), golgi apparatus, mitochondria, ribosomes, chromosome, chloroplast, lysosome, peroxisome.

UNIT II

Cell Organization 12 h

Cell membrane - structure and function, transport of nutrients and ions across the membranes. Diversity of plasma membranes (Trilamilar, bimolecular leaflet, lattice, micellar, fluid mosaic model). Desmosomes, plasmodesmata. Cell junctions –adherent, gap and tight junctions.

UNIT III

Cell Transport 10 h

Membrane transport types. General classes of transport systems- uniport, symport, antiport. Diffusion- passive and facilitated. Active transport- primary and secondary. The P-type ATPases (Na+K + -ATPase), ion channels (ligand-gated and voltage-gated).

UNIT IV

Cell Signaling 12 h

Intracellular signaling – categories of signaling – types of signal receptors - Receptors of special importance - Extra Cellular Matrix- Cell Interactions. Endocrine, paracrine, autocrine signaling and juxtacrine signalling .

UNIT V

Cell Cycle 13 h

Cell cycle - Mitosis – meiosis and their significance. Cell Ageing – mechanism – theories (Free radical theory and somatic mutation theory). Cell death - necrosis, apoptosis. Difference between necrosis and apoptosis. Mechanism of apoptosis. Characteristics of cancer cell. Tumor cells - Stages of progression.

TEXT BOOKS:

1. Rastogi, C.S. 2005. **Cell Biology.** 3rd edition. New Age International Publishers.
2. Aminul Islam. 2011. **Text Book of Cell Biology**. 2nd edition. Books and Allied (P) Ltd.

REFERENCES:

1. Bruce Alberts. 1998. **Essential Cell Biology.** 1st edition. Garland Publishers.
2. De Roberties. 2003. **Cell and Molecular Biology.** 8th edition. EDP Lippincott Williams.
3. Gerald Karp. 2002. **Cell and Molecular Biology.** 3rd edition. John Wiley Sons.
4. Lodish, H. & Baltimore. D. 1994. **Molecular cell Biology**. 2nd edition. American Scientific Books.
5. Philip Sheeler, Donald E Bianchi. 1993. **Cell and Molecular Biology.** 3rd edition. John Wiley sons.

COURSE CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
193BT1A1CB	BIODIVERSITY	THEORY	4	1		3

Total Credits: 3

Total instruction hours: 60

Preamble:

1. To study the diversity and conservation of organisms.
2. To know the importance of diversity.
3. To understand the ethics of conservation.

Course outcomes

On successful completion of the course, students will be able to:

CO Number	CO Statement	Knowledge Level
CO1	Understand the nature, concept and definition of Biodiversity, conservation strategies.	K1, K2
CO2	Familiarize with Global patterns of Biodiversity	K1, K2
CO3	Focus on Biodiversity & major biomes of world	K1,K2
CO4	Highlight Biodiversity for Sustainable Development	K1,K2
CO5	Awareness on Ethics of Conservation	K2,K3

Mapping with Programme Outcomes

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	M
CO2	S	M	S	S	M
CO3	S	M	S	S	S
CO4	S	M	S	S	S
CO5	S	M	S	S	S

S-Strong: M-Medium; L-Low

193BT1A1CB	BIODIVERSITY	SEMESTER - I

Total Credits: 3

Total instruction hours: 60

CONTENTS

UNIT – I 13 h

Biodiversity –Concept and definition

Scope and Constraints of Biodiversity Science, Composition and Scales of biodiversity. **Biodiversity and its types :** Genetic Diversity, Species/Organismal Diversity, Ecological/Ecosystem Diversity, Landscape/Pattern Diversity, Agrobiodiversity, Bicultural Diversity and Urban Biodiversity

UNIT– II 12 h

Global patterns of Biodiversity

Cataloging and Discovering Species, Geographical Patterns of Species Richness, Biogeography, Importance of Distribution Patterns (Local Endemics, Sparsely Distributed Species, Migratory Species), GAP Analysis. **Species & individual in the ecosystem** - a) Habitat & niche b) Ecological equivalence c) Biological clock d) Basic behavioral patterns

UNIT – III

Biodiversity Threats and Conservation 12 h Specific flora & fauna.Biodiversity & Conservation – Overexploitation threatening living species, rare and endangered species, International Trade. **Threats to Biodiversity** - Animals threatened by International trade, Problems in Controlling International Trade (Enforcement, Reservations, Illegal Trade), Free Trade & the Environment, Free Trade & Conservation, etc., In situ and ex situ conservation.

UNIT – IV

Community Ecology 13 h

Interspecific interactions - Interspecific Competition, Host-Parasite interactions, Predator-prey interactions, Plant herbivore interaction. **Community ecology** - Structure and function of communities, Functional aspects of communities, Stability and change in communities **Regulation of communities** - Role of species diversity, Role of predators, Role of competition, Role of nutrients, other factors

UNIT– V

Biodiversity for Sustainable Development 10 h

Sustainable management of biodiversity: International and regional policies. Biodiversity Act, National Biodiversity Board and other organizations worldwide. International conventions and treaties on conservation. **Biodiversity Institutes in India:** Zoological Survey of India, Botanical Survey of India, Forest Research Institute, Central Marine Fisheries Research Institute. **Ethics of conservation:** Legal, Ethical and Conservation issues related to uses of biodiversity, Global Conservation Issues.

TEXT BOOKS:

1. Krishnamurthy K V.2003. **Textbook of Biodiversity.** 1st edition. Science Publisher.
2. Narendran, T. C. 2006. **An Introduction to Taxonomy**. Zoological Survey of India, Kolkata.

REFERENCES:

1. Negi, S.S.1993**. Biodiversity and its Conservation in India.** 1st edition. Indus Publishing Co.
2. Mike J Jeffries. 2006. **Biodiversity and Conservation**. 1st edition. Routledge.
3. Michael I. Jeffery, Jeremy Firestone, Karen Bubna-Litic. 2008. **Biodiversity Conservation, Law and Livelihoods.** 1st edition. Cambridge University Press.
4. Singh, G.2008. **Plant Systematics: Theory and Practice**. Oxford & IBH Publishing Co. Pvt. Ltd.
5. Joanne M. Willey, Linda M. Sherwood. 2011. **Prescott's Microbiology**. 8th edition. McGraw Hill Education.

COURSE CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
193BT1A1CP	CELL BIOLOGY AND BIODIVERSITY	PRACTICAL			4	2

Total Credits: 2

Total instruction hours: 48

CONTENTS

1. Demonstration of Basic Laboratory Practices and instrument handling*
2. Calculations of Molarity, Normality and Percentage Solution
3. Preparation of buffer in different pH - Phosphate, Acetate, Tris buffer
4. Preparation of equilibrated phenol
5. Simple staining of Bacteria and observation under stereomicroscope*
6. Microscopic observation of Monocot and Dicot Leaf, Root and Stem section
7. Staining of plant cells – Onion epidermal cells
8. Staining of starch granules
9. Cell counting using Haemocytometer
10. Blood smear preparation for blood cell identification
11. Mitotic preparation from onion root tip
12. Preparation of Herbaria – Five families (1 Plant from each family) with Authentication from authorized agencies*
13. Field visits to nearby Zoo, Forest, Nursery, and Culture collection centre – Herbaria/Botanical Garden*
14. Introduction to Biodiversity Database-IBIN
15. Preparation of Insect Box and Calculation of Species richness by line and plot analysis*

*** DBT STAR College Scheme experiments**

REFERENCES:

1. Janarthanan, S. and Vincent,S. 2007. **Practical Biotechnology– Methods and Protocols.**
2. Jeffery M Becker., Guy A Caldwell. and Eve Ann Zachgo. 2007. **Biotechnology– A laboratory Course.** 2nd edition. Academic Press.
3. Joseph Sambrook**,** Michael R. Green**.**2012**. Molecular Cloning: A Laboratory Manual.** 4th edition. Cold Spring Harbor.
4. John Davey, Michael Lord.2003. **Essential Cell Biology Volume 1: Practical Approach.** 1st edition. OUP Oxford.
5. David Lindenmayer, Mark Burgman. 2005. **Practical Conservation Biology**. CSIRO Publishing, Australia

Course Code	Course Name	Category	L	T	P	Credit
192CE1A1IB	CHEMISTRY FOR BIOLOGISTS	IDC	4	-		4

PREAMBLE

This course has been designed for students to learn and understand

- The basic concepts of chemical bonding in molecules
- The essentials of organic chemistry and coordination chemistry. Enable to differentiate the organic molecule configurations.
- The fundamentals of solution concepts and to know the kinetics of chemical reactions.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	State the basic theories in coordination chemistry and to name the inorganic compounds	K1
CO2	Classify bonding in molecules, crystals structures and evaluate their bonding characteristics	K2
CO3	Apply concepts of bonding in organic molecules & their displacement reactions with mechanism	K2, K3
CO4	Assess the preparation of laboratory solutions	K3
CO5	Categorize the spontaneity of the reaction, the nature of catalyst and reaction pathway.	K2

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	M
CO2	S	S	S	S	S
CO3	S	S	M	S	S
CO4	S	S	S	S	S
CO5	M	M	S	S	S

S – **Strong** **M** – **Medium** **L** – **Low**

192CE1A1IB	IDC – I: CHEMISTRY FOR BIOLOGIST'S	SEMESTER I

Total Credits: 4

Total Instructions Hours: 4

Unit I Coordination Chemistry and Fertilizers

Coordination Chemistry

Nomenclature, Theories of Werner, Sidge-Wick, Pauling, Chelation examples, Haemoglobin, Chloropyll. Applications in qualitative and quantitave analysis of EDTA.

Fertilizers

Urea, ammonium sulphate, ammonium Nitrate, Potassium Nitrate, NPK fertilizer, Triple Superphosphate, Pollution of air, Water and Sol-sources, remedies.

Unit II Chemical Bonding

Molecular Orbital Theory- bonding, anti-bonding and non-bonding orbitals. MO-configuration of H2, N2, O2, F2- bond order– diamagnetism and paramagnetism.

Ionic Bond: Nature of ionic bond, structure of NaCl and CsCl, factors influencing the formation of ionic bond.

Covalent Bond: Nature of covalent bond, structure of CH4, NH3, H2O, shapes of BeCl2, BF3, based on VSEPR theory and hybridization.

Unit III Basic Organic Chemistry

Electron displacement effect in organic compounds - Inductive effect – Electromeric effect - Resonance effect, Hyperconjugation and Steric effect.

Isomerism, Symmetry of elements (Plane, Centre and Axis of symmetry), Molecules with one chiral carbon and two adjacent chiral carbons –Optical isomerism of lactic acid and tartaric acid, Enantiomers, Diastereomers – Separation of racemic mixture, Geometrical isomerism (maleic and fumaric acid). R/S and E/Z configuration assignments for simple molecules.

Unit IV Solutions

Normality, molarity, molality, mole fraction, mole concept.

Primary and secondary standards – preparation of standard solutions.

Principle of Volumetric analysis (with simple problems).

Indicators – Theory of indicators- Acid base and quinonoid.

Strong and weak acids and bases - Ionic product of water- pH, pKa, pKb

Unit V Chemical Kinetics and Catalysis

Rate of reaction, rate law, order, molecularity, first order rate law, half life period of first order equation, pseudo first order reaction, zero and second order reactions. Derivation of rate expression for I and II order kinetics.

Catalysis – homogenous, heterogeneous and enzyme catalysis (definition only), enzymes used in industry, characteristics of catalytic reactions

Text Books

1 R. D. Madan. 2014. Modern Inorganic Chemistry, Revised Edition, S. Chand & Company.

2 Puri , Sharma, Pathania. 2017. Principles of Physical Chemistry, 47th Edition, Vishal Publishing Company.

3 Bahl Arun, Bahl B.S. 2016. Organic Chemistry, 22nd Edition, S. Chand & Company.

Reference Books

1 M. K. Jain, S. C. Sharma. 2007. Organic Chemistry, Shoban Lal Nayin Chand.

2 Gopalan R. 2004. Elements of Analytical Chemistry, Sultan Chand & Sons.

Course Code	Course Name	Category	L	T	P	Credit
191TLIA2TA	**தநிழ்த்தொள் - II**	Theory	4	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- மநொமிப் ொடங்கின் யொனிொக தநிமரின் ணொடு, கொத்திவு ஆகினயற்ற அினச் மெய்தல்
- கற நற்றும் நபபகற அினச் மெய்தல்
- நொணயர்கின் றடபொக்கத் தி ணகற ஊகக்கொயித்தல்

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	யொழ்க்றகத்தி ணங்கள் (Life Skills)- நொணயின் மனொக்கத்திற ஊகக்கொயித்தல்	K1,K2,K3
CO2	நதிப்பக்கல்யி (Attitude and Value education)	K2,K4
CO3	ொட இறணச் மெனல்ொடுகள் (Co-curricular activities)	K2,K3,K4
CO4	மினல் ஆக்கம் (Ecology)	K4
CO5	மநொமி அிவு (Tamil knowledge)	K5, K6

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	M	M	M	M
CO3	S	M	M	M	M
CO4	S	M	M	M	M
CO5	S	M	M	M	M

S **Strong** **M** **Medium** **L** **Low**

191TLIA2TA II	தநிழ்த்தொள் - II	SEMESTER

Total Credits: 3
Total Instruction Hours: 60 h

Syllabus

Unit I **அ இகக்கினம்** 12 h

1. திரகக்கா ள்

அ.அ ன் யிமறுத்தல் (அ. ண் 04)

ஆ.ட்ொபொய்தல் (அ. ண்: 80) இ.ொன ொண் றந (அ. ண் 99) ஈ.கா ப ் ிதல் (அ. ண் 110)

2. தூப - ஔறயனொர் (10 ொடலக்கள் - 6,7,9,10,14,16,17,23,26,30)

Unit II **அ இகக்கினம்** 10 h

1. ொடினொர் - அிவ ாறடறந

2.மமநொமி ொனாறு - யட்டு மி

3. கொரொற்து - ததொமி ரயஙக்கொட்டி தறநகற யற்பறுத்தின ொடலக்கள் (1 தல்- 18ொடலக்கள்)

Unit III **உறபறட** 10 h

1. மற்த ொர ப் தணல் - திர.யி.க.

2. உளம் காிர்நத்து - .யபதபொொொர்

3. ொஙக்கம கள் - ய.ச.நொணிக்கம்

Unit IV **உறபறட** 13 h

1.மரினொர் உணரத்தும் சனநரினொறதமம் ொநதரந ம் தய. ஆற த்து

2. யபயணகக்கம் - றகொொதி

3.மநொமிமமி ம் - ஸ். பொநகிரஷண்

Unit V **இகக்கின யபொறு, இகக்கணம் நற்றும் னிற்ொிப்காதி** 15 h

அ.இகக்கின யபொறு

1. திமண் கழக்கணகக்கு நாலக்கள்

2. தநிழ் உறபறடனின் ததொற்ம்

யரச்ொிமம் ஆ. இகக்கணம்

யழா, யிழாயறநதி,

மொி

பனிற்ொிப்காதி

1. நூல நதிபடு நற்றும் திறபகக்றத திொய்வு

2. தனியியபக் கரிப ப ழதல்

Text Books

1	மதொகுபப்ப: தநிழத்துறட, டொகட்ர ண்.ஜி.ி. கறட நற்றும் அி யினல் கலல்ரி (தனட்டொட்டி) மெயம்மள் நற்றும் உறபறடத் திபட்டு. (தலஃதிபப்ப.) மெனற்றட: ிய மெஞ்சரி பகஹவஸ் (ிி) ிிட்.

References

1	தபொெிரினர் பயர் இயபச, தெொந. (ஜறட2012). தநிழ் இகக்கின யபொறு. (ட்டொம் திபப்ப) மெனற்றட: நணியொெகர் திபகம்.
2	தபொெிரினர் றயர் ொெக்கினதநரி (2013). இகக்கணம் இகக்கின யபொறு மநொமித்தி ண். (தலதிபப்ப) மெனற்றட தயநத்தன் திபகம்.
3	தநிழ் இறணனக் கலயிக்கமகம் <http://www.tamilvu.org/>

Course Code	Course Name	Category	L	T	P	Credit
191TL1A2HA	HINDI-II	Theory	4	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- To develop the writing ability and develop reading skill.
- To learn various concepts and techniques for criticizing literature
- To learn the techniques for expansion of ideas and translation process.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the fundamentals of novels and stories	K1
CO2	Understand the principles of translation work	K2
CO3	Apply the knowledge writing critical views on fiction	K3
CO4	Build creative ability	K3
CO5	Expose the power of creative reading	K2

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	M	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong M Medium L Low

191TL1A2HA	HINDI-II	**SEMESTER II**

Total Credits: 3
Total Instruction Hours: 60 h

Syllabus

Unit I — 15 h

आधननकऩद्य –

शबरी(श्ीनरशमेहत ा) प्रक ाशक:

ऱ ोकभ ारत ीप्रक ाशन

ऩहऱ ीमोंज ि ेऱ, दरब ार ीबबज ्डग,

मह ात्म ाग ाॅध ीम ाग,

इऱ ाहाब ाद-211001

Unit II — 15 h

उऩन ्य ास: सेव ासदन-

प्रेमचन्द प्रक ाशक:

सम्मत्रप्रकाशन

204 ऱ ीऱ ाअऩ ार्टगमर्टस, 15 हज ्टग ्सर ोड’

अश ोकनगरइऱ ाहाब ाद-211001

Unit III — 15 h

अनव ादअभ्य ास-III

(कवऱहहन ्दीस ेअ ांग्र े ि ीम)

(ऩ ाठ1 to 10)

प्रक ाशक: दक्ष□णभ ारतप्रच ारसभाचेनैई-17

Unit IV — 15 h

ऩत्रऱखन: (औऩच ाररकय ाअन ौऩच ाररक)

Course Code	Course Name	Category	L	T	P	Credit
191TL1A2FA	FRENCH- II	Theory	4	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- To Acquire Competence in General Communication Skills – Oral + Written – Comprehension & Expression
- To Introduce the Culture, life style and the civilization aspects of the French people as well as of France
- To help the students to acquire Competency in translating simple French sentences into English and vice versa

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the Basic verbs, numbers and accents	K1
CO2	To learn the adjectives and the classroom environment in France	K2
CO3	Learn the Plural, Articles and the Hobbies	K3
CO4	To learn the Cultural Activity in France	K3
CO5	To learn the Sentiments, life style of the French people and the usage of the conditional tense	K2

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	S	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong **M Medium** **L Low**

191TL1A2FA	FRENCH- II	**SEMESTER II**

Total Credits: 3
Total Instruction Hours: 60 h

Syllabus

Unit I – Super! 13 h

•Compétenc e Culturelle

L'égalitéhomme/femme

Compétence De communication

INTERACTION:

Exprimer des sentiments, exprimer la joie, le plaisir, le bonheur

- RÉCEPTION ORALE:

Comprendre un jeuradiophonique

- RÉCEPTION ÉCRITE:

Comprendre des announces

- PRODUCTION ÉCRITE:

Écrire des cartespostales •

Compétencegrammaticale

Les noms de professions masculine/feminine

- Le verb finir et less

Verbes du groupe

en-ir

- Le present de l'impératif
- Savoir(present)
- Le participe passé:

Fini, aimé, arrive, dit,écrit

- Quel(s), quelle(s)..:

InterrogatifetExclamatif

- À + infinitive
- Les articles: n,une,des

Unit II Quoi? 13 h

•ompétenc e Culturelle

e 20 siècle:

Petitsprogrés Grand progrés

Compétence De communication

- INTERACTION:

Decrirequelque chose, unepersonne

- RECEPTION ORALE:

Comprendre un message publicitaire

- RÉCEPTION ÉCRITE:

Comprendre un déplianttouristique

- PRODUCTION

ÉCRITE: Écrire des petites announces

Compétence grammatical

- On
- Plus, moins
- Le verbealler:
- Present, impératif
- Aller + infinitife
- Le pluriel en –x

Unit III – Et aprés 12 h

Compétenc e Culturelle

Nouvelles du jour

Compétence De communication

INTERACTION:

Raconteur,situer un récitdans le temps

RÉCEPTION ORALE:

Comprendreune description

RÉCEPTION ÉCRITE:

Comprendre un test

PRODUCTION ÉCRITE:

écrire des cartespostales

Compétencegrammaticale

L'imparfait:: quel-Ques forms pour introduire le récit:Ilfaisait, il y avait, ilÉtait

Un peu, beaucoup, trop,Assez

és

verbevenir

Présent, impératif

En Suisse, auMaroc, aux Etats-Unis

Unit IV Maisoui! 12 h

Compétenc e Culturelle La

génération des20-30 ans

Compétence De communication

INTERACTION:

Donner son opinion,

Expliquerpourquoi

RÉCEPTION ORALE:

Comprendre des informations à la radio

RÉCEPTION ÉCRITE:

Comprendre un texteinformatif

PRODUCTION ÉCRITE:

éncrire un mél de protestation

Compétencegrammaticale

Répondre, prendre:

Présent, impératif, part Passé

Parcequepourquoi

Tout/tous, toute/s

Tous/toutes les…

(répétition action)

Unit V Maisnon! 10 h

•Compétenc e Culturelle De la

ville à la campagne Compétence

De communication

INTERACTION:

Débat:: exprimerl'accord, exprimer le Désaccord

RECEPTION ORALE:

Comprendre un message sur un répondeurtéléphonique

RÉCEPTION ÉCRITE:

Comprendre un témoignage

PRODUCTION ECRITE: Rediger des petites Annonces immobilieres

Compétencegrammaticale

Le verbedevoir:Present et participe passé

Le verbe vivre, present

Aller + infinitive

Venir+ infinitive

Etre pour/contre

Text Books

1 Marcella Di Giura Jean-Claude Beacco, AlorsINew Delhi – 110007:Goyal Publishers Pvt Ltd86, University Block Jawahar Nagar (Kamla Nagar).

Course Code	Course Name	Category	L	T	P	Credit
191TL1A2MA	MALAYALAM-II PROSE: NON-FICTION	Theory	4	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- To develop the writing ability and develop reading skill.
- To learn various concepts and techniques for criticizing literature.
- To learn the techniques for expansion of ideas and translation process.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the fundamentals of novels and stories	K1
CO2	Understand the principles of translation work	K2
CO3	Apply the knowledge writing critical views on fiction	K3
CO4	Build creative ability	K3
CO5	Expose the power of creative reading	K2

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	S	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong M Medium L Low

191TL1A2MA	MALAYALAM-II PROSE: NON-FICTION	**SEMESTER II**

Total Credits: 3
Total Instruction Hours: 60 h

Syllabus

Unit I 12 h

Biography

Unit II 12 h

Biography

Unit III 12 h

Travelogue

Unit IV 12 h

Travelogue

Unit V 12 h

Travelogue

Text Books

1. Unit III, IV &V:Pottakkadu,S.K. KappirikaludeNattil. Kottayam: D.C. Books.
2. Bhatathirippadu,V.T.KannerumKinavum. Kottayam: D.C. Books.

References

1. Dr. George,K.M.(). Jeevacharitrasahithyam. (Edn.) Kottayam: N.B.S.
2. Dr. NaduvattomGopalakrishnan.JeevacharitrasahithyamMalayalathil. Trivandrum:Kerala BhashaInstitute.
3. Dr. VijayalamJayakumar. AthmakathasahithyamMalayalathil. (Kottayam:N.B.S.
4. Prof. Ramesh Chandran.SancharasahithyamMalayalathil. (10 Edn.) Trivandrum: Kerala Bhasha Institute.

Course Code	Course Name	Category	L	T	P	Credit
191EL1A2EA	ENGLISH - II	Language - II	4	0	1	3

PREAMBLE

This course has been designed for students to learn and understand

- To experience the effect of dialogue, the brilliance of imagery and the magnificence of varied genres
- To strengthen the student's English vocabulary and understanding of English sentence structure
- To communicate effectively and acquire knowledge on the transactional concept of English language

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Interpret skills in communication and to shape their attitude	K2
CO2	Develop oral and written language skills in a business context	K3
CO3	Analyze to gain key strategies and expressions for communicating with professionals	K4
CO4	Inspect the knowledge to the corporate needs	K4
CO5	Formulate Inter and Intrapersonal skills	K6

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	S
CO2	S	S	S	S	S
CO3	M	S	S	S	M
CO4	S	S	M	S	M
CO5	S	S	S	S	M

Strong M Medium L Low

191EL1A2EA	ENGLISH - II	SEMESTER II

Total Credits: 3
Total Instructions Hours: 60

Syllabus

Unit I Technical English 10

Communication: Process- Methods- Channels- Barriers of Communications

Phonetics: Basics of phonetics - Consonants and Vowel sounds - Pronunciation Guidelines- Problem Sounds and Differences in Pronunciation

Reading Skills: Skimming and Scanning- Reading Different Kinds of Texts- Types- Developing a Good Reading Speed

Writing Skills: Note- Making and note taking, Summarizing and Paraphrasing- Paragraph Writing: Structure and principles

Unit II Business English 11

Structure and Planning of Letters: Elements of Structure- Forms of Layout- Style- Importance and Steps for Planning- Writing Business Letters

Quotation, Order and Tender: Inviting - Sending Quotation letter - Placing Orders- Inviting Tenders

E-mail Correspondence: Structure- Procedure- Style- Guidelines- Jargon and Acronyms- Security Precaution

Seminar and Meetings: Introduction- Organizing a Seminar- Sample Brochure- Conducting and Participating in a Meeting

Unit III Professional English 14

Report Writing: Importance- Process- Types- Structure

Memo: Importance- Structure

Notice, Agenda and Minutes: Meeting- Notice- Agenda- Minutes: Preparation- Structure- Delivery

Brochures: Purpose- Audience- Qualities

Unit IV Employment Communication 11

Resume Writing : Elements of Resume - difference between CV and Resume - Writing Job Application Art of Conversation: Small Talk- Body Language- Principles of Good Conversation Interview: Organizational role- Goals- Types- Process
terview

Group Discussion: Importance- Features- Strategies- Barriers

Unit V Soft Skills 14

Self - Discovery and Goal Setting: Self - Discovery - What Comprises It?- Goals and Types- Benefits, Areas and Clarity of Goal Setting - Critical thinking

Positive Thinking (PT) and Attitude: Benefits of PT and Attitude- Develop Positive Attitude and Thinking- Drive out Negative Thinking and Attitude

Etiquettes and Manners: Home, Table and Business- Time Management: Nature and Characteristics- Objectives and Significance

Developing Emotional Intelligence (EI): Salient Features- Components of EI- Intrapersonal Development

Text Books

1 Prabha, Dr. R. Vithya & S. Nithya Devi. 2019. Sparkle. (1st Edn.) McGraw - Hill Education. Chennai.

2 Rizvi, Ashraf. M. 2018. Effective Technical Communication. McGraw - Hill Education, Chennai.

References

1 Ghosh, B.N. Editor. 2017. Managing Soft Skills for Personality Development. McGraw - Hill Education, Chennai.

2 Adams, Katherine L. and Gloria I. Galanes. 2018. Communicating in Groups- Applications and Skills. McGraw - Hill Education, Chennai.

3 Koneru, Aruna. 2017. Professional Communication. McGraw - Hill Education, Chennai.

4 Koneru, Aruna. 2011. English Language Skills. McGraw - Hill Education, Chennai.

5 Sharma, R.C. and Krishna Mohan. 2016. Business Correspondence and Report Writing. 5th Edn. McGraw - Hill Education, Chennai.

Course Code	Course Name	Category	L	T	P	Credit
193BT1A2CA	CORE III: MOLECULAR BIOLOGY	CORE	4	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- To study the basic concept of life.
- To learn process of cellular mechanisms.
- To learn process of cellular mechanisms.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the basis of DNA and RNA	K1, K2
CO2	Imparts knowledge on the mode of DNA replication	K1, ,K2
CO3	Provide in-depth knowledge of transcriptional events	K2,K3
CO4	Focus on translational events and its role in gene expression	K2,K3
CO5	Know the concept of DNA mutation and repair mechanisms	K2,K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	M	M	S	M	M

S Strong M Medium L Low

193BT1A2CA	CORE : MOLECULAR BIOLOGY	**SEMESTER II**

Total Credits: 3
Total Instruction Hours: 60 h

Syllabus

Unit I Historical and Conceptual Background 12 h

Discovery of DNA as genetic material - Griffith's experiment, Avery, Macleod and McCarty Experiment and Hershy and Chase experiment. Structure of Nucleoside and Nucleotide. Structure of DNA (Watson and Crick Model), Types of DNA (A-DNA, B-DNA and Z- DNA). Structure and Types of RNA (mRNA, tRNA and rRNA).

Unit II Central Dogma & Replication 13 h

Over view of Central dogma, Experimental proof for Semi conservative method. Enzymes & accessory proteins involved in DNA replication. Replication process in prokaryotic & Eukaryotic DNA. Differences between Prokaryotic and eukaryotic replication. Rolling circle model of replication.

Unit III Transcription 13 h

Importance of DNA binding Proteins, RNA polymerase. Mechanism of Transcription in prokaryotes & Eukaryotes. Differences between Prokaryotic and eukaryotic transcription. Post transcriptional Modifications in RNA - 5′ cap formation, 3′-end polyadenylation. Splicing and Processing of m- RNA, r-RNA & t-RNA. Transcriptional regulation in prokaryotes – lac operon and trp operon.

Unit IV Translation 12 h

Overview of Genetic code, wobble hypothesis. Mechanism of translation in Prokaryotes & Eukaryotes. Post translational modifications of proteins-Phosphorylation, Deformylation, Glycosylation, Acetylation, Amidation, Lipid attachment, S - Nitrosylation and Disulfide bond formation. Translational inhibitors.

Unit V Mutation and DNA Repair 10 h

Mutation: Types of mutation, Mutants (Physical and Chemical). DNA repair Mechanisms - Nucleotide excision, Base excision, Mismatch repair, Photo-reactivation, SOS and recombination repair

Text Books

1. Lodish, H & Baltimore. D. (1994). Molecular cell Biology. (2nd Edn.) United States,American Scientific Books.
2. De Roberties, (2003). Cell and Molecular Biology. (8th Edn.) New York, EDP Lippincott Williams:

References

1. Lewin, B. (2004). Genes V. (5th Edn.) New York: Oxford University press.
2. Gerald Karp, (2002). Cell and Molecular Biology. (3rd Edn.) United states: John Wiley Sons.
3. Freifelder, D& Malacinski, G.M. (1996). Essential of Molecular Biology. (2nd Edn.) New Delhi: Panima Publishing Co.
4. De Robertis, E. M. F. & Eduardo de Robertis. (2017). Title of the Book. (8th Edn.) United States: CCH, a Wolters Kluwer Business.

Course Code	Course Name	Category	L	T	P	Credit
193BT1A2CB	**CORE** IV : MICROBIOLOGY	CORE	4	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- Define the science of microbiology and general techniques used.
- Describe beneficial and harmful activities of microorganisms to humans.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the fundamental concepts of microbiology	K1
CO2	Know the basics of media preparation and different sterilization techniques	K1,K2
CO3	Distinguish different phases in microbial growth and learn about nutritional classification	K2,K3
CO4	Discuss the structure, reproduction and the causative diseases of bacteria	K2,K3
CO5	Discuss the structure, reproduction and the causative diseases of virus	K2,K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	M
CO2	S	M	S	S	S
CO3	M	M	S	S	M
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S Strong M Medium L Low

193BT1A2CB	CORE : MICROBIOLOGY	**SEMESTER II**

Total Credits: 3
Total Instruction Hours: 60 h

Syllabus

Unit I Concepts of Microbiology 12 h

History of Microbiology - Biogenesis Vs Abiogenesis, Contributions of Louis Pasteur, Robert Koch, Edward Jenner, Alexander Fleming. Light microscopy – Bright, Dark Field, Phase contrast, Fluorescence. Electron Microscopy – Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM).

Unit II Media, Sterilization Techniques and Growth of Microbes 12 h

Sterilization- Methods - Physical – Dry Heat, Moist Heat, Cold sterilization and Chemical. Preparation of Culture Media – types. Growth curve - Determination of Generation Time, Measurement of Growth – Viable count, Turbidometry and Direct Cell count. Nutritional classification of microbes.

Unit III Bacteria – Structure and its causative diseases 12 h

Classification (Berg's manual) - Bacterial Structure, Reproduction of Bacteria. Diseases caused by Mycobacterium tuberculosis (Tuberculosis), Salmonella typhi(Typhoid), Vibrio cholera (Cholera), Clostridium tetani (Tetanus) and Staphylococcus aureus (Skin Infections).

Unit IV Virus – Structure and its causative diseases 12 h

Virus structure, Classification (Baltimore), Reproduction – Generalized and Specialized, Diseases caused HIV (AIDS), Hepatitis B Virus (Jaundice), Varicella zoster (Chicken Pox) and Polio myelitis (Polio).

Unit V Fungus – structure and its causative diseases 12 h

Fungal structure –classification- Reproduction. Tinea rubrum (body ringworm), Tinea pedis (athlete's foot), Candida species (brochitis), Actinomyces isrelii (oral infection), Aspergillosis fumigates (sinus, bronchi,lungs).

Text Books

1. Atlas, M, Ronald (1995). Principles of Microbiology. (2nd Edn.) New York: McGraw-Hill.
2. Michael Pelzar, (2001). Microbiology. (5thEdn.) New Delhi: McGraw Hill Education (India) Pvt Ltd.

References

1. Prescott, L. M., John P. Harley, Donald A. Klein., (2004). Microbiology. (6th Edn.) New York: McGraw-Hill Science Publication.
2. Gerard J. Tortora, (2012). Microbiology: An Introduction. (11th Edn.) United States: Benjamin Cummings Publishers.
3. Vidhyasekaran, P. (2008). Fungal pathogenesis in plants and crops: molecular biology and host defence mechanisms. (2nd Edn.) Boca Raton, Florida: CRC Press.
4. Crueger and A Crueger, (1990). Biotechnology: A textbook of Industrial Microbiology. (1st Edn.) Sunderland, MA: Sinauer associates.

193BT1A2CP	CORE PRACTICAL II : MOLECULAR BIOLOGY & MICROBIOLOGY	**SEMESTER II**

Total Credits: 2
Total Instructions Hours: 48 h

S.No	Contents
1	Isolation of DNA from Plant
2	Isolation of DNA from Animal tissue
3	Isolation of DNA from Bacteria
4	UV mutagenesis
5	Staining of Bacteria – Negative and Gram staining
6	Fungal Staining
7	Observation of fungi under stereomicroscope*
8	Isolation of microorganism from soil by serial dilution method
9	Bacterial growth curve
10	Antibiotic sensitivity test
11	Methylene Blue Reduction test

Note : 9 is Mandatory out of 11

* DBT STAR College Experiment

References

1. Joseph Sambrook, Michael R. Green. 2012. Molecular Cloning: A Laboratory manual. 4th edition. Cold Spring Harbor
2. Chaitanya, K.V. 2013. Cell and Molecular Biology: A Lab Manual. Phi Publisher
3. Cappuccino. 2005. Microbiology: A Laboratory Manual. Pearson Education.
4. Kannan, N. 2002. Laboratory Manual in General Microbiology. Panima Publishers.

Course Code	Course Name	Category	L	T	P	Credit
194CT1A2IC	IDC : COMPUTERS FOR BIOLOGISTS	IDC	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- To enable the students to understand the fundamentals of Computer
- To understand the basic concept s of Word, Power Point, Excel.
- To know the idea on biological data processing

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the fundamentals of Computer	K1 ,K2
CO2	Learn the concept of MS-Word.	K1,K2
CO3	Apply the creativity of slide presentation	K2,K3
CO4	Apply the formulas and functions in Excel	K3
CO5	Knowledge on biological data	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	M	S	S	S
CO4	S	S	S	S	M
CO5	S	S	S	S	S

S Strong M Medium L Low

194CT1A2IC	IDC : COMPUTERS FOR BIOLOGISTS	**SEMESTER II**

Total Credits: 4
Total Instruction Hours: 48 h

Syllabus

Unit I Basics of Computers 10 h

Architecture of Computers – Concepts of Computes , parts, storage device – Data Storage- Hardware and Software- Computer Languages and Operating Systems- Networking of Systems-Internet-Search Engines, LAN, WAN – Email - Password Security

Unit II MS Word 8 h

Ms-Office : Microsoft Word – Introduction- Basics of using MS-Word – Formatting – Text Creation- Advanced features- Application of MS-Word

Unit III MS Powerpoint 8 h

Ms- Power Point : Presentation Creation – Add visual enhancements- Work with Slides and Slide text- Hyperlink and Functions - Animations

Unit IV MS Excel 10 h

Ms-Excel : Introduction – Tools in Excel Manipulation of Cells- Formulas, functions and operations – Formatting - Charts – Macros – Advanced Excel –Biological Data Processing in Excel

Unit V Biological Databases 12 h

Computing Changing Biology – Database - DB Collection –DB organizing – Types of data : Gene data- DNA data- Text data- Image data- Video data- Software Support for data analysis

Text Books

1. Gary B. Shelly, Misty E Vermaat., (2010). Discovering Computers and Microsoft Office 2010: A Fundamental Combined Approach. (Edn.) Cengage Learning Publication:.
2. Cynthia Givase, Per Jambeck, (Year). Developing Bio Informatics Computer Skills. (Edn.) : O'Reily Media.

References

1. Elaine Marmel (2016). Microsoft Office 2016. (Edn.) : John Wiley Publishers.
2. Joan Lambert and Joyce Cox, (2013). Microsoft Power Point 2013. (Edn.) : Microsoft Press.

Course Code	Course Name	Category	L	T	P	Credit
196BM1A2AA	AECC : HUMAN RIGHTS	AECC	2	-	-	2

PREAMBLE

This course has been designed for students to learn and understand

- To study how human values and personality traits help to develop the characteristics of each individual
- Understanding the moral values towards the enrichment of the society
- Identify the impact of ethics and values on the global development of the current scenario

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the concept of human values, personality traits and character formation.	K2
CO2	Acquire the knowledge through value education towards national and global development.	K1
CO3	Introduce the basic concepts of conflict, emotions and adolescent emotions.	K1
CO4	Illustrate the techniques in therapeutic measures like yoga and meditation.	K2
CO5	Learn the concepts of human rights, rights for women and children and domestic violence.	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	M
CO2	S	M	S	S	S
CO3	S	S	M	S	S
CO4	S	S	S	S	M
CO5	S	S	M	S	S

S Strong M Medium L Low

196BM1A2AA	AECC : HUMAN RIGHTS	**SEMESTER II**

Total Credits: 2
Total Instruction Hours: 24 h

Syllabus

Unit I Introduction to human values 05 h

Concept of Human Values - Value Education Towards Personal Development - Aim of education and value education - Evolution of value oriented education - Concept of Human values - Types of values - Components of value education - Personal Development: Self analysis and introspection - Sensitization towards gender equality - Physically challenged - Intellectually challenged - Respect to age - Experience - Maturity - Family members - Neighbours - Co-workers - Character Formation towards Positive Personality: Truthfulness - Constructivity - Sacrifice - Sincerity - Self Control - Altruism - Tolerance - Scientific Vision.

Unit II Value education and Social values 05 h

Value Education Towards National and Global Development National and International Values: Constitutional or national values - Democracy - Socialism - Secularism - Equality - Justice - Liberty - Freedom and fraternity -Social Values - Pity and probity - Self control - Universal brotherhood - Professional Values - Knowledge thirst - Sincerity in profession - Regularity - Punctuality and faith - Religious Values - Tolerance - Wisdom - Character - Aesthetic values - Love and appreciation of literature and fine arts and respect for the same - National Integration and international understanding.

Unit III Global Development on Ethics and Values 04 h

Impact of Global Development on Ethics and Values: Conflict of cross-cultural influences - Mass media - Cross-border education - Materialistic values - Professional challenges and compromise - Modern Challenges of Adolescent Emotions and behave or Sex and spirituality: Comparison and competition - Positive and negative thoughts - Adolescent Emotions - Arrogance - Anger - Sexual instability - Selfishness - defiance.

Unit IV Yoga and Meditation 05 h

Therapeutic Measures: Control of the mind through - Simplified physical exercise - Meditation – Objectives - Types - Effect on body - Mind - Soul - Yoga – Objectives - Types - Asanas - Activities: Moralisation of Desires -Neutralisation of Anger - Eradication of Worries - Benefits of Blessings.

Unit V Human Rights and Rights of Women and Children 05 h

Human Rights - Concept of Human Rights – Indian and International Perspectives Evolution of Human Rights - Definitions under Indian and International

documents - Broad classification of Human Rights and Relevant Constitutional Provisions - Right to Life - Liberty and Dignity - Right to Equality - Right against Exploitation - Cultural and Educational Rights - Economic Rights - Political Rights - Social Rights - Human Rights of Women and Children - Social Practice and Constitutional Safeguards - Female Foeticide and Infanticide - Physical assault and harassment - Domestic violence - Conditions of Working Women - Institutions for Implementation - Human Rights Commission - Judiciary - Violations and Redressel Violation by State - Violation by Individuals - Nuclear Weapons and Terrorism Safeguards.

References

1. Brain Trust Aliyar, 2008, Value Education for health, happiness and harmony. Vethathiri publications, Erode.
2. Grose. D. N, 2005, A text book of Value Education. Dominant Publishers and Distributors, New Delhi.
3. Yogesh Kumar Singh & Ruchika Nath, 2005, Value Education, P. H Publishing Corporation, New Delhi.
4. Venkataram & Sandhiya. N, 2001, Research in Value Education, APH Publishing Corporation, New Delhi.
5. Seetharam. R. (Ed), 1998, Becoming a better Teacher Madras Academic Staff College.
6. Brain Trust Aliyar, 2004, Value Education for Health, Happiness and Harmony. Vethathiri publications, Erode.
7. Swami Vivekananda, 2008, Personality Development. Advaita Ashrama, Kolkata.
8. Dey A. K, 2002, Environmental Chemistry. New Delhi – Vile Dasaus Ltd

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Third Semester										
Part I										
191TL1A3TA	Language -I	Tamil – III	3	1	-	3	25	75	100	3
191TL1A3HA		Hindi – III								
191TL1A3MA		Malayalam –III								
191TL1A3FA		French - III								
Part - II										
191EL1A3EA	Language -II	English - III	3		1	3	25	75	100	3
Part - III										
193BT1A3CA	Core V	Genetics	3	1	-	3	25	75	100	3
193BT1A3CB	Core VI	Biochemistry	2	1	-	3	25	75	100	3
193BT1A3CP	Core Practical III	Genetics & Biochemistry	-	-	4	5	40	60	100	2
192MT1A3ID	IDC III	Mathematics	3	1	-	3	25	75	100	4
193BT1A3SA	SEC I	Personality Development	3	-	-	3	25	75	100	3
193BT1A3GA	GE I	Mushroom Technology	2	-	-	2	-	50	50	2
	LoP	Lab on Project	-	-	-	-	-	-	-	-
Part - IV										
191TL1A3AA	AECC - III	Basic Tamil	2	-	-	-	-	50	50	2
191TL1A3AB		Advanced Tamil								
195CR1A3AA		Women's Rights								
		Total	**21**	**4**	**5**				**800**	**25**

EXTRA CREDIT COURSES

The following are the courses offered under self study to earn extra credits:

S. No.	Course Code	Course Name
1	193BT1ASSA	Environmental Management
2	193BT1ASSB	Biofertilizer Technology

ourse Code	Course Name	Category	L	T	P	Credit
191TLIA3TA	தமிழ்த் தாள்– III	மொழி-I	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- மொழிப்பாடங்களின் வாயிலாக தமிழரின் பண்பாடு , பகுத்தறிவு ஆகியவற்றை அறியச் செய்தல்
- கலை மற்றும் மரபுகளை அறியச் செய்தல்
- மாணவர்களின் படைப்பாக்கத்திறன்களை ஊக்குவித்தல்

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	வாழ்க்கைத்திறன்கள் (Life Skills) – மாணவனின் செயலாக்கத்திறனை ஊக்குவித்தல்	K1,K2,K3
CO2	மதிப்புக்கல்வி (Attitude and Value education)	K2,K4
CO3	பாட இணைச்செயல்பாடுகள் (Co-curricular activities)	K2,K3,K4
CO4	சூழலியல் ஆக்கம் (Ecology)	K4
CO5	மொழி அறிவு(Tamil knowledge)	K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	M	M	M	M
CO3	S	M	M	M	M
CO4	S	M	M	M	M
CO5	S	M	M	M	M

S Strong M Medium L Low

191TLIA3TA	பகுதி – 1 : தமிழ் தாள் : 3	SEMESTER III

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I 10 h

1. காப்பியங்களின் தோற்றமும் வளர்ச்சியும்
2. சிலப்பதிகாரம் – மனையறம் படுத்த காதை
3. மணிமேகலை – வஞ்சிமாநகர் புக்க காதை

Unit II 10 h

1. கம்பராமாயணம் – கும்பகர்ணன் வதைப்படலம் (பா. எண் : 60 – 100)
2. பெரிய புராணம் – அதிபத்தநாயனார் புராணம்

Unit III 10 h

1.சிற்றிலக்கியங்களின் தோற்றமும் வளர்ச்சியும்

2.தமிழ்விடு தூது – தூதுப்பொருள்கள் மட்டும் 101 முதல் 112 வரை(12 கண்ணிகள்)

3.திருக்குற்றாலக்குறவஞ்சி – வசந்தவல்லி பந்தாடிய சிறப்பு (6: 4கண்ணிகள்)

4.கலிங்கத்துப்பரணி – களம் பாடியது (போர்க்களக் காட்சி –பா.எண்: 472–502)

Unit IV 10 h

1. நாடகங்களின் தோற்றமும் வளர்ச்சியும்
2. நாடகம் - ஔவை–ஆசிரியர் இன்குலாப்

Unit V 08 h

1. 'பா' வகைகள் : வெண்பா, ஆசிரியப்பா, கலிப்பா, வஞ்சிப்பா - பொது இலக்கணம் மட்டும்.
2. அணி: உவமையணி, உருவக அணி, இல்பொருள் உவமையணி விளக்கம், உதாரணம்.

அ) அலுவலகம் சார்ந்த கடிதம்: விண்ணப்பங்கள், வேண்டுகோள், முறையீடு,

ஆ) வாசகர் கடிதம்: நாளிதழ், வானொலி, செய்தி ஊடகங்களுக்கு விமர்சனம் எழுதுதல்.

Text Books

1 மொழிப்பாடம் - 2020, தொகுப்பு : தமிழ்த்துறை , டாக்டர் என்.ஜி.பி. கலை அறிவியல் கல்லூரி.

2 இன்குலாப் – 2017. ஒளவை (நாடகம்), அன்னம் வெளியீடு, சென்னை.

References

1 புலவர் சோம. இளவரசு - 2014. இலக்கிய வரலாறு , மணிவாசகர் பதிப்பகம் , சென்னை – 108,

2 பேராசிரியர் முனைவர் பாக்யமேரி – முதற் பதிப்பு 2013 , இலக்கணம் இலக்கிய வரலாறு மொழித்திறன், பூவேந்தன் பதிப்பகம், சென்னை.

3 இணையதள முகவரி : www.tamilvirtual.com

Course Code	Course Name	Category	L	T	P	Credit
191TL1A3HA	HINDI-III	Language - I	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- To develop the writing ability and develop reading skill.
- To learn various concepts and techniques for criticizing literature, to learn the techniques for expansion of ideas and translation process.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the fundamentals of novels and stories.	K1
CO2	Understand the principles of translation work.	K2
CO3	Apply the knowledge writing critical views on fiction.	K3
CO4	Build creative ability.	K3
CO5	Expose the power of creative reading.	K2

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	S	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong M Medium L Low

191TL1A3HA	HINDI-III	SEMESTER III

Total Credits: 03

Total Instruction Hours: 48 h

Syllabus

Unit I — 10 h

पद्य – काव्य पराशर (भोलानाथ)

(प्राचीन- कबीर, तुलसी, सुर, मीरा, आधुनिक- मैथिलीशरण गुप्त, अरूण कमल)

प्रकाशक: जवाहर पुस्तकालय

सदर बाजार, मथुरा

उत्तर प्रदेश - 281001

Unit II — 10 h

हिन्दी साहित्य का इतिहास: (साधारण ज्ञान)

आचार्य रामचन्द्र शुक्ल

लोकभारती प्रकाशन इलाहाबाद

Unit III — 10 h

अलंकार:अनुप्रास,यमक, श्लेष, वक्रोक्ति, उपमा,रूपक

प्रकाशक: विनोद पुस्तक मंदिर

आगरा - 282002

Unit IV — 10 h

संवाद लेखन

पुस्तक: व्याकरण प्रदिप - रामदेव

प्रकाशक: हिन्दी भवन 36 इलाहाबाद - 211024

Unit V — 08 h

अनुवाद अभ्यास-III (केवल हिन्दी से अंग्रेजी में)

(पाठ 10 to 20)

प्रकाशक: दक्षिण भारत प्रचार सभा चेनैई -17

Course Code	Course Name	Category	L	T	P	Credit
191TL1A3MA	MALAYALAM - III	Language - I	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- To develop the writing ability and develop reading skill.
- To learn various concepts and techniques for criticizing literature, to learn the techniques for expansion of ideas and translation process.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the fundamentals of novels and stories.	K1
CO2	Understand the principles of translation work.	K2
CO3	Apply the knowledge writing critical views on fiction.	K3
CO4	Build creative ability.	K3
CO5	Expose the power of creative reading.	K2

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	S	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong M Medium L Low

191TL1A3MA	MALAYALAM - III	SEMESTER III

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I 10 h

Kumaranasan

Unit II 10 h

Kumaranasan

Unit III 10 h

Kumaranasan

Unit IV 10 h

Kavyanchali Collection of Poems.

Unit V 08 h

Kavyanchali Collection of Poems.

Text Books

1 Chinthavishtayaya Sitha By Kumaranasan DC.Books Kottayam

2 Kavyanchali -Group of Authors DC.Books Kottayam

References

1 Kavitha Sahithya Charithram –Dr.M.Leelavathy Sahithya academy Thrissur.

Course Code	Course Name	Category	L	T	P	Credit
191TL1A3FA	FRENCH-III	Language - I	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- To Acquire Competence in General Communication Skills – Oral + Written – Comprehension & Expression.
- To Introduce the Culture, life style and the civilization aspects of the French people as well as of France.
- To help the students to acquire Competency in translating simple French sentences into English and vice versa.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the Basic verbs, numbers and accents.	K1
CO2	To learn the adjectives and the classroom environment in France.	K2
CO3	Learn the Plural, Articles and the Hobbies.	K3
CO4	To learn the Cultural Activity in France.	K4
CO5	To learn the Sentiments, life style of the French people and the usage of the conditional tense.	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	S	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong M Medium L Low

191TL1A3FA	FRENCH-III	SEMESTER III

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Excuses et vœux 10 h

Compétence Culturelle : Convivialité - (lieux et société, - l'apéritif)

Compétence de Communication

- **INTERACTION ORALE:** Accueillir quelqu'un, s'excuser,remercier
- **RÉCEPTION ORALE**: Comprendre des announces enregistrées
- **RÉCEPTION ÉCRITE:** Compremdre une affiche
- **PRODUCTION ÉCRITE:** Écrire des cartes de vœux

Compétence Grammatical

Pronoms personnels toniques moi,je…;toi…tu - Pronoms personnels objets Me,te,le… - Lesverbsen-ercomme appeler,acheter - Lesadjectives possessives nos,vos,leurs

Unit II Bravo et merci 8 h

Communication et technologies (leportable, internet)

- **INTERACTION ORALE:** Interagir au téléphone , féliciter
- **RÉCEPTION ORALE:** Comperendre une emission à la radio
- **RÉCEPTION ORALE:** Comprendre une définition
- **PRODUCTION ECRITE:** Écrire des plaques commemoratives

Oui,que - Le passé composé - Le participe passé - J'ai eu,ella a été -

Longtemps,pendant …, de… à

Unit III Faire et dire 10 h

Jeunes : enquête

- **INTERACTION ORACE:** Demander de l'aide, donner des instructions
- **RÉCEPTION ORALE:** Comprendre un message enregistré
- **RÉCEPTION ÉCRITE :** Comprendre un article d'un magazine de consommateurs
- **PRODUCTION ÉCRITE :** Écrire un règlement

- du,de la (de l)',des,de

V Faire ci ou faire ça 10 h

Les vacances des Français

- **INTERACTION ORALE :** Proposer quelque chose,accepter,refuser
- **RÉCEPTION ORALE :** Comprendre une émission de cuisine
- **RECEPTION ÉCRITE :** Comprendre une brochure d'informations
- **PRODUCTION ÉCRITE :** Ecrire un'texte de promotion touristique

S'il y a du soleil : L'hypothèse (supposition, Condition) la préposition S i + indicatif

Sinon… ou + indicatif - Sortir,partir - Quelques, plusieurs - Le long de - Au milieu de… - Au sommet de…

Unit V Dialogue writing 10 h

1. Au Restaurant
2. A la poste
3. A L' Aeroport
4. A La Gare
5. Chez Le Medecin

Text Books

1 Marcella Di Giura Jean-Claude Beacco, Alors II. Goyal Publishers Pvt Ltd 86, University Block ,Jawahar Nagar (Kamla Nagar), New Delhi – 110007

Course Code	Course Name	Category	L	T	P	Credit
191EL1A3EA	ENGLISH - III	Language II	4	0	0	3

PREAMBLE

This course has been designed for students to learn and understand

- The basics of English grammar and specific usage
- The importance of the vocabulary and use in different contexts
- The necessity of communication and composition writing skills

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn English grammar and its specific usage	K2
CO2	Know the methods of improving reading skills	K3
CO3	Understand the importance of speaking skills and developing it through various practices	K3
CO4	Comprehend the basic steps of reading and its necessity	K3
CO5	Acquire the writing skills and mandatory similar practices	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	S	S
CO2	S	S	S	S	S
CO3	M	M	S	M	S
CO4	S	S	S	S	M
CO5	M	S	M	S	S

S Strong M Medium L Low

191EL1A3EA	ENGLISH - III	SEMESTER III

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Basics of English 10 h

Phrasal verb - Notions and Conventional Idiomatic Expressions - One-Word Substitution - Word Formation - Homophones - Spelling - Sentence Completion – Sentence Pattern

Unit II Listening 08 h

Listening and Hearing - Principles of listening - Types of listening - incidental listening - active and effective listening - discriminative listening - critical listening - listening vs practice - Barrier to Listening - Guidelines for Improving Listening

Unit III Speaking 10 h

Monologues - Dialogue - Role Play - JAM (Just A Minute talk) - Debate - Public Speaking - Group Discussion - Interview - Showing Directions - Accent and Neutralization

Unit IV Reading 10 h

Mechanics of Reading - Types of Reading - Summarization - Paraphrasing - Analysis and Interpretation - Reading Comprehension – Reading with purpose and making predictions - Cloze Passage

Unit V Writing 10 h

Paraphrase Writing - Techniques and Methods of Paraphrasing - Precis Writing - Difference between Paraphrase and Precis - review writing - Hints Developing - Editorial Writing - Tabloid - Column Writing

Text Books

1. Bhatnagar R. P. 2013. English for Competitive Examinations. Macmillan Publishers, Chennai.
2. KoneruAruna. 2011. English Language Skills. McGraw Hill Education, Chennai.

References

1. Radhakrishna Pillai G. 2000. English for Success. Emerald Publishers, Chennai.
2. Gauri Mishra, Ranjana Kaul. 2016. Language Through Literature. Primus Books, New Delhi.
3. Miles Craven. 2008. Cambridge English Skills Real Listening and Speaking. First Edition, Cambridge University Press, India.
4. Teaching Adult: A Literary Resource Book. 2012. New Readers Press, New York, United States.

Course Code	Course Name	Category	L	T	P	Credit
193BT1A3CA	GENETICS	CORE	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- Concepts of Mendelian and Non-Mendelian inheriance
- Theory of inheritance and gene interaction
- The overview on genetic disorders

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the history and concept of Mendelian laws	K1, K2
CO2	Recognize the structure of chromosome, gene and its interaction	K1, K2
CO3	Differentiate the natural horizontal gene transfer methods	K1,K2
CO4	Interpret chromosomal variations and genetic disorders	K1,K2, K3
CO5	Classify the pedigree analysis and administer genetic counseling	K1,K2, K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	M	M	S
CO4	S	M	M	M	S
CO5	S	S	S	S	S

S Strong M Medium L Low

193BT1A3CA	GENETICS	SEMESTER III

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Mendelian & Non Mendelian Inheritance 09 h

History of Genetics, Mendel's work: Monohybrid Experiment, Dihybrid Experiment, Back Cross and Test Cross. Chromosomal theory of Inheritance, Extranuclear inheritance (mitochondrial, chloroplast), Maternal inheritance.

Unit II Concept of Gene, Alleles and Chromosome 10 h

Gene vs Allele, Multiple Alleles, Pseudo alleles, Gene Interactions: Allelic (Co-Dominance, Incomplete Dominance), Non Allelic (Epistasis and Lethal genes). Concept of loci on Chromosome, Structure of Prokaryote and Eukaryote chromosome, Karyotyping

Unit III Chromosomal Variations and Abberations 10 h

Mutation- Physical and Chemical, Numerical – Euploidy and Aneuploidy; Structural (deletion, duplication, inversion and translocation). Single Gene Disorders: Autosomal Dominant -Achondroplasia, polycystic kidney, Autosomal Recessive - Cystic fibrosis, Sickle cell Anaemia, X- linked Dominant - Rett syndrome, X linked recessive - Haemophilia, Multifactorial - Cleft lip and palate

Unit IV Natural Horizontal Gene Transfer Methods 09 h

Genetic analysis of bacteria - Bacterial transformation, Conjugation (sex factor, Hfr strain, F' factor), Transduction in Bacteria (General and Specialized), Linkage and Crossing over, Recombination- Holliday model

Unit V Transposons and Population Genetics 10 h

Model organism for genetic analysis of development- Drosophila & Arabidopsis. Transposable elements of Prokaryotes (IS Elements, Composite and Tn3 Family) and Eukaryotes (Maize transposable elements). Gene frequency, Hardy – Weinberg law

Text Books

1. Strickberger, M. W. 2013. Genetics. 3rd edition. Prentice Hall College Division, New Delhi.
2. Winter, P.C., Hickey,G. I. and Fletcher, H.L. 2000. Genetics. 1st edition. Viva Books Pvt Ltd., India

References

1. Trun, N. and Trempy, J. 2004. Fundamental Bacterial Genetics. Blackwell publishing. Singapore
2. Strachan, T. and Read, A. P. 2006. Human Molecular Genetics. 3rd Edition. Wiley & Sons. United States
3. Maquat, L. 2018. Molecular Biology. 5th edition. CRC Press. United States
4. Brown, T. A. 1999. Genetics. 3rd edition. Chapman and Hall. London, UK

Course Code	Course Name	Category	L	T	P	Credit
193BT1A3CB	BIOCHEMISTRY	CORE	2	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- The structure & function of bio molecules
- The aspects of metabolism & their regulatory pathways
- The classification, structure, functions of biomolecules and its metabolism

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Identify the concepts of biochemical pathways and carbohydrates	K1, K2
CO2	Paraphrase the classification, structure, properties and metabolism of amino acids and protein	K1, K2
CO3	Discuss the classification, structure, properties, biosynthesis and oxidation of lipids	K1, K2
CO4	Compare the classification, structure, functions of nucleic acids and metabolism of nucleotides	K2, K3
CO5	Categorize the classification of enzymes, mechanism of action and enzyme kinetics	K2, K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	S
CO2	S	S	M	S	S
CO3	S	S	M	S	S
CO4	S	S	M	S	S
CO5	S	M	S	S	S

S Strong M Medium L Low

193BT1A3CB	BIOCHEMISTRY	SEMESTER III

Total Credits: 3

Total Instruction Hours: 36 h

Syllabus

Unit I Carbohydrates 7 h

Structure and classification, Glycolysis and gluconeogenesis. Krebs's cycle. Electron transport chain. HMP shunt pathway

Unit II Protein 7 h

Amino acid: Essential and non essential amino acids, Properties and Metabolism of amino acids (Glycine and Tryptophan). Protein: Classification and Properties – four levels of protein structure & conformations, Ramachandran Plot.

Unit III Lipids 7 h

Lipids: Nomenclature, Classification and biological significance. Simple Lipids and Compound lipids. Synthesis and metabolism of fatty acids (α, β and ω Oxidation of fatty acids). Cholesterol Biosynthesis and regulation

Unit IV Nucleic acids 7 h

Nucleic acids: Classification, structure and functions of nucleic acids, Biosynthesis of Purines and pyrimidines -De novo pathway, Salvage pathway, Regulation and Metabolism of Purine and pyrimidine.

Unit V Enzyme kinetics 8 h

Enzymes: Nomenclature and Classifications of enzyme. Coenzymes, Abzymes, Ribozymes. Mechanism of enzyme actions - Active site, Lock and Key model & Induce fit Hypothesis, Enzyme substrate complex formation. Kinetics: Derivation of Michaelis- Menton equation, Types of inhibitions - Competitive, Non Competitive, Uncompetitive, Feedback and Allosteric.

Text Books

1. Murray, R.K., Rodwell, V.W. 2009, Harper's Illustrated Biochemistry, 28th edition, McGraw Hill publications, India

2. Berg, J.M., Stryer, L. et al. 2015, Biochemistry, 8th edition, Palgrave Macmillan Publications, India

References

1. Zubay, G.L. 1995. Principles of Biochemistry. 1st edition. WCB publishers. USA.

2. Lehninger, A.L. and Cox, M. M. 1993. Principles of Biochemistry. 2nd edition. CBS Publishers And Distributors. New Delhi.

3. Fromm, H.J. and Hargrovem M. 2012. Essentials of Biochemistry, Kindle edition. Springer publisher

4. Voet, D. and Voet, J. G. 1995. Fundamentals of Biochemistry. 2nd edition. John Wiley and Sons Inc. USA

193BT1A3CP	CORE PRACTICAL : GENETICS AND BIOCHEMISTRY	SEMESTER III

Total Credits: 2
Total Instructions Hours: 48 h

S.No	LIST OF EXPERIMENTS
1	Problem solving in Monohybrid cross and dihybrid cross
2	Isolation of Auxotrophic Mutants / Antibiotic Resistants by Gradient plate technique
3	Sex chromatin observation from Buccal smear *
4	Determination of Phage Titre
5	Problem solving in Pedigree Analysis
6	Determination of Thermal death time
7	Determination of gene frequency using Hardy Weinberg law
8	Estimation of Glucose by Anthrone method
9	Estimation of Fructose by Dinitro Salicylic Acid method
10	Estimation of Amino Acids by Ninhydrin method
11	Estimation of Ascorbic acid by DNPH method.
12	Estimation of Protein by Lowry's or Bradford's method*

Note: 1) Out of 12 - 10 Mandatory
2) * DBT STAR experiments

References

1. Mertens, T.R. and Hammersmith, R.L. 1997. Genetics Laboratory Investigations. 11th edition. Benjamin Cummings. USA.
2. Sadasivam, S. and Manickam,A. 1996. Biochemical Methods, 4th edition. New Age International. India
3. Sambrook, J. and Green, M.R. 2012. Molecular Cloning: A Laboratory Manual. 4th edition. Cold Spring Harbor. USA

Course Code	Course Name	Category	L	T	P	Credit
192MT1A3ID	MATHEMATICS	IDC	3	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- Set operations and their properties
- Importance of Matrix method and simultaneous linear equation.
- probability distribution and test of significance in Chi-square ,t test , F test and ANOVA table

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	explain the concept of Set operations	K1
CO2	demonstrate the concept of Matrix	K2
CO3	apply the concept of Mean , Median and Mode	K3
CO4	recognize the concept of probability distribution , Chi-square test and t test	K3
CO5	analyzing the concept of ANOVA and F test	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	M
CO2	S	M	S	M	S
CO3	M	S	S	S	M
CO4	M	M	S	S	S
CO5	S	S	S	S	S

S Strong M Medium L Low

192MT1A3ID	MATHEMATICS	SEMESTER III

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Set Theory 8 h

Sets–Types of sets – Venn diagram – Set operations – Union –Intersection - Complement – Difference – Law of algebras of sets –Properties of sets – Number of elements -Sums involved in two sets

Unit II Matrix 10 h

Matrix Basic Concepts - Types of Matrices - Addition and Multiplication of Matrices – Determinants - Crammer's Rule -Inverse of a Matrix - Matrix Method - Rank ofMatrix

Unit III Measures of central tendency and dispersion 10 h

Statistics- Meaning - Diagrammatic and Graphical Representation- Measures of Central Tendency-Mean – Median– Mode - Measures of dispersion- Range – Standard deviation

Unit IV Probability Distribution 10 h

Probability distributions – Discrete Distribution -BinomialDistribution-Poisson Distribution –Continuous Distribution - Normal Distributions-Student's t test and Chi square test

Unit V ANOVA and F –test 10 h

Analysis of Variance- One way Classification – Two way Classification- Three way Classification of data – F- test -Test for single variance and difference between variance only known and unknown variances

Note: Theory 20% and Problem 80%

Text Books

1. Vittal.P.R,2012, 'BusinessMathematicsandStatistics', third edition,Margham Publications, Chennai
2. Vittal.P.R., 2015, ' Mathematical Statistics ', Margham Publication, Chennai

References

1. Navnitham P.A,2013,'Business Mathematics & Statistics ', second edition , Jai Publishers, Trichy
2. Gupta S.P. and Gupta. M.P, 2002, ' Business Statistics ' , 17th edition , Sultan Chand andSons, New Delhi
3. Das N.G , Das J.K , 2012, ' Business Mathematics and Statistics' , First Edition, McGraw Hill Education Private Limited, Bengaluru
4. Gupta.S.C and Kapoor.V.K,2017, ' Fundamentals of Applied Statistics', Sultan Chand and Sons , New Delhi

Course Code	Course Name	Category	L	T	P	Credit
193BT1A3SA	PERSONALITY DEVELOPMENT	SEC	3	-	-	3

PREAMBLE

This course has been designed for students to learn and understand

- Value of self introspection for better output in education and work
- The strengths of personal effectiveness in all round development
- The importance of communication skills in bioscience

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Sketch the values of self introspection	K1 and K2
CO2	Interpret the relationship between healthy eating and mind	K1 and K2
CO3	Compose the pros and cons of personal effectiveness	K1, K2 and K3
CO4	Hypothesize the importance of mind	K1, K2 and K3
CO5	Appraise oneself as a biologist	K1, K2 and K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	M	M	M

S Strong M Medium L Low

193BT1A3SA	PERSONALITY DEVELOPMENT	SEMESTER III

Total Credits: 3

Total Instruction Hours: 36 h

Syllabus

Unit I Concept of Good Health 7 h

Personality Development – psychological and physical. Development of soft skills, healthy interpersonal relationship, networking. Healthy and balanced diet and exercise. Classification of food, nutritional value, acceptable dietary intake.

Unit II Healthy body creates healthy mind 7 h

Role of nutraceuticals with special reference to diabetes mellitus, hypertension, hypercholesterolemia, cancer. Concept of antioxidants in dietary supplements in prevention and treatment of cancer, obesity and stress. Role of nutraceuticals and functional foods in pediatrics, geriatrics, sports, pregnancy and lactation.

Unit III Biological Psychology 7 h

Fundamental issues of biological psychology – mind brain relationship. Biological causes of behavior. Regulation of internal environment - temperature – hunger – thirst –emotions. Biological theories of sleep – stages of sleep and sleep disorder

Unit IV Advanced Mental Attitude 7 h

Conquer mental worries – working of brain with regard to emotions – techniques to analyse worries – facts about worries – how to avoid fatigue – dressing sense and attitude - environment and mind – stress related to mental attitude – guilt related to mental attitude.

Unit V Transform as a Biologist 8 h

Words to transform your life – think practical – speak logical – causes and consequences of proactiveness – trend of questioning and its benefits. Looking at criticism positively - live goal oriented – positive vibrations and aura

Text Books

1. Carnegie, D. 2018. Art of Public Speaking. 4th edition. Samaria Publishing. India.
2. Leggett, B. 2017. 3rd edition. Self Development. Orange Smile Publishing. United States.

References

1. Coelho, P. 2010. 2nd edition. The Alchemist. Harpar Collins Press. United States.
2. Shanahan, C. 2019. Deep Nutrition: Why your genes need traditional foods. 2nd edition. St. Martin's Press. United States.
3. Carnegine, D. 2017. How to Stop worrying and start living. 3rd edition. Manjula Publishing, India.
4. Covey, S. R. 2015. Seven Habits of Highly Effective People. 1st edition, iBookstore special video edition.

193BT1A3GA	GENERIC ELECTIVE: MUSHROOM TECHNOLOGY	SEMESTER III

Total Credits: 2

Total Instruction Hours: 24 h

Syllabus

Unit I Basic concepts of Mushroom Technology 5 h

Mushroom Technology - Introduction, History and Scope. Edible and Poisonous Mushrooms. Importance and nutritive value of edible mushrooms. Mushroom research centers in India

Unit II Types of mushroom and its cultivation 5 h

Cultivation of button mushroom (Agaricus bisporus), milky mushroom (Calocybe indica), oyster mushroom (Pleurotus sajorcaju) and paddy straw mushroom (Volvariella volvcea)

Unit III Production, Harvest and Storage methods 5 h

Isolation and culture of spores, culture media preparation. Production of mother spawn, multiplication of spawn - Inoculation Technique

Unit IV Cultivation technology 5 h

Substrates, composting technology, bed, polythene bag preparation, spawning - Cropping and its importance

Unit V Mushroom production 4 h

Harvest -types and Storage methods and post marketing surveillance and types.

Text Books

1. Krishnamoorthy, A.S et al. 1991. Oyster Mushrooms. 2nd edition. TNAU Department of Plant Pathology. Tamil Nadu
2. Suman, B C, and Sharma V P. 2007. Mushroom Cultivation in India. 1st edition. Daya Publishing House. India

References

1. NIIR Board of Consultants and Engineers. 2011. Handbook on Mushroom Cultivation and Processing.1st edition. Asia Pacific Business Press Inc. India
2. Biswas S. 2012. Mushrooms: A Manual for Cultivation. 1st edition. PHI Learning Private Limited. New Delhi
3. Thapa, C.D et al. 2017. Mushroom Culture. 1st edition. Agrimoon.com.
4. Russel, S. 2018. Essential guide to Mushroom Cultivation. 2nd edition. Storey Publishing, United States

193BT1ASSA	SELF STUDY - ENVIRONMENTAL MANAGEMENT	SEMESTER III

Total Credits: 1

Syllabus

Unit I Ecology and Ecosystem

Ecology - ecosystem and their types - definitions - environmental components and interrelationships - physical, chemical and biological characteristics of environment energy flow and materials cycling.

Unit II Pollution

Definition - source of pollution - types of pollution - air, water, soil, noise and radioactive pollution - environmental sanitation - environmental issues - global - national - regional and local

Unit III Environmental Standards

Prescribed environmental standards - WHO - Pollution Control Board – risk probability and hazards to humans - toxicology - chemical hazards - biological hazards: disease development and developing countries.

Unit IV Pollution Control Methods

Pollution control methods - physical, chemical and biological - waste water treatment - activated sludge process, oxidation ponds and trickling filter - anaerobic process.

Unit V Environmental Management

Tool for environment management - Environmental Impact Assessment – waste minimization techniques - environmental planning in urban development – natural resources and sustainable development - environmental ethics.

Text Books

1. Joseph, K. and Nagendra, R. 2004. Essentials of Environmental Studies. 2nd edition. Pearson Education. New Delhi
2. Tyler, M.J.R.2004. Environmental Science. 2nd edition. Thomson Brooks/Cole Publishing. Singapore.

References

1. Dhamejam, S.K. 2005. Environmental Science and Engineering. 2nd edition. Kataria sons. Delhi
2. Dubey, R.C. 2006. Environmental Health Ecological Perspectives. 3rd edition. Jones and Bartlett Publishers. USA
3. Dash, M.C. 1998. Fundamentals of Ecology. 2nd edition. Tata McGraw Hill. India .
4. Scragg, A. 2007. Environmental biotechnology. 2nd edition. Oxford university press. India.

193BT1ASSB	SELF STUDY - BIOFERTILIZER TECHNOLOGY	SEMESTER III

Total Credits: 1

Syllabus

Unit I Introduction to Biofertilizers

An introduction to fertilizers, synthetic fertilizers, natural fertilizers, inorganic fertilizers, organic fertilizers, bio-fertilizers - importance, advantages and constraints.

Unit II Culturing Methods

Isolation, culturing methods, enumeration and identification of microbial species - Rhizobium, Azospirillum Azotobacters, blue green algae and phosphate solubilisers.

Unit III Rhizobium

Morphology of Rhizobium, Azospirilium, Azotobacters, blue green algae and phosphate solubilisers and maintenance - inoculant preparation.

Unit IV Preparation of Inoculants

Preparation of microbial inoculants - large-scale production of microbes – their application as biofertilizers - crop responses to biofertilizers

Unit V Algae and Biofertilizers

Azolla - distribution, morphological and biochemical characteristics – cyanobacterial symbionts - azolla biofertilizer technology - organic matter and composting – method of processes, applications and limitations

Text Books

1. Rao, N.S. 2000. Biofertilizers in Agriculture. 2nd edition. Oxford & IBH publishing Co. New Delhi

2. Sundararaj, D.D. and Thulasidas, G. 1993. Botany of Field Crops. 2nd edition. McMilan India Ltd. India

References

1. Jeswani, L.M. and Balddev, B. 1990. Advances in Pulse Production Technology. 1st edition. ICAR. New Delhi..

2. Malsen, L.J.G.V. and S. Somaatmadja. 1993. PROSEA - Plant Resources of South East Asia. No.1. Pulses. 2nd edition. International Book Distributors, Dehradun.

3. Prohit, S.S. 2003. Ecology and environment and pollution. 1st edition. Agrobios publications. India

4. Varma. P.S. 1998. Concept of ecology. 1st edition. Chand & Co Ltd. India .

191TLIA3AA	பகுதி – 4 : அடிப்படைத்தமிழ்தாள் : 1(Basic Tamil)	SEMESTER III

Total Credits: 2

Total Instruction Hours: 24 h

இளங்கலை 2019–20ஆம் கல்வியாண்டு முதல் சேர்வோர்க்குரியது (10 மற்றும் 12 – ஆம் வகுப்பு வரை தமிழ் மொழிப்பாடம் பயிலாதவர்களுக்கு) (பருவத் தேர்வு உண்டு)

அலகு : 1 தமிழ் மொழியின் அடிப்படைக் கூறுகள் 12 h

அ) எழுத்துகள் அறிமுகம் :

1. உயிர் எழுத்துக்கள் - குறில் , நெடில் எழுத்துகள்
2. மெய் எழுத்துக்கள் - வல்லினம், மெல்லினம், இடையினம்
3. உயிர்மெய் எழுத்துக்கள்

ஆ) சொற்களின் அறிமுகம்: பெயர்ச்சொல், வினைச்சொல் – விளக்கம் (எ.கா.)

அலகு : 2 குறிப்பு எழுதுதல் 12 h

1. பெயர், முகவரி, பாடப்பிரிவு , கல்லூரியின் முகவரி
2. தமிழ் மாதங்கள்(12), வாரநாட்கள்(7),
3. எண்கள் (ஒன்று முதல் பத்து வரை), வடிவங்கள், வண்ணங்கள்
4. ஊர்வன, பறப்பன, விலங்குகள், மனிதர்களின் உறவுப்பெயர்கள்
5. ஊர்களின்பெயர்கள் (எண்ணிக்கை 10)
6. பயிற்சிப் பகுதி (உரையாடும் இடங்கள்) : வகுப்பறை, பேருந்து நிலையம், சந்தை

வினாத்தாள் அமைப்பு முறை - மொத்த மதிப்பெண்கள் - 100

பகுதி –அ

சரியான விடையைத் தேர்வு செய்தல் 10x2=20

பகுதி –ஆ

சரியா? தவறா? தேர்ந்தெடுத்து எழுதுக . 10x2=20

பகுதி-இ

ஒரு பக்க அளவில் விடையளிக்க 03x20=60

குறிப்பு:

- அனைத்து அலகுகளில் இருந்தும் வினாக்கள் அமைதல் வேண்டும்
- பகுதி இ–க்கான வினாக்கள் இது அல்லது அது என்ற அடிப்படையில் அந்தந்த அலகுகளில் அமைதல் வேண்டும்

Text Books

1 அடிப்படைத் தமிழ். 2019. தொகுப்பு : தமிழ்த் துறை, டாக்டர் என். ஜி.பி. கலை மற்றும் அறிவியல் கல்லூரி, நியூ செஞ்சுரி புக் ஹவுஸ்(பி)லிட். சென்னை

References

1 ஒன்றாம் வகுப்பு பாடநூல் - தமிழ்நாடு அரசு பாடநூல் கழகம்

2 வலைதள முகவரி : http://tamilvu.org

191TLIA3AB	பகுதி – 4 : சிறப்புத் தமிழ் தாள் : 1 **(Advanced Tamil)**	**SEMESTER - III**

Total Credits: 2

Total Instruction Hours: 24 h

இளங்கலை 2019– 2020 ஆம் கல்வியாண்டு முதல் சேர்வோர்க்குரியது (10 மற்றும் 12 – ஆம் வகுப்புகளில் தமிழ் மொழிப்பாடம் பயின்றவர்களுக்கு உரியது)(பருவத் தேர்வு உண்டு)

அலகு – 1 மரபுக் கவிதைகள் 05 h

அ) பாரதியார் கவிதைகள்

- தமிழ்நாடு
- மனதில் உறுதி வேண்டும்
- வருகின்ற பாரதம் (பா.எண்.5-8)

ஆ) பாரதிதாசன் கவிதைகள்

- இன்பத்தமிழ்
- நீங்களே சொல்லுங்கள்
- வாளினை எடடா!

இ) தாராபாரதி கவிதைகள்

- வேலைகளல்ல வேள்விகள்

அலகு – 2 புதுக்கவிதைகள் 05 h

- கம்பன் கவியரங்கக் கவிதை - மு.மேத்தா
- தமிழா! நீ பேசுவது தமிழா! - காசியானந்தன்
- நட்புக் காலம் (10 கவிதைகள்) - அறிவுமதி கவிதைகள்

அலகு – 3 இலக்கணம் 04 h

- வல்லினம் மிகும் மற்றும் மிகா இடங்கள்
- ர, ற,- ல, ழ, ள - ந, ண, ன - ஒலிப்பு நெறி, பொருள் வேறுபாடு அறிதல்

அலகு – 4 கடிதங்கள் எழுதுதல் 05 h

- பாராட்டுக் கடிதம்
- நன்றிக் கடிதம்
- அழைப்புக் கடிதம்
- அலுவலக விண்ணப்பங்கள்

அலகு – 5 பாடம் தழுவிய வரலாறு 05 h

- பாரதியாரின் இலக்கியப் பணி
- பாரதிதாசனின் இலக்கியப்பணி
- மரபுக்கவிதை, புதுக்கவிதை - விளக்கம்

வினாத்தாள் அமைப்பு முறை - மொத்த மதிப்பெண்கள் - 100

பகுதி –அ	
சரியான விடையைத் தேர்வு செய்தல்	10x2=20
பகுதி –ஆ	
கோடிட்ட இடங்களை நிரப்புக.	10x2=20
பகுதி –இ	
இரண்டு பக்க அளவில் விடையளிக்க	4x15=60

குறிப்பு:

- பகுதி –அ அனைத்து அலகுகளில் இருந்தும் இரண்டு வினாக்கள் அமைதல் வேண்டும்
- பகுதி இ –க்கான வினாக்கள் இது அல்லது அது என்ற அடிப்படையில் அந்தந்த அலகுகளில் அமைதல் வேண்டும்

Text Books

1 சிறப்புத் தமிழ் . 2019. தொகுப்பு : தமிழ்த் துறை, டாக்டர் என். ஜி.பி. கலை மற்றும் அறிவியல் கல்லூரி, நியூ செஞ்சுரி புக் ஹவுஸ்(பி)லிட். சென்னை

References

1 புலவர் சோம. இளவரசு - 2014. இலக்கிய வரலாறு, மணிவாசகர் பதிப்பகம், சென்னை – 108

2 வலைதள முகவரி : http://tamilvu.org

195CR1A3AA	WOMEN'S RIGHTS	SEMESTER III

Total Credits: 2

Total Instruction Hours: 24h

Syllabus

Unit I Rights to Infant & Child 4 h

Issues for women in India- Law relating to Female infanticide-Rights to the survival of a child-Child Labour- Child trafficking –Child Marriage- Protection of Children against Sexual Offences Act 2012 (POCSO)

Unit II Rights to women 5 h

Matrimonial protection-Protection against dowry-Protection to pregnancy-Sexual offences-Law relating to work Place- Directive principles of Constitution (Article 39 a, d, e & Article 42, 43 & 46) - Trafficking of women

Unit III Laws for Senior Citizen women 5 h

Constitutional Rights –Personal Laws- The Tamil Nadu Maintenance and Welfare of Parents and Senior Citizens Rules in 2009- The National Council for Older person- Government Provisions for elderly persons

Unit IV Civil and Political Rights of Women 5 h

Right of inheritance-Right to live with decency and dignity-The Married women's Property Act 1874-Personl law women's right to property-Women Reservation Bill-National Commission for Women-Political participation Pre independent political participation of women-Participation of Women in post independent period

Unit V International convention on Womens' Right 5 h

Convention on the Elimination of All Forms of Discrimination against Women(CEDAW)-United Nations population Fund(UNFPA)-Protocol to the African Charter on the rights of women in Africa-Convention on the Nationality of Married women-Convention on the political rights of women- Inter-American convention on granting of civil and political rights for women-Universal declaration of Human rights

Text Books

1 Women & Law(2009)-Krishna Pal Malik-Allahabad Law University, Delhi

References

1 Women's Human Rights in India(2019)-Christian Foster and Jaya Sagade- Routledge India

2 Justice for Women: Concerns and Expressions (2008)-Anand AS –Universal Law Publishing Co.

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Fourth Semester										
Part - I										
191TL1A4TA	Language - I	Tamil-IV	3	1	-	3	25	75	100	3
191TL1A4HA		Hindi-IV								
191TL1A4MA		Malayalam-IV								
191TL1A4FA		French – IV								
Part – II										
191EL1A4EA	Language - II	English – IV	3	-	1	3	25	75	100	3
Part – III										
193BT1A4CA	Core VII	Immunology	3	1	-	3	25	75	100	3
193BT1A4CB	Core VIII	Bioinformatics	3	-	-	3	25	75	100	3
193BT1A4CP	Core Practical IV	Immunology& Bioinformatics	-	-	4	6	40	60	100	2
192PY1A4IA	IDC - IV	Biophysics	4	-	-	3	25	75	100	4
193BT1A4SA	SEC - II	Biotechniques	3	-	-	3	25	75	100	3
193BT1A4GA	GE - II	Apiculture	2	-	-	3	-	50	50	2
	LoP	Lab on Project	-	-	-	-	-	-	-	-
Part - IV										
191TL1A4AA	AECC IV	Basic Tamil	2	-	-	3	-	50	50	2
191TL1A4AB		Advanced Tamil								
192PY1A4AA		General Awareness								
Total			**23**	**2**	**5**	**-**	**-**	**-**	**800**	**25**

Course Code	Course Name	Category	L	T	P	Credit
191TL1A4TA	பகுதி-1: தமிழ் - தாள்- IV	மொழி	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- மொழிப்பாடங்களின் வாயிலாகத் தமிழரின் பண்பாடு , பகுத்தறிவு ஆகியவற்றை அறியச் செய்தல்
- கலை மற்றும் மரபுகளை அறியச் செய்தல்
- மாணவர்களின் படைப்பாக்கத்திறன்களை ஊக்குவித்தல்

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	வாழ்க்கைத்திறன்கள் (Life Skills) – மாணவனின் செயலாக்கத்திறனை ஊக்குவித்தல்	K1,K2 & K3
CO2	மதிப்புக்கல்வி (Attitude and Value education)	K2,K4
CO3	பாட இணைச்செயல்பாடுகள் (Co-curricular activities)	K2,K3 & K4
CO4	சூழலியல் ஆக்கம் (Ecology)	K4
CO5	மொழி அறிவு (Tamil knowledge)	K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	M	M	M	M
CO3	S	M	M	M	M
CO4	S	M	M	M	M
CO5	S	M	M	M	M

S Strong M Medium L Low

191TLIA4TA	பகுதி-1: தமிழ் - தாள்- IV	SEMESTER IV

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I **எட்டுத்தொகை** 10 h

1. இலக்கிய வரலாறு - எட்டுத்தொகை நூல்கள்
2. நற்றிணை – குறிஞ்சித் திணை

I.பா.எண் : 01 – கபிலர்

II.பா.எண் : 88 – நல்லந்துவனார்

III.பா.எண் : 102 – செம்பியனார்

2. குறுந்தொகை – முல்லைத்திணை

I.பா.எண் : 65 – கோவூர்கிழார்

II. பா.எண் : 167 – கூடலூர்கிழார்

மருதத்திணை

I.பா.எண் : 08 – ஆலங்குடி வங்கனார்

II.பா.எண் : 61 – தும்பிசேர்கீரனார்

III.பா.எண் :196 – மிளைக் கந்தன்

நெய்தல் திணை

I.பா.எண் : 57 – சிறைக்குடி ஆந்தையார்

Unit II **எட்டுத்தொகை** 08 h

1. கலித்தொகை – பாலைக்கலி

I.பா.எண் :9 – பெருங்கடுங்கோ

2. அகநானூறு – மருதத்திணை

I.பா.எண் : 86 – நல்லாவூர்கிழார்

குறிஞ்சித் திணை

I.பா.எண் :198 – பரணர்

2. புறநானூறு - I.பா.எண் : 188 – பாண்டியன் அறிவுடை நம்பி

II.பா.எண் : 192 – கணியன் பூங்குன்றனார்

III.பா.எண் : 279 – ஒக்கூர் மாசாத்தியார்

IV.பா.எண் : 312 – பொன்முடியார்

Unit III **பத்துப்பாட்டு** 10 h

1. இலக்கிய வரலாறு - பத்துப்பாட்டு நூல்கள்
2. பட்டினப் பாலை – கடியலூர் உருத்திரங் கண்ணனார்

Unit IV **புதினம்** 10 h

1. புதினத்தின் தோற்றமும் வளர்ச்சியும்
2. புதினம்

1.புத்துமண் –- சுப்ரபாரதிமணியன்

Unit V **இலக்கணம் மற்றும் திறனாய்வுப் பகுதி** 10 h

I.இலக்கணம்

1. அகத்திணை – அன்பின் ஐந்திணை - விளக்கம்
2. புறத்திணை – 12 திணைகள் - விளக்கம்

II.பயிற்சிப் பகுதி

புதினத் திறனாய்வு – கொங்கு வட்டாரப் புதினங்கள்

1. நாகம்மாள் – ஆர். சண்முகசுந்தரம்
2. மானாவாரி மனிதர்கள் – சூர்யகாந்தன்
3. ஈரம் கசிந்த நிலம் – சி. ஆர். ரவீந்திரன்
4. ஒண்டிக்காரன் பண்ணையம் – மா. நடராசன்

Note: பயிற்சிப் பகுதியில் வினாக்கள் அமைத்தல் கூடாது

Text Books

செய்யுள் திரட்டு - மொழிப் பாடம் - 2020- 21

1 தொகுப்பு: தமிழ்த்துறை, டாக்டர் என்.ஜி.பி. கலை அறிவியல் கல்லூரி, வெளியீடு : நியூ செஞ்சுரி புக் ஹவுஸ், சென்னை – 600 098.

2 சுப்ரபாரதிமணியன், முதற் பதிப்பு -2019, புத்துமண் புதினம் – நியூ செஞ்சுரி புக் ஹவுஸ், சென்னை – 600 098. (Unit-IV)

References

1 பேராசிரியர் புலவர் சோம . இளவரசு, எட்டாம் பதிப்பு -2014, தமிழ் இலக்கிய வரலாறு - மணிவாசகர் பதிப்பகம், சென்னை – 600 108.

2 பேராசிரியர் முனைவர் பாக்கியமேரி , முதற் பதிப்பு - 2013 , இலக்கணம் - இலக்கிய வரலாறு - மொழித்திறன் -பூவேந்தன் பதிப்பகம், சென்னை-600 004.

3 தமிழ் இணையக் கல்விக்கழகம்.http://www.tamilvu.org/

Course Code	Course Name	Category	L	T	P	Credit
191TL1A4HA	Part- I : HINDI - Paper-IV	Language	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- To develop the writing ability and develop reading skill.
- To learn various concepts and techniques for criticizing literature, to learn the techniques for expansion of ideas and translation process.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the fundamentals of novels and stories.	K1
CO2	Understand the principles of translation work.	K2
CO3	Apply the knowledge writing critical views on fiction.	K3
CO4	Build creative ability.	K3
CO5	Expose the power of creative reading.	K2

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	S	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong M Medium L Low

191TL1A4HA	Part- I : HINDI - Paper-IV	SEMESTER IV

Total Credits: 03

Total Instruction Hours: 48 h

Syllabus

Unit I — 10 h

नाटक – लडाई – सर्वेश्वरदयाल सक्सेना

प्रकाशक: वाणी प्रकाशन

21-A, दरियागंज

नई दिल्ली-110002

Unit II — 10 h

एकांकी: एकांकी पंचामृत – डॉ राम कुमार

(भोर और तारा छोड़कर)

प्रकाशक: जवाहर पुस्तकालय

सदर बाजार, मथुरा

उत्तर प्रदेश-281001

Unit III — 10 h

काव्य मंजरी- (डा मुन्ना तिवारी)

मैथिलीशरण गुप्त- मनुष्यता, जयशंकर प्रसाद- बीती विभावरी जागरी

सूर्यकान्त त्रिपाठी निराला- तोडती पत्थर और भिक्षुक

Unit IV — 10 h

सूचना लेखन

पुस्तक: व्याकरण प्रदिप – रामदेव

प्रकाशक: हिन्दी भवन 36 इलाहाबाद-211024

Unit V — 08 h

अनुवाद अभ्यास-III (केवल अंग्रेजी से हिन्दी में)

(पाठ 10 to 20)

प्रकाशक: दक्षिण भारत प्रचार सभा चेनैई -17

Course Code	Course Name	Category	L	T	P	Credit
191TL1A4MA	Part- I : MALAYALAM - Paper-IV	Language	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- To develop the writing ability and develop reading skill.
- To learn various concepts and techniques for criticizing literature, to learn the techniques for expansion of ideas and translation process.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the fundamentals of novels and stories.	K1
CO2	Understand the principles of translation work.	K2
CO3	Apply the knowledge writing critical views on fiction	K3
CO4	Build creative ability.	K3
CO5	Expose the power of creative reading.	K2

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	S	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong M Medium L Low

191TL1A4MA	Part- I : MALAYALAM - Paper-IV	SEMESTER IV

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I 10 h

Drama

Unit II 10 h

Drama

Unit III 10 h

Drama

Unit IV 10 h

Screen Play

Unit V 08 h

Screen Play

Text Books

1. Manju Poloru Penkutty, Screen Play By Kalavoor Ravikumar, Published by DC.Books, Kannur.
2. Lankalakshmi, Drama By C.N.Sreekandan Nair Published by D C.Books Kottayam

Course Code	Course Name	Category	L	T	P	Credit
191TL1A4FA	Part- I : **FRENCH-** Paper-IV	**Language**	**3**	**1**	**-**	**3**

PREAMBLE

This course has been designed for students to learn and understand

- To Acquire Competence in General Communication Skills – Oral + Written – Comprehension & Expression.
- To Introduce the Culture, life style and the civilization aspects of the French people as well as of France.

  To help the students to acquire Competency in translating simple French sentences into English and vice versa.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn the Basic verbs, numbers and accents	K1
CO2	To learn the adjectives and the classroom environment in France	K2
CO3	Learn the Plural, Articles and the Hobbies.	K3
CO4	To learn the Cultural Activity in France	K3
CO5	To learn the Sentiments, life style of the French people and the usage of the conditional tense	K2

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	M	M	M	S
CO3	S	M	S	M	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

S Strong M Medium L Low

191TL1A4FA	Part- I : FRENCH- Paper-IV	SEMESTER IV

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I **Cœur et santé** 10 h

• Author du Couple	• INTERACTION ORALE: Exprimer son intérêt pour quelqu'un, exprimer l'affection • RECEPTION ORALE: Comprendre une chanson • RECEPTION ÉCRITE: Lire un horoscope • PRODUCTION ÉCRITE: Écrire une letter au courrier du cœur	• J'étais…L'imparfait(1) • Aussi brilliant que… • Le plus beau, le moins cher • Le verbe connaître

Unit II **Problémes problems** 10 h

• Le bénvolat	• INTERACTION ORALE: Interroger sur la tristesse, I'abattement, exprimer sa sympathie, rassurer • RÉCEPTION ORALE: Comprendre une interview à la radio • RECEPTION ÉCRITE: Comprendre un test de magazine • PRODUCTION ÉCRITE: Écrire une letter a un(e) amie	• Les pronoms indfinis rien, quelque chose • Le verbe crier • Du pluriel: eau, eu, al • Se soigner, s'excuser, se renseigner, s'appeler • La phrase ngative: ne… plus, ne… jamais, ne… rien, ne… personne

Unit III C'est qui? C'est comment? 10 h

• Les classes socials	INTERACTION ORALE: Décrire quelqu'un RECEPTION ORALE: Comprendre un bulletin météo RECEPTION ÉCRITE: Comprendre une courte interview PRODUCTION ÉCRITE: Écrire des notices biographiques	• Les adjectifs qualificatifs: Formes au masculin et au féminin • ll fait beau, il neige, il pleut… • Le verbe décrier • Les verbs en –indre • Les adjectifs possessifs féminins mon, ton, son devant voyelle ou h

Unit IV Et après? Et après 10 h

• La mémoire et l'histoire	• INTERACTION ORALE: Raconter une anecdote, une histoire, attire l'attention • RÉCEPTION ORALE: Comprendre une interview à la radio • RÉCEPTION ÉCRITE: Comprendre des faits divers • PRODUCTION ÉCRITE: Écrire une bréve	• L'imparfait(2) • Les verbs en – oir • Les pronoms démonstratifs ça et cela • Prés de… Loin de… • La forme passive

Unit V Dialogue writing 08 h

a) Les Courses
b) A La Banque
c) Ecole
d) Professions
e) Bijoux

Text Books

1. *Marcella Di Giura Jean-Claude Beacco,* **Alors II. Pages 88 – 162,** Goyal Publishers Pvt Ltd 86, University Block ,Jawahar Nagar (Kamla Nagar), New Delhi – 110007.
2. *French Made Easy by Rashmi Varma, Goodwill Publishing House, New Delhi* – 110 008.

Course Code	Course Name	Category	L	T	P	Credit
191EL1A4EA	ENGLISH- IV	LANGUAGE	4	-	-	3

PREAMBLE

This course has been designed for students to learn and understand

- The basics of English grammar and specific usages
- The importance of the vocabulary and use in different contexts
- The necessity of communication and composition writing skills

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn English grammar and its specific usage	K2
CO2	Know the ways of improving English language vocabulary	K3
CO3	Understand the importance of English language in competitive exams	K3
CO4	Acquire the basic needs of communication skills and methods	K3
CO5	Comprehend the composition writing and similar skills	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	M	S
CO2	S	S	M	M	S
CO3	S	S	S	M	M
CO4	S	M	M	S	S
CO5	M	S	M	S	S

S Strong M Medium L Low

191EL1A4EA	ENGLISH- IV	SEMESTER IV

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Grammar 10 h

The use of correlatives - The perfect tense - appended questions - the infinitive - negative verbs - redundant conjunctions - use of make and do - fairly and rather

Unit II Vocabulary 10 h

Words and contextual uses - Synonyms - Antonyms - Add one out - inflectional - infix- telescoping - loanwords - British and American words - Thesaurus

Unit III Language Use 08 h

Spotting Errors - Words often confused - Reconstructing a Passage - Clause - Idioms and colloquialism - Language aptitude - Clipping

Unit IV Communication 11 h

Different Types of Asking - Oral rehearsal - Describing person, Diagram, Data, Table - Vote of thanks - Small talk - Refusal and Apology

Unit V Composition 09 h

General Essay writing - Mind map - Reviews - Title expansion - Creative writing - Content writing - Translation - Abstracting - Flash Fiction

Text Books

1. Wood F.T. 2010. A Remedial Grammar for Foreign Students. Macmillan Publishers, India. [Unit I and II]
2. Bhatnagar R.P. 2013. English for Competitive Examinations. 3rd Edition. Trinity Press, New Delhi. [Unit III, IV and V]

References

1. Radhakrishna Pillai G. 2000. English for Success. Emerald Publishers, Chennai.
2. Krishnaswamy N. 2000. Modern English a Book of Grammar Usage and Composition. Macmillan Publishers, India.
3. Arulselvi Evangelin. 2012. Teaching of Special English. Saratha Pathippagam, Chennai.
4. Rawdon Wyatt. 2008. Check Your Vocabulary for TOFEL. Macmillan Publishers, India.

Course Code	Course Name	Category	L	T	P	Credit
193BT1A4CA	IMMUNOLOGY	CORE	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- the cells of immune system
- the different techniques in immunology.
- the applications of immune techniques.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the concepts in immunology	K1
CO2	Learn basics of Immune Response and Transplantation Technology	K1, K2
CO3	Discuss and distinguish different antigen antibody interactions, Allergic reactions and Tumour immunology	K1,K2,K3
CO4	Learn about different antibody production techniques	K1,K2,K3
CO5	Awareness on types of vaccines and its significance	K1,K2,K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	S	S	S	S
CO3	M	S	S	S	S
CO4	M	M	S	S	S
CO5	M	S	S	S	S

S Strong M Medium L Low

193BT1A4CA	IMMUNOLOGY	SEMESTER IV

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Basic concepts of Immunology 10 h

History and scope of immunology - types of immunity - primary and secondary lymphoid organs - immunoglobulin structure - function and synthesis; memory cells, idiotypic network, lymphocyte differentiation.

Unit II Types of immune response 10 h

Complement systems - structure and function of MHC class I and II molecules - antigen recognition and presentation - Humoral and Cell mediated immune responses - immune suppression and immune tolerance - Transplantation immunology- Graft rejection.

Unit III Hypersensitivity and Tumor immunology 10 h

Antigen- antibody reaction, Hypersensitivity - IgE mediated, antibody mediated, immune complex mediated and delayed type hypersensitivity. Tumor immunology- tumor associated antigens, Immune response to tumor. Auto immune disorders.

Unit IV New Generation Antibodies 09 h

Hybridoma and monoclonal antibody production, immune diagnosis and applications - human monoclonal antibodies, catalytical antibodies - complement fixation - assessment of immune complexes in tissues.

Unit V Vaccinology 09 h

Vaccines- Immunization types- Vaccine types- live attenuated vaccines, killed vaccines and purified polysaccharide vaccines- toxoid vaccines - recombinant vaccines and DNA vaccines.

Text Books

1. Kuby J, 2003, "Immunology ", 5th edition, W.H. Freeman and Company, New York.
2. Rao CV, 2002, "Textbook of Immunology", 1st edition, Narosa Publishing House, India

References

1. Riot I, 1988, "Essentials of Immunology", 6th edition, Blackwell Scientific Publications, USA.
2. Tizard A, 1995, "Immunology ", 4th edition, Saunders college publishers, USA.
3. Ramesh, 2016, "Immunology", 1st edition, McGraw Hill Education, India Private Limited.
4. Ed Harlow, David Lane, 1988, "Antibodies Laboratory Manual", Cold Spring Harbor Laboratory Press, USA.

Course Code	Course Name	Category	L	T	P	Credit
193BT1A4CB	BIOINFORMATICS	CORE	3	-	-	3

PREAMBLE

This course has been designed for students to learn and understand

- biological databases and their applications.
- the applications of various tools.
- biology better in terms of computer algorithms.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Insight on storage and retrieval of data	K1
CO2	Understanding biological databases with applications	K1, K2
CO3	Discuss and distinguish the types of protein structures and its implications in function	K2,K3
CO4	Explain the sequences and its alignment which determines several roles of biomolecules	K2, K3
CO5	Comprehend the molecular modelling and visualization for drug designing	K1, K2, K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	M	S	S	S
CO4	S	M	S	S	S
CO5	S	S	S	S	M

S Strong M Medium L Low

193BT1A4CB	BIOINFORMATICS	SEMESTER IV

Total Credits: 3

Total Instruction Hours: 36 h

Syllabus

Unit I Introduction to Bioinformatics 8 h

Big Data – Biological data. Retreival of information. Evolution of Bioinformatics – history, scope and applications. Internet- World wide web - search engines, Entrez, PubMed. Commercial softwares used for biological information

Unit II Biological databases 7 h

Types.Nucleic acid databases (NCBI, EMBL, DDBJ), protein databases (PDB, Expasy, Swiss Prot, Prosite), specialized databases, model organism databases. Phylogenetic trees - evolutionary relationship using PHYLIP

Unit III Protein structures 7 h

Physical properties – structural and sequence database for proteins – CATH, SCOP, FSSP – fold classification based on structure. Primary, secondary, tertiary, super secondary structures of proteins. Structure and functional relationship of proteins

Unit IV Sequence Alignment and Genomics 7 h

Introduction to sequence alignments and dynamic programming: Local alignment, global alignment, pairwise and multiple alignment. FASTA – characteristics, BLAST and its types. Gene expression analysis – cDNA microarray. EST databases (DBEST, UNIGENE).

Unit V Docking 7 h

Docking – Principle, steps. Lead compound, protein target. Computer Aided Drug Designing– applications. High throughput screening- working and applications. Molecular modelling and visualization. QSAR. Human Genome project.

Text Books

1. Shanmughavel P, 2006, "Trends in Bioinformatics", Pointer Publishers, Jaipur, India.
2. Lesk AM, 2003, "Introduction to Bioinformatics", Oxford University Press, New Delhi.

References

1. Andrew R Leach, 2001, "Molecular Modeling: Principles and Application", Pearson Publishers, United Kingdom.
2. Hans X, 2008, "Basic principles and applications", Wiley publications, United States
3. Yvonne C Martin, 1998, "Designing bioactive molecules three-dimensional techniques and applications", American Chemical Society, United States
4. Leo, Albert, Hockma, Hansch, Corwin, 1995, "Exploring QSAR", 2nd edition, American Chemical Society, United States.

193BT1A4CP	CORE PRACTICAL IV: IMMUNOLOGY & BIOINFORMATICS	SEMESTER IV

Total Credits: 2
Total Instructions Hours: 48 h

S.No	List of Experiments
1	Blood grouping and Rhtyping *
2	Preparation of Serum
3	Precipitin ringtest
4	Single Radial Immunodiffusion
5	Double Radial Immunodiffusion
6	Immunoelectrophoresis
7	Rocket Immunoelectrophoresis
8	Retrieving data from Biological Databases.*
9	Retrieving articles with filter criteria (PubMed)
10	Pairwise alignment using BLAST.
11	Construction of phylogenetic trees.
12	Visualization of protein structures and interpretation.

Note: Any 10 out of 12 experiments will be carried out. DBT STAR College Scheme Experiments *

References

1. Ivan Lefkovits, 1996, "Immunology Methods Manual: The Comprehensive Sourcebook of Techniques", 1st edition, Academic Press Inch, United States.
2. Jack Bradshaw L, 1995, "Laboratory Immunology", 2nd Edition, Saunders College Publishing, United States.
3. Agostino, Michael J, 2013, "Practical Bioinformatics", 1st Edition, Garland Science Publishers, United States.
4. Iftekhar M and Ghalib M, 2015, "Bioinformatics Practical Manual: Sequencing Practical", Biocuration Labs, Bangalore.

Course Code	Course Name	Category	L	T	P	Credit
192PY1A4IA	BIOPHYSICS	IDC	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- To study the application of physics to biological systems
- To learn the concepts and techniques of biophysics
- To find the applications of biophysics in molecular studies and medicine

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn basic of Molecular Biophysics	K1
CO2	Understand the Membrane Biophysics, Physical Properties of membrane and Membrane potentials	K1, K2
CO3	Know the biophysical techniques applied in understating biomolecules	K1, K2
CO4	Learn about Neurobiophysics; Nervous System, Visionary System and Hearing System	K1, K2, K3
CO5	Know the Role of Radiation Physics in applied medical diagnosis & treatment	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	M
CO3	M	M	S	S	S
CO4	S	S	M	S	S
CO5	M	S	S	S	S

S Strong **M** Medium **L** Low

192PY1A4IA	BIOPHYSICS	SEMESTER IV

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Introduction to Biophysics 10 h

Introduction - Molecular Biophysics; Thermodynamics of Biological system: First and second laws of thermodynamics, activation energy. Bioenergetics: Basic concept of energy coupling reactions in biological processors, Energy requirements in cell metabolism, high energy bonds, energy currency of cell.

Unit II Membrane Biophysics 10 h

Physical Properties of membrane: Elastic properties, Elastic constants, Charge-induced microstructures and domain. Membrane melting. Membrane potentials: Cell surface charge, Resting membrane potential, Action potential, Membrane impedance and capacitance, Transmembrane potential, total electrochemical potential.

Unit III Biophysical Techniques and Methods 9 h

Introduction to Light: Reflection, Refraction, Diffraction, Interference phenomena, Refractometry: Refraction of light and Snell's law, refractive index, principle, design, working and application of Abbe's refractometer. Polarimetry, Viscomentry, Static Scattering Techniques, Dynamic Scattering Techniques, X-Ray Diffraction and Molecular Structure, Optical Tweezers, Patch Clamping, Molecular Dynamics, Potential Energy Contour Tracing.

Unit IV Neurobiophysics 9 h

Introduction: The Nervous System; Synapse, Physics of Membrane Potentials, Membrane potential due to diffusion, Voltage Clamp, Sensory Mechanisms -The Eye; The visual receptor, Electrical activity and visual generator potentials, Neural aspects of vision, Visual communications, Physical Aspects of Hearing - The Ear; Elementary acoustics, Theories of hearing.

Unit V Radiation & Medical Biophysics 10 h

Basics of Radiation Physics: Isotopes, Isobars, Isotones, Isomers, Radioactivity, General properties of alpha, beta and gamma radiations, Radiation units. Radiolysis of water, Production of free radicals & their interactions, Radiation chemical yield and G value, Target theory, Single hit & Multi hit theory, Effect of

radiation on Nucleic acids, Proteins, Enzymes. Radioisotopes in biology, Medicine (Therapy & diagnosis), Agriculture, Biological applications of radioisotope, Radio-labeling & Tracer techniques, Radiation sterilization of medical product.

Text Books

1. VasanthaPattabhi , Gautham N, 2002, "Biophysics", 1st Edition, Kluwer Academic Publishers , United States
2. Rodney MJ, Cotterill, 2002, "Biophysics: An Introduction", 2nd edition, John Wiley & Sons Ltd, United States

References

1. Tom AWaigh, 2007, "Applied Biophysics- A Molecular Approach for Physical Scientists" , 1st edition, John Wiley & Sons Ltd, United States
2. Jay L Nadeau, 2018, "Introduction to Experimental Biophysics Biological Methods for Physical Scientists", 2nd Edition, CRC Press, United States.
3. Glaser, Roland, 1999, "Biophysics", 1st edition, Springer-Verlag Berlin, Heidelberg.
4. Parke, William C, 2020, "Biophysics: A Student's Guide to the Physics of the Life Sciences and Medicine", 1st edition, Springer International Publishing, United States

Course Code	Course Name	Category	L	T	P	Credit
193BT1A4SA	BIOTECHNIQUES	SEC	3	-	-	3

PREAMBLE

This course has been designed for students to learn and understand

- the function and application of several common measurement systems used in Biotechnology.
- the technical vocabulary associated with instrumentation.
- To design and basic signal analysis.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the Principle and the types of Centrifugation	K2, K3
CO2	Classifying the chromatographic techniques and analyzing its applications	K2,K3
CO3	Imparts knowledge on the Electrophoresis and Blotting Techniques	K3, K4, K5
CO4	Focus on Spectroscopic Techniques and it's applications	K4, K5
CO5	In depth understanding of Radio-isotopic Techniques and its applications	K4, K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S Strong M Medium L Low

193BT1A4SA	BIOTECHNIQUES	SEMESTER IV

Total Credits: 3

Total Instruction Hours: 36 h

Syllabus

Unit I Centrifugation 7 h

Sedimentation Principle, Types of rotors, Preparative and Analytical Centrifuges, Density Gradient Centrifugation, Differential centrifugation.

Unit II Chromatography Techniques 7 h

Theory and Application of Paper Chromatography, TLC, Gel Filtration Chromatography, Ion Exchange Chromatography, Affinity Chromatography, GLC and HPLC.

Unit III Electrophoresis Techniques 7 h

Theory and Application of PAGE, Agarose Gel Electrophoresis, 2D gel electrophoresis, Iso-electric Focusing, Immuno diffusion, Immuno Electrophoresis, ELISA, RIA, Southern, Northern and Western Blotting.

Unit IV Spectroscopic Techniques 7 h

Theory and Application of UV and Visible Spectroscopy, Fluorescence Spectroscopy, MS, NMR, ESR, Atomic Absorption Spectroscopy.

Unit V Radio-isotopic Techniques 8 h

Introduction to Radioisotopes and their Biological Applications, Radioactive Decay – Types and Measurement, Principles and Applications of GM Counter, Solid and Liquid Scintillation Counter, Autoradiography.

Text Books

1. Sawhney SK & Randhir S, 2006, "Introductory Practical Biochemistry", 3rd edition, Narosa publishing House, India.
2. Boyer, Rodney F Benjamin and Cummins, 2001, "Modern Experimental Biochemistry", 2nd edition, Pearson Education, UK.

References

1. Freifelder D, 1982, "Physical Biochemistry: Application to Biochemistry and Molecular Biology", 2nd edition, W. H. Freeman Publishers, USA
2. Walker J & Wilson K, 2000, "Principle & Technique – Practical Biochemistry", 5th edition, Cambridge university press, UK.
3. Rakesh S. Sengar , Amit Kumar , Reshu Chaudhary , Ashu Singh, 2018, "Advances in Molecular Techniques", 1st edition, CRC Press, USA.
4. Walt Ream, Katharine GF, 1998, "Molecular Biology Techniques: An Intensive Laboratory", Academic Press, USA.

193BT 1A4GA	GENERIC ELECTIVE –II: APICULTURE	SEMESTER IV

Total Credits: 2

Total Instruction Hours: 24 h

Syllabus

Unit I History 5 h

History of Bee keeping – Present status of Apiculture in India – species of honey bees.

Unit II Lifecycle and Cultivation 5 h

Bee colony, Castes. Natural colonies and their yield. Types of beehives – structure – location, care and management.

Unit III Apiculture Industry 5 h

Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc.

Unit IV Social status of Apiculture 5 h

Bee foraging: Pollen and nectar yielding plants. Honey Extraction, seasonal maintenance. Economics of Apiculture and Management.

Unit V National and International Status 4 h

Honey yield in national and international market. Prospects of apiculture as self-employment venture.

Text Books

1 Ghosh G K, 1998, "Beekeeping in India" , Ashish Publishers, India.

2 Abrol D P, 2010, "A Compressive Guide to Bees and Beekeeping", Scientific Publishers, India.

References

1 Singh D & Singh DP, 2006, "A Handbook of Beekeeping", Agrobios, India.

2 NPCS Board of Consultants & Engineers, 2015, "The Complete Book on Beekeeping and Honey Processing", 2nd edition, NIIR Project Consultancy Services, India.

3 Davis I & Cullum-kenyan R, 2019, "Guide to Beekeeping", 2nd edition, Bloomsbury Publication, Australia.

4 Rahman A, 2018, "Text Book on Beekeeping", 1st edition, Kalyani Publications, India.

191TL1A4AA	பகுதி – 4 : அடிப்படைத்தமிழ் - தாள் : II (Basic Tamil)	SEMESTER IV

Total Credits: 2

Total Instruction Hours: 24 h

இளங்கலை 2019–20ஆம் கல்வியாண்டு முதல் சேர்வோர்க்குரியது

(10 மற்றும் 12 – ஆம் வகுப்பு வரை தமிழ் மொழிப்பாடம் பயிலாதவர்களுக்கு)

(பருவத் தேர்வு உண்டு)

அலகு : 1 12 h

நீதி நூல்கள்

I.ஆத்திசூடி - "அறம் செய விரும்பு" முதல் "ஔவியம் பேசேல்"வரை -12 பாடல்கள்

II.கொன்றைவேந்தன் - "அன்னையும் பிதாவும் முன்னறி தெய்வம்" முதல்

"எண்ணும் எழுத்தும் கண் எனத் தகும்" வரை -7 பாடல்கள்

III.திருக்குறள் - 6 பாடல்கள்

1. அகர முதல 1
2. மனத்துக் கண்.....34
3. இனிய உளவாக 100
4. தீயவை தீய பயத்தலான்.....202
5. கற்க கசடற 391
6. கண்ணொடு கண்ணினை.....1100

அலகு : 2 12 h

I. எளிய நீதிக்கதைகளும் வாழ்க்கை முறைகளும்

1. நீதிகாத்த மன்னன்
2. சிங்கமும் முயலும்
3. புத்திசாலி உழவனும் போக்கிரிப் பூதமும்
4. தேனீயும் புறாவும்
5. முயல் கூறிய தீர்ப்பு

II. தமிழகப் பண்பாடுகள்

1. தமிழர் விழாக்கள் - பொங்கல், ஆடிப்பெருக்கு
2. தமிழர் கலைகள் - தெருக்கூத்து, ஓவியம், சிற்பம்
3. தமிழர் விளையாட்டுகள்- ஏறுதழுவுதல், சடுகுடு

III . பயிற்சிப் பகுதி

1. படத்திற்கு ஏற்ற சொற்களை எழுதுதல்.
2. சொற்களைத் தொடராக்குதல்.
3. பொருத்துதல்,
4. உரையாடல் பகுதி

Note: பயிற்சிப் பகுதியில் வினாக்கள் அமைத்தல் கூடாது

வினாத்தாள் அமைப்பு முறை - மொத்த மதிப்பெண்கள் - 100

பகுதி – அ

சரியான விடையைத் தேர்வு செய்தல் 10x2=20

பகுதி – ஆ

சரியா? தவறா? தேர்ந்தெடுத்து எழுதுக . 10x2=20

பகுதி - இ

ஒரு பக்க அளவில் விடையளிக்க 03x20=60

குறிப்பு:

- அனைத்து அலகுகளில் இருந்தும் வினாக்கள் அமைதல் வேண்டும்
- பகுதி இ –க்கான வினாக்கள் இது அல்லது அது என்ற அடிப்படையில் அந்தந்த அலகுகளில் அமைதல் வேண்டும்

Text Books

1 அடிப்படைத்தமிழ் - 20-21. தொகுப்பு : தமிழ்த்துறை , டாக்டர் என்.ஜி.பி. கலை அறிவியல் கல்லூரி, நியூ செஞ்சுரி புக் ஹவுஸ்(பி)லிட். சென்னை-600 098

References

1 ஒன்றாம் வகுப்பு பாடநூல் - தமிழ்நாடு அரசு பாடநூல் கழகம்

2 வலைதள முகவரி : http://tamilvu.org

191TL1A4AB	பகுதி – 4 : சிறப்புத்தமிழ் - தாள் : II (Advanced Tamil)	SEMESTER - IV

Total Credits: 2

Total Instruction Hours: 24 h

இளங்கலை 2019– 2020 ஆம் கல்வியாண்டு முதல் சேர்வோர்க்குரியது

(10 மற்றும் 12 – ஆம் வகுப்புகளில் தமிழ் மொழிப்பாடம் பயின்றவர்களுக்கு உரியது

(பருவத் தேர்வு உண்டு)

அலகு – 1 05 h

திருக்குறள்

I அறத்துப்பால்

1. இனியவை கூறல் - அதிகார எண் : 10
2. அடக்கமுடைமை - அதிகார எண் : 13

II பொருட்பால்

1. கல்வி - அதிகார எண் : 40
2. உழவு - அதிகார எண் : 104

III இன்பத்துப்பால்

1. தகையணங்குறுத்தல் - அதிகார எண் :109
2. பிரிவாற்றாமை - அதிகார எண் : 116

அலகு – 2 05 h

கட்டுரைத் தொகுப்பு

I நல்வாழ்வு - டாக்டர் மு.வரதராசன்

1. நம்பிக்கை
2. புலனடக்கம்
3. பண்பாடு

II இளைஞர்களின் ஒளிமயமான எதிர்காலத்திற்கு - கு.வெ. பாலசுப்பிரமணியம்

1. காலக்கணக்கு
2. நற்பழக்கமே செல்வம்

அலகு – 3 05 h

I காப்பியங்கள் - குறிப்பு எழுதுதல்

1. சிலப்பதிகாரம்
2. மணிமேகலை
3. கம்பராமாயணம்
4. பெரியபுராணம்

II ஊடகம் - காட்சி ஊடகங்கள்

1. தொலைக்காட்சி
2. திரைப்படம்
3. இணையம்
4. முகநூல்
5. கீச்சகம்
6. கட்செவி அஞ்சல்

அலகு – 4 05 h

இலக்கணம் - வழக்கறிதல்

1. இயல்பு வழக்கு
2. தகுதி வழக்கு

அலகு – 5 04 h

I படைப்பாற்றல் பகுதி

கவிதை,கட்டுரை எழுதச்செய்தல் - பொதுத் தலைப்பு

II பயிற்சிப் பகுதி

தமிழில் தட்டச்சு செய்தல் - யூனிகோடு எழுத்துருவில்.

Note: பயிற்சிப் பகுதியில் வினாக்கள் அமைத்தல் கூடாது

வினாத்தாள் அமைப்பு முறை - மொத்த மதிப்பெண்கள் - 100

பகுதி –அ

சரியான விடையைத் தேர்வு செய்தல் 10x2=20

பகுதி –ஆ

கோடிட்ட இடங்களை நிரப்புக 10x2=20

பகுதி –இ

இரண்டு பக்க அளவில் விடையளிக்க 4x15=60

குறிப்பு :

- அனைத்து அலகுகளில் இருந்தும் இரண்டு வினாக்கள் அமைதல் வேண்டும்
- பகுதி இ –க்கான வினாக்கள் இது அல்லது அது என்ற வகையில் அந்தந்த அலகுகளிலிருந்து அமைதல் வேண்டும்.

Text Books

1 சிறப்புத்தமிழ் 20-21. தொகுப்பு : தமிழ்த் துறை , டாக்டர் என்.ஜி.பி. கலை அறிவியல் கல்லூரி, நியூ செஞ்சுரி புக் ஹவுஸ்(பி) லிட். சென்னை- 600 098

References

1 பேராசிரியர் புலவர் சோம . இளவரசு, எட்டாம் பதிப்பு - 2014, தமிழ் இலக்கிய வரலாறு – மணிவாசகர் பதிப்பகம், சென்னை – 600 108.

2 பேராசிரியர் முனைவர் பாக்கியமேரி , முதற் பதிப்பு- 2013, இலக்கணம் - இலக்கிய வரலாறு - மொழித்திறன் -பூவேந்தன் பதிப்பகம், சென்னை-600 004.

3 வலைதள முகவரி : http://tamilvu.org

192PY1A4AA	AECC : GENERAL AWARENESS	SEMESTER IV

Total Credits: 2
Total Instructions Hours: 24 h

S.No	Contents
1	Current Events
2	General Science
3	Geography of India
4	Tamil and Other Literature
5	Inventions and Discoveries
6	Numerical and Mental Aptitude
7	Verbal and Non Verbal Reasoning
8	Socio- Culture and Heritage of India
9	Indian Economy and Political System
10	History of India and Freedom Struggle

References

1. Majid Hussain, Arrora N D, 2019, "General Studies -TNPSC Group -I ", G.K.Publications (P) Ltd. New Delhi
2. Aggarwal R S, 2014, "Verbal and Non Verbal Reasoning" S Chand & Company, New Delhi
3. Competition Success Review, Competitive Success Publisher, New Delhi
4. Pratiyogita Darpan, Pratiyogita Darpan Publishers, Agra.

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Fifth Semester										
Part - III										
193BT1A5CA	Core - IX	Recombinant DNA Technology	4	1	-	3	25	75	100	4
193BT1A5CB	Core – X	Plant and Animal Biotechnology	4	1	-	3	25	75	100	4
193BT1A5CC	Core – XI	Bioprocess Technology	4	1	-	3	25	75	100	3
193BT1A5CP	Core Practical	rDNA, Bioprocess, Plant & Animal Biotechnology	-	-	5	6	40	60	100	2
193BT1A5SA	SEC - III	Entrepreneurial Biotechnology	3	1	-	3	25	75	100	3
193BT1A5DA	DSE - I	Clinical Trials	3	1	-	3	25	75	100	4
193BT1A5DB		Biomaterials								
193BT1A5DC		Food Biotechnology								
193BT1A5LA	LoP	Lab on Project	-	-	-	-	50	-	50	1
193BT1A5TA	IT	Industrial Training	**Grade A to C**							
Part - IV										
192MT1A5AA	AECC - V	Research Methodology	2	-	-	2	-	50	50	2
		Total	**20**	**5**	**5**				**700**	**23**

Course Code	Course Name	Category	L	T	P	Credit
193BT1A5CA	RECOMBINANT DNA TECHNOLOGY	CORE	4	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The fundamentals of recombinant DNA technology
- The different types of vectors used in recombinant DNA technology
- The application of recombinant DNA technology

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the steps in recombinant DNA preparation, introduction and selection	K1,K2
CO2	Explain the features of various types of bacterial cloning vectors	K1, K2
CO3	Explain the features of various types of cloning vectors for yeast, animal and plants	K1,K2
CO4	Describe and apply various molecular techniques	K2, K3
CO5	Demonstrate the different applications of recombinant based products	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	S
CO2	M	S	M	M	M
CO3	S	S	M	M	M
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S Strong **M** Medium **L** Low

193BT1A5CA	RECOMBINANT DNA TECHNOLOGY	SEMESTER V

Total Credits: 4

Total Instruction Hours: 60 h

Syllabus

Unit I Fundamentals of recombinant DNA technology 12 h

History and scope of rDNA technology, Strategies of cloning, Cutting and Joining of DNA- Linkers and Adapters, other enzymes involved in cloning, Features of host cell. Selectable and Screenable markers used in recombinant DNA technology.

Unit II Cloning vectors for Bacteria 12 h

Plasmids - properties of plasmid, types of plasmids, plasmid compatibility and incompatibility, copy number and its control. Features of Bacterial Vectors, E. coli vectors- pBR322 and pUC vectors, Bacterial Artificial Chromosome (BAC). Cloning in Bacillus.

Unit III Viral vectors and other special vectors 12 h

Viral Vectors Lambda Phage vectors, cosmid, phagemid, M13. Yeast vectors– YIP, YEP, YRP and YAC. Animal vectors- SV40 Vectors, Retero viral and Baculo viral vectors. Plant Vectors- Ti plasmid as a gene vector, expression vectors and shuttle vectors.

Unit IV Molecular techniques and their applications 12 h

Construction of cDNA and genomic DNA libraries. PCR and its types. DNA Sequencing, Probes - probe construction and labeling. Introduction of cloned genes into cell– transformation, particle bombardment, liposome mediation, and electroporation. Blotting techniques Southern, Western and blotting. Micro array.

Unit V Applications of Recombinant DNA based products 12 h

Recombinant DNA based products – Humulin, Somatotropin, Erythropoietin, Tissue Plasminogen activator, Factor-VIII and Interferon. Ethical issues in GM products, Institutional Animal Ethics Committee, Recombinant DNA Advisory Committee and Institutional Bio safety Committee.

Text Books

1. Brown, T. A, 1998, "Introduction to Gene Cloning", 3rd Edition, Stanley Thornes Publishing Ltd.
2. Primrose, S. B, 2003, "Principles of Gene Manipulation", 6th Edition, Blackwell Science Ltd.

References

1. Ernst. L. Winnacker, 2003, "From Genes to Clones", 2nd Edition, Panima Publishing Corporation.
2. James. D. Watson, 2001, "Recombinant DNA technology", 2nd Edition, WH Freeman and company.
3. Brown, T.A, 2016, "Gene Cloning and DNA Analysis", 7th Edition, Wiley Blackwell.
4. Primrose, S.B. and Twyman, R. 2013, "Principles of Gene Manipulation and Genomics", 7th Edition, Wiley Blackwell.

Course Code	Course Name	Category	L	T	P	Credit
193BT1A5CB	PLANT AND ANIMAL BIOTECHNOLOGY	CORE	4	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The fundamentals of Plant tissue culture and its application in laboratory settings
- Plant genetic engineering techniques and its applications
- Production of animal cells in culture and its maintenance

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Impart knowledge on basics of plant tissue culture and its requirements	K1
CO2	Acquire knowledge about the gene transfer techniques and applications	K2
CO3	Understand the genetic engineering and gene modification in agriculture	K3
CO4	Gain insight on animal cell culture methods	K2, K3
CO5	Highlight the maintenance of animal cells in culture	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	S	S	S	S	S
CO3	S	S	S	M	S
CO4	S	M	S	M	S
CO5	S	S	S	S	S

S Strong **M** Medium **L** Low

193BT1A5CB	PLANT AND ANIMAL BIOTECHNOLOGY	SEMESTER V

Total Credits: 4

Total Instruction Hours: 60 h

Syllabus

Unit I Plant tissue culture 12 h

Tissues culture media - Composition and its preparation. Plant Tissue Culture applications- Micropropagation, Callus culture, somatic embryogenesis, suspension culture, embryo culture, haploid culture, protoplast culture and fusion, Somoclonal variation, artificial seeds, hardening.

Unit II Gene transfer 12 h

Plant transformation technology- Ti and Ri plasmids, binary & co-integrated vector systems; viral vectors and their applications; 35S and other promoters; genetic markers-reporter genes- Cloning Strategies- Gene transfer methods in plants- Direct DNA transfer methods, Agrobacterium mediated nuclear transformation.

Unit III Plant Genetic Engineering 12 h

Applications of Plant Genetic Engineering – crop improvement, herbicide resistance, insect resistance, virus resistance, plants as bioreactors. Genetic modification in Agriculture - transgenic plants, genetically modified foods, ecological impact of transgenic plants.

Unit IV Animal cell culture 12 h

Culture media; Balanced salt solutions and simple growth medium, Physical, chemical and metabolic functions of different constituents of culture medium; Role of carbon dioxide, serum, growth factors, glutamine in cell culture; Serum and protein free defined media and their applications. Risks in a tissue culture laboratory and safety - biohazards. Facilities for animal cell culture- infrastructure, equipment, culture vessels.

Unit V Animal Cell, Tissue and Organ culture 12 h

Primary cell culture techniques - mechanical disaggregation, enzymatic disaggregation, separation of viable and non-viable cells. Mass culture of cells - manipulation of cell line selection - types of cell lines -maintenance of cell lines - immobilization of cells and its application - synchronization of cell cultures. Cryopreservation - germplasm conservation. Medical/pharmaceutical products of animal cell culture.

Text Books

1 Singh, B. D, 2006, "Plant Biotechnology", 1st Edition, Kalyani Publishers.

2 Ranga, M. M, 2000, "Animal Biotechnology", 1st Edition, Agrobios.

References

1 Razdan, M. K, 2002, "Introduction to Plant tissue culture", 2nd Edition, Oxford & IBH publishing company.

2 Chawla, H. S, 2013, "Introduction to Plant Biotechnology", 3rd Edition, Oxford & IBH publishing company

3 Jennie P. Mathur and David Barnes, 1998, "Animal Cell Culture Methods", Volume 57, Academic Press.

4 Ian Freshney, R, 2015, "Culture of Animal Cells", 7th Edition, Wiley Blackwell.

Course Code	Course Name	Category	L	T	P	Credit
193BT1A5CC	BIOPROCESS TECHNOLOGY	CORE	4	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- The basics of bioprocess technology and its industrial applications.
- The industrial based bioprocess production.
- The upstream, downstream processes of microbial products.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the concepts of industrial important strain isolation, preservation and strain improvement.	K2
CO2	Acquire knowledge on industrial level media preparation and sterilization process.	K3
CO3	Learn about industrial bioreactors types and monitoring control.	K3
CO4	Gather knowledge on the recovery and purification of fermentation products using various analytical methods	K3, K4
CO5	Articulate the knowledge of microbial products in commercial based applications.	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	M	S	S
CO4	S	S	S	M	M
CO5	M	S	M	M	S

S Strong **M** Medium **L** Low

193BT1A5CC	BIOPROCESS TECHNOLOGY	SEMESTER V

Total Credits: 3

Total Instruction Hours: 60 h

Syllabus

Unit I Introduction to Bioprocess Technology 12 h

Introduction to Bioprocess Technology: components and types of fermentation process, industrially important microorganisms: isolation, screening, preservation and maintenance. Strain improvement: mutation, protoplast fusion, rDNA technology, genomics, transcriptomics, fluxomics and engineered microbes.

Unit II Industrial Media Preparation and Sterilization 12 h

Medium requirements for bioprocess technology, carbon, nitrogen, mineral sources, buffers, antifoam agents and medium optimization. Sterilization of media and fementers, scale – up process and starter culture technology. Rheological properties of media.

Unit III Types of Bioreactor 12 h

Introduction: Bioreactor and Fermenter, Basic design of a microbial reactor, Classification of Bioreactor and Industrial applications: Stirred Tank Reactor, Airlift Reactor, Bubble Column Reactor, Packed Bed Reactors, Fluidized Bed Reactor, Photobioreactor and Membrane Bioreactor. Monitoring and control of bioreactor process.

Unit IV Downstream Processing 12 h

Recovery and Purification of fermentation products: Removal of microbial cells and other solid materials, foam separation, Precipitation, Filtration and Centrifugation. Cell Disruption- Physical, Chemical methods, extractors, chromatography, membrane process, drying, crystallization and whole broth processing.

Unit V Applications of Bioprocess Technology 12 h

Bioprocess Economics: National and International Market potential of microbial products and future trends. Exploration of commercially important microbial products and applications: Therapeutic drugs (Monoclonal antibodies and insulin), Biofuel Production (Bioethanol and Methane), Antibiotics (Penicillin and Streptomycin), Amino acids (Glutamic acid and Aspartic acid) and Organic acids (Lactic acid and citric acid), Probiotics and Single Cell Proteins (SCP).

Text Books

1. Kalaichelvan, P.T. Arulpandi, I, 2007, "Bioprocess Technology", 1st Edition, MPJ Publishers.
2. Peter F Stanbury, Allan Whitaker, Stephen J Hall, 2017, "Principles of Fermentation Technology", 3rd Edition, Butterworth-Heinemann (Elsevier).

References

1. Arindam Kuila and Vinay Sharma, 2018, "Principles and Applications of Fermentation Technology", 1st Edition, Scrivener Publishing.
2. Hrudayanath Thatoi , Pradeep K. Das Mohapatra, Sonali Mohapatra, Keshab C. Mondal, 2020, "Microbial Fermentation and Enzyme Technology", 1st Edition, CRC Press.
3. Michael L. Shuler and Fikret Kargi, 2015, "Bioprocess Engineering: Basic Concepts", 2nd Edition, Pearson Education India.
4. Pauline M. Doran, 2012, "Bioprocess Engineering Principles", 2nd Edition, Elsevier

193BT1A5CP	rDNA, Bioprocess, Plant & Animal Biotechnology	SEMESTER V

Total Credits: 2
Total Instructions Hours: 60 h

S.No	Contents
1	Isolation of Genomic DNA from bacteria
2	Isolation of Plasmid DNA from bacteria
3	Isolation of Genomic DNA from Plant Tissue
4	Isolation of Genomic DNA from Animal Tissue
5	Southern blotting & Western Blotting
6	PCR*
7	Restriction Digestion and Ligation*
8	Screening of Antibiotic producing & Amylase producing microorganism
9	In vitro germination of seeds
10	Micro propagation & Callus induction
11	Artificial seed production
12	Isolation of Chick Embryo fibroblast
13	Isolation of liver and spleen cells (Chicken)
14	Animal Cell count
15	Cell viability test

Note: *DBT STAR college experiments

References

1. Satish Kumar Sinha. 2012. Plant tissue culture: Theory and Practice.1st edition. Oxford University Press
2. Choudhary, S. S, Choudhary, P. and Choudhary, S.K. 2005. Laboratory guide in biosciences. 2nd edition. Kalyani publishers.
3. Razdan, M. K. 2002. Introduction to Plant tissue culture. 2nd edition. Oxford &IBH publishing company.
4. R. Ian Freshney. 2010. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, Sixth Edition. John Wiley & Sons, Inc

Course Code	Course Name	Category	L	T	P	Credit
193BT1A5SA	ENTREPRENEURIAL BIOTECHNOLOGY	SEC	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- Entrepreneurial opportunities in Biotechnology
- Good laboratory procedure and practices and standard operating
- IPR and safety issue of the biological products

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the concept of Entrepreneurship strategy	K1,K2
CO2	Know the business opportunities in plant tissue culture companies	K1,K2
CO3	Understand the farming technique and certification procedures	K1,K2
CO4	Learn about business scope in commercial important products like Biofertilizer, Biopesticide, Vermicompost etc	K1,K2
CO5	Apply the Biopharmaceutical products, IPR and product safety management in industry	K2,K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	S	S
CO2	S	S	M	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S **Strong** **M** **Medium** **L** **Low**

193BT1A5SA	ENTREPRENEURIAL BIOTECHNOLOGY	SEMESTER V

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Introduction 10 h

Concept of Entrepreneurship, Definition, characteristics of entrepreneurship, Types of entrepreneurship. Startup process. Business identification, Project plan, Source of fund, production and marketing. Importance of ROC, Risk involved in entrepreneurship.

Unit II Opportunities in PTC 9 h

Business opportunities in Plant Tissue Culture – Banana, Bamboo, Sugarcane and Orchids like Carnation and Gerbera. Important PTC companies in India.

Unit III Procedures and Certification in Organic farming 9 h

Organic farming- Methods, Standards, Market potential and products impact. Tamilnadu Organic Certification Department (TNOCD) – process of organic certification, TNOCD certified products.

Unit IV Commercialization 10 h

Business scope for Biofertilizer, Biopesticide, Vermicompost, Mushroom, Single Cell Protein, Apiculture, Dairy products (Example with one commercially important product for all the above)

Unit V Biopharmaceutical products, IPR and product safety 10 h

Insulin, Vaccines, Therapeutic products, Monoclonal antibodies, Hormones, Interferon (Example with one commercially important product for all the above). Importance of IPR, Patents, Trade Marks, Trade secret, Copyright, Product safety and liability, Insurance and contracts.

Text Books

1. Kumari Manimuthu Veeral, D, 2015, "Textbook of organic farming", Agrotech Publishing Academy.
2. Kanka, S. S., 1997, "Entrepreneurship Development", S. Chand and Co.

References

1. Kolehinsky P, 2004, "The Entrepreneur's guide to Biotechnology startup", 4th Edition, www.elelexa.com
2. Casson M, Yeung B, Basu A and Wadespm N, 2006, "The Oxford Handbook of Entrepreneurship", Oxford University Press.
3. Shimasaki C, 2014, "Biotechnology Entrepreneurship", 1st Edition, Academia Press.
4. Eric Ries, 2011, "The Lean Startup", 1st Edition, Kindle Publication.

Course Code	Course Name	Category	L	T	P	Credit
193BT1A5DA	CLINICAL TRIALS	DSE	3	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The regulations on clinical trials.
- The different guidelines applicable.
- The difference between different phases of clinical trials.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the phases of pre-clinical trials	K2
CO2	Gain knowledge on clinical guidelines and regulations of DCGI	K3
CO3	Comprehend the ethics of clinical trials	K3
CO4	Gather information on various guidelines of international organization.	K3, K4
CO5	Learn about filling the consent forms and data information sheets.	K3, K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	M	S	S
CO4	S	S	S	M	S
CO5	S	S	S	M	S

S Strong M Medium L Low

193BT1A5DA	CLINICAL TRIALS	SEMESTER V

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Pharmaceutical Industry 10 h

Introduction to Pharmaceutical Industry, Preclinical studies - Preclinical technology.Phase I, Phase II A and B, Phase III A and B, Phase IV and Types of Post marketing surveillances.

Unit II DCGI and FDA Regulations 10 h

DCGI – roles and responsibilities - Clinical research regulation of DCGI.FDA Regulations for Clinical Trials, FDA Guidelines and Information Sheets, FDA Compliance Program Guidance Manuals, FDA Bioresearch Monitoring Program (BIMO).

Unit III Ethical Guidelines 10 h

Ethical Guidelines for Biomedical Research in Human Subjects, Central Ethics committee on Human Research (CECHR), Ethics in Clinical Research for Communicable and Non Communicable Diseases. Ethics concerned with virology and serology studies.

Unit IV Guidelines of Various Organizations 10 h

History of GCP, ICH Guidelines for Good Clinical Practice, Central Drugs Standardization and Control Organization, Government of India, Schedule Y.

Unit V Consent and Ethics 8 h

CRF design, Informed Consent Documents - Subject Information Sheet and Informed Consent Form, Ethics Committee Approvals.

Text Books

1. Katzung, B.G, 1995, "Basic and Clinical Pharmacology", 12th Edition, Prentice Hall of Intl.
2. Murugesh, N, 2014,"A Concise text book of Pharmacology", 7th Edition, Sathya Publications.

References

1. Hackshaw, A, 2009, "A Concise Guide to Clinical Trials", 1st Edition, Wiley Publishers.
2. Chin, R, and Bruce Y.L, 2008, "Principles and Practice of Clinical Trial Medicine", 1st Edition, Academic Press.
3. Weinberg, S, 2009, "Guide Book for Drug Regulatory Submissions", 1st Edition, John Wiley & sons.
4. Haynes, R.B., Sackett, D.L., Guyatt, G.H., and Tugwell, P, 2005, "Clinical Epidemiology: How to Do Clinical Practice Research", 3rd Edition, Lippincott- Williams and Wilkins.

Course Code	Course Name	Category	L	T	P	Credit
193BT1A5DB	BIOMATERIALS	DSE	3	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The basic concepts of Biomaterials
- The naturally occurring Biomaterials
- About the different types of biomaterials and its application medical field

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define Biomaterials and its applications	K2
CO2	Biomaterials extracted from Protein.	K3
CO3	Biomaterials extracted from Carbohydrates.	K3
CO4	Biopolymers, synthesis and its uses	K3, K4
CO5	Biocompatibility materials used in medical field	K3, K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	M	S	S
CO4	S	S	M	M	M
CO5	S	S	M	M	S

S Strong **M** Medium **L** Low

193BT1A5DB	BIOMATERIALS	SEMESTER V

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Fundamentals of Biomaterials 10 h

Biomaterials- properties of biomaterials, Surface Properties and Surface Characterization of Biomaterials, Role of Water in Biomaterials. Applications of biomaterials in medical field.

Unit II Protein as Biomaterials 10 h

Collage and Gelatin-Alginate: Structure, Preparation and application. Fibroin (protein in silk): Production and its use.

Unit III Carbohydrates as Biomaterials 10 h

Carbohydrates: Modified carbohydrates; Actin gas lubricants for biomedical applications; Bacterial Polydextrose; Carbohydrates modified from enzymes, Cellulose and Chitin-Chitosan: structure, preparation and application

Unit IV Biopolymers 10 h

Biopolymers: Synthesis from a simple biological monomer - hyaluronate polymer; Dextrans, Rubber produced by bacteria and fungi, PHB, PCL; Production of a copolymer of PHB and PHV.

Unit V Biocompatibility materials 8 h

Metallic Implant materials, Ceramic implant materials, Polymeric implant materials, Skin and Maxillofacial implant and blood interfacing implants.

Text Books

1. Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, M.D, Jack E. Lemons, 2013, "Biomaterials Science An Introduction to Materials in Medicine", 3rd Edition, Elsevier Inc.

2. Ratledge, C. and Kristiansen, B., 2001, "Basic Biotechnology", 2nd Edition, Cambridge University Press.

References

1. Yoshiharu D, 1990, "Microbial polyesters", 1st Edition, VCH Weinheim Publishers.

2. Joon Park and Lakes R. S, 2007, "Biomaterials: An Introduction", 3rd Edition, Springer Verlag Publishers.

3. David Byrom, 1991, "Novel materials from biological source", 1st Edition, Macmillan Publishers Limited.

4. Masoud Mozafari, 2020, "Handbook of Biomaterials and Biocompatibility", 1st Edition, Woodhead Publishing.

Course Code	Course Name	Category	L	T	P	Credit
193BT1A5DC	FOOD BIOTECHNOLOGY	DSE	3	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The role of microbes in food industry.
- The food preservation techniques in food industry.
- The food safety and quality control system.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the basics of food technology	K2
CO2	Gain information on role of microbes in foods	K3
CO3	Comprehend the food preservation techniques	K3
CO4	Correlate the food packaging techniques in food industries	K3, K4
CO5	Articulate food safety techniques in food industries	K3, K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	M	S	S
CO5	S	S	M	M	S

S Strong M Medium L Low

193BT1A5DC	FOOD BIOTECHNOLOGY	SEMESTER V

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Introduction to food technology 10 h

Role of biotechnology in food production - transgenic plant foods: carbohydrates, proteins, vitamins nutritional quality improvement of the food crops by genetic engineering. Production of food from fungi, algae and bacteria: SCP, mushrooms production technology.

Unit II Role of Microbes in food production 10 h

Homo & hetero-fermentative bacteria, yeasts & fungi; Lactic acid bacteria fermentation and starter cultures, Alcoholic fermentations -Yeast fermentations - fungal fermentations. Microbes associated in yoghurt, cheese, fermented milks, breads, idly and soya products.

Unit III Traditional Foods & Techniques of food preservation 10 h

Traditional south Indian foods history – rice based, pickles, curry podi, jaggary sweets. Role of banana leaf packing and serving. Canning, cold storage, freezing, cryogenic freezing. Preservation by fermentation: curing and pickling. Use of preservative: chemical preservative, class II preservatives, bio-preservatives.

Unit IV Food Packaging 10 h

Definition, factors involved in selection, functions of food packaging. Types of packaging materials and their functioning properties; Aseptic packaging of foods:sterilization techniques of food and packaging material; Advantages and disadvantages associated with packaging of foods.

Unit V Food safety and quality control 8 h

Impact of food safety on global trade; Food safety in retail food businesses; international food service operators, institutional food service operators. HACCP, Surveillance networks, functions of USFDA, USDA and EPA; Food Safety and Standards Act India 2006; Prevention of Food Adulteration Act, India, 1954.

Text Books

1. Byong, H.L, 2004, "Fundamentals of Food Biotechnology", 2nd Edition, Wiley Blackwell.
2. Perry, J.G, 2002, "Introduction to Food Biotechnology", 1st Edition, CRC Press.

References

1. Gustavo F. Gutierrez-Lopez, Gustavo V. Barbosa Canosa, 2003, "Food Science and Food Biotechnology", 1st Edition, CRC Press.
2. Shivashraya Singh, 2014, "Dairy Technology", 2nd Edition, New India Publishing Agency.
3. McSwane D, 1997, "Essentials of Food Safety and Sanitation", 2nd Edition, Prentice Hall.
4. Motarjemi, Y. and Lelieveld, H, 2013, "Food Safety Management", 1st Edition, Academic Press.

Course Code	Course Name	Category	L	T	P	Credit
192MT1A5AA	RESEARCH METHODOLOGY	AECC	2	-	-	2

PREAMBLE

This course has been designed for students to learn and understand

- the art of using different research methods and techniques
- planning and writing of researchproposals and dissertations, as well as a thesis
- the necessity for research ethics and guidelines to pursue research

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	learn thebasics of the research methods and techniques	K1
CO2	remember the hypothesis, laws related to research problem	K1
CO3	understand the limitations of experimentation in research	K2
CO4	illustrate the concept of interdisciplinary and multidisciplinary research	K3
CO5	analyze the ethics and responsibilities of research	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	M	S	S
CO4	S	S	M	M	M
CO5	S	S	M	M	S

S Strong M Medium L Low

192MT1A5AA	RESEARCH METHODOLOGY	SEMESTER V

Total Credits: 2

Total Instruction Hours: 24 h

Syllabus

Unit I Introductionto Research 4 h

Research: Introduction- Basic, Applied and Evaluation research – multidisciplinary and interdisciplinary Research – value of research skills – formulating a research problem – Research in relation to Teaching and Publishing

Unit II Hypotheses, Theories and Laws 6 h

Hypotheses – Theories – Laws. Scientific statements: their justification and acceptance: verification – Falsification – Acceptance – Peer review

Unit III Experimentationand research 5 h

The roles and limitations of experimentation – Experimentation and research – conducting experiments - validity and reliability in experimentation – Design of experiments

Unit IV Scientific method and Research Design 4 h

Introduction to Scientific method – Research Design - Components - research design and proposal -checklist in the preparation of proposals

Unit V Ethics and Responsibility in Scientific Research 5 h

Ethics – guidelines for Ethical practices in research - unethics to ethics in research - responsibility of Scientists and of Science as an Institution

Text Books

1 PerterPruzan, (2016), Research Methodology: The Aims, Practices and Ethics of Science. Springer, Switzerland

References

1 Thomas, C.G. (2015) Research Methodology and Scientific Writing.Ane Books Pvt. Ltd.: New Delhi.

2 Locharoenrat, K. (2017) Research Methodologies for Beginners.Pan Stanford Publishing: Singapore.

3 Ranjit Kumar, (2014) Research Methodology: A Step-by-Step Guide for Beginners. SAGE Publications Ltd.: Singapore.

4 Kothari, C.R. Garg, G. (2009) Research Methodology Methods and Techniques. New Age International Publishers, New Delhi..

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Sixth Semester										
Part-III										
193BT1A6CA	Core –XII	Bioprospecting	3	1	-	3	25	75	100	4
193BT1A6CB	Core –XIII	Environmental Biotechnology	3	1	-	3	25	75	100	4
193BT1A6CC	Core – XIV	Bionanotechnology	3	1	-	3	25	75	100	3
193BT1A6CP	Core Practical	Bioprospecting, Environmental Biotechnology & Bionanotechnology	-	-	5	6	40	60	100	2
193BT1A6SA	SEC - IV	Pharmaceutical Biotechnology	3	-	-	3	25	75	100	3
193BT1A6DA	DSE-II	Genomics	3	1	-	3	25	75	100	4
193BT1A6DB		Bioethics & Biosafety								
193BT1A6DC		Drug Design & Delivery								
193BT1A6DD	DSE-III	Proteomics	3	1	-	3	25	75	100	4
193BT1A6DE		Biomarker Technology								
193BT1A6DF		Stem Cell Technology								
Part - IV										
193BC1A6AA	AECC - VI	Innovation, IPR and Entrepreneurship	2	-	-	-	-	-	50	2
Part-V										
193BT1A6XA		Extension Activity	-	-	-	-	50	-	50	1
		Total	**20**	**5**	**5**				**800**	**27**
		Grand Total							**4400**	**140**

Course Code	Course Name	Category	L	T	P	Credit
193BT1A6CA	**CORE** - XII **:** BIOPROSPECTING	CORE	3	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The introduction about Bioprospecting and Biodiversity
- The Bioprospecting potentials of available natural resources
- The regulations related with biodiversity and bioprospecting

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Familiarize the students in major areas of bioprospecting and biodiversity	K2
CO2	Apprehend the bioprospecting aspects related to microorganisms	K2,K3
CO3	Obtain a comprehensive knowledge about natural products from plants	K2,K3
CO4	Gain the knowledge about bioprospecting knowledge about marine sources	K2,K3
CO5	Familiar with regulatory legislation and convention in bioprospecting for commercialization	K3,K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	M
CO2	S	S	M	M	M
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S Strong **M Medium** **L Low**

193BT1A6CA	CORE - XII : BIOPROSPECTING	**SEMESTER VI**

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Bioprospecting and Biodiversity 09 h

Biodiversity in different agro ecological regions, endangered species, inventorisation and monitoring. Introduction, concepts and practices of bioprospecting; Traditional and modern bioprospecting; bioprospecting and biodiversity.

Unit II Bioactive Compounds from Microbes 10 h

Aerobic and anaerobic (extremophiles/archaea) organisms for bioprospecting. Bioactive compounds from microbes: bacteria, actinomycetes and fungi for antibiotics, antiviral compounds and anticancer agents. Plant growth promoting bacteria – Azospirillum lipoferum, Bacillus licheniformis, Pseudomonas chlororaphis, Rhizobia sp.

Unit III Bioactive Compounds from Plants 10 h

Bioprospecting of plants for novel medicines, random, ethnobotanical approaches and indigenous traditional knowledge for screening of medicinal plants. Isolation of crude and pure phytocompounds. Bioassays, structural elucidation, large scale production and market accessibility of phytocompounds.

Unit IV Bioactive Compounds from Marine Sources 10 h

Discovery of novel compounds from marine sources: coral - terpenoids, diterpenoids; sponges - spongothymidine and spongouridine; bryozoans - secondary metabolites and anti cancer drugs; molluscs, tunicates and seaweeds.

Unit V Metagenomics and regulations for Bioprospecting 09 h

Metagenomics: microbes from soil, plants, animals and human beings. Bioprospecting of novel genes/biomolecules and enzymes for industrial and medicinal uses. Regulations-Convention on Biological Diversity- Intellectual property rights- Patenting of new genes and/or bioactive principles.

Text Books

1. Swaminathan, M.S. and Kocchar, S.L. (Es.) (1989). Plants and Society, MacMillan Publication Ltd.,

2. Sharma, O.P. (1996). Hills Economic Botany, Tata McGraw Hill Co., Ltd., New Delhi.

References

1. Krishnan. S and Bhat. D.J. 2009. Plant and Fungal Biodiversity and Bioprospecting, Broadway Book Center, India.

2. Bull A. T. (ed.) 2004. Microbial Diversity and Bioprospecting, ASM Press, Washington DC.

3. Igor, P (ed.). 2011. Research in Biodiversity - Models and Applications, InTech publishers,

4. Russell Paterson, Nelson Lima. 2017. Bioprospecting: Success, Potential and Constraints. Springer, Cham.

Course Code	Course Name	Category	L	T	P	Credit
193BT1A6CB	ENVIRONMENTAL BIOTECHNOLOGY	CORE	3	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The ecosystem and organization
- The chemistry involved in environment
- The management of sustainable environment

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the structure and organization of ecosystem	K1, K2
CO2	Comprehend chemistry behind environmental effects	K3
CO3	Manage and control the pollution and wastage	K2, K3
CO4	Industrial Safety Management	K2
CO5	Comprehend the environmental policies	K2,K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	M
CO5	S	S	M	M	S

S Strong M Medium L Low

193BT1A6CB	ENVIRONMENTAL BIOTECHNOLOGY	SEMESTER VI

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Ecosystem-structure and organization 09 h

Ecosystem-Definition, structure primary production, secondary production- food chain - food web- trophic levels- energy flow- pyramid of biomass–pyramid of energy. Biogeochemical cycle: Nitrogen and Phosphorous

Unit II Environmental chemistry 10 h

Chemistry of water, alkalinity and acidity of water, hardness of water, concept of BOD, and COD. Heavy metals, metal solubility, complexation and chelation. Surface and interface chemistry - Adsorption, absorption, catalysis, colloids, surfactants, examples, types of adsorption, desorption

Unit III Pollution and Waste Management 10 h

Pollution- types- sources- effects and its control measures- air- water-land-noise-thermal-pesticide-radioactive-greenhouse effect, ozone and its importance - global warming - Acid rain. Sewage Treatment System-Characteristics, Primary, secondary and tertiary treatment. Solid waste disposal and solid waste Management

Unit IV Industrial Safety Management 09 h

Industrial Safety Standards. Industrial Accidents and Disasters - Frequency Rate, Prevention and Control. Dispersion of Radioactive material and release of Toxic and inflammable materials. Work Study - Method of Study and Measurement. Measurement of Skills. Safety - Cost of Expenses. Principles and Functions in Safety Management

Unit V Environmental policies 10 h

International environmental policy – environmental problems and their impact on international system,– international law- soft law - (treaties, conventions and protocols).The Environmental Protection Act, 1986, The forest conservation act 1980, The Wildlife Protection Act 1972 (2002 amendment), Plastics Waste management Rules 2015

Text Books

1. Singh,Y.K. 2006. Environmental Science. 1stEdition.NewAgeInternational(P) Limited, India

2. Agarwal,S.K.2007.EnvironmentalBiotechnology.1stEdition.APHPublishing, India.

References

1. MartinAlexander.1999. BiodegradationandBioremediation.2ndedition.AcademicPress, USA

2. AlanScragg.2007. Environmental Biotechnology. 2nd edition. Oxford university press

3. Miller, G.T., Scott, JR., Spoolman, E. 2010. Environmental Science. 13th Edition. YolandaCossioPublisher, USA

4. Mohapatra, P.K. 2006. Textbook of Environmental Biotechnology. 1st Edition. IK International Publishing House Pvt. Ltd., India

Course Code	Course Name	Category	L	T	P	Credit
193BT1A6CC	CORE:BIONANOTECHNOLOGY	CORE	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- The Basics of Bionanotechnology and its characteristics
- The latest trends of bionanoparticles in all fields
- The drug delivery system in nanotechnology

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn basic of Bionanotechnology	K1, K2
CO2	Understand the basic of Bionanomachinery and protein folding	K2
CO3	Elucidate the functional concept of biomaterials	K3
CO4	Learn about microarray technology,Nanobiosensors, Biochips and its application	K1,K2
CO5	Comprehend the drug delivery system and cancer biology based on bionanotechnology	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	M	M
CO5	S	S	M	M	S

S Strong M Medium L Low

193BT1A6CC	CORE:BIONANOTECHNOLOGY	SEMESTER VI

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Introduction to Nanotechnology 10 h

Opportunities and challenges of Nanotechnology. Key features of Nano-size, Comparison of particle behavior at nanosize to macrosize. Strategies for Nanoarchitecture (top down & bottom up approaches). Introduction to Nanobiotechnology – Biogenic nanoparticle synthesis from plants, bacteria and yeast. Biomolecular design

Unit II Structural Bionanotechnology 10 h

Structural principles of Bionanotechnology: Natural Bionanomachinery – (Eg lotus leaf effect, Gecko lizard, fish hair structures, butterfly wings). Overview of Nanodevices - Strategies for construction of Nanodevices using Carbon as a raw material. Protein folding Aspects: Stable structure, Globular proteins, Role of chaperones in folding, lipid bilayer, DNA based nanostructures

Unit III Functional Bionanotechnology 10 h

Principles of Functional Bionanotechnology. Information-driven nanoassembly: Energetics; Biomaterials- Filaments and fibrils, Minerals combined with biomaterials for specific applications. Biomolecular sensing taste and light sensors. Machine phase Bionanotechnology- Muscle sarcomeres and nerves

Unit IV Clinical based Bionanotechnology 09 h

Differentiation of Nanoparticles and Nanosystems. Conventional drug delivery & targeted drug delivery – its role and advantages; Clinical Trials involved in Bionanotechnology

Unit V Applications of Bionanotechnology 09 h

Principles, types and applications ofBionano-imaging, Magnetic nano-particles, nano-biosensors, biochips, biorobotics, nanopore technology and nanoarrays in medicine, agriculture, food and environmental science

Text Books

1 Niemeyer, C.M. and Mirkin, C.A. 2004. Nanobiotechnology: Concepts, Applications and Perspectives. 1st Edition. Wiley-VCH, Germany

2 Shoseyov, O. & Levy, I. 2007. Nanobiotechnology: Bioinspired Devices and Materials of the Future. 1st Edition. Humana Press, USA

References

1 Shah, MA and Shah, KA. 2019. Nanotechnology - The Science of Small. 2nd Edition. Wiley Sons, India

2 Poole, CP and Owens, FJ. 2020. Introduction to Nanoscience & Nanotechnology. 2nd Edition. Wiley India Pvt. Ltd., India.

3 Sanders, WC. 2018. Basics Principles of Nanotechnology. 1st Edition. CRC Press, USA.

4 Varghese, T and Balakrishna, KM. 2016. Nanotechnology: An Introduction to Synthesis, Properties and Applications of Nanomaterials. 1st Edition. Atlantic Press, India.

193BT1A6CP	BIOPROSPECTING, ENVIRONMENTAL BIOTECHNOLOGY &BIONANOTECHNOLOGY	SEMESTER VI

Total Credits: 2
Total Instructions Hours: 60 h

S.No	Contents
1	Herbal bioprospecting – Phytochemical analysis of medicinal plants and its comparison
2	Medicinal bioprospecting - Preparation of different medicinal products
3	Marine Bioprospecting – Synthesis of useful products from the marine sources (eg. Agar from seaweeds)
4	Microbial Bioprospecting –isolation and identification of microbes producing useful metabolites (eg, Fungi/Bacteria).
5	Analysis of chloride content from ground water obtained from various parts of the city
6	Determination of Alkalinity present in different sources of water
7	Analysis of Acidity present in ground water from different sources
8	Determination of Chemical Oxygen Demand
9	Determination of MPN from the given water sample
10	Synthesis of Nanoparticles using herbal plants*
11	Spectral analysis of Nanoparticles obtained from herbal sources*
12	Antibacterial screening of metallic Nanoparticles.*

Note: *DBT STAR college experiments

References

1 Choudhary, SS, Choudhary, P and Choudhary, SK. 2005. Laboratory Guide in Biosciences. 2nd edition. Kalyani publishers, India.

2 Reddy, SR and Charya MAS. 2012. Microbial Diversity: Exploration and Bioprospecting. 1st edition. Scientific Publisher.

3 Krishnan, S and Bhat. DJ. 2009. Plant and Fungal Biodiversity and Bioprospecting, Broadway Book Center, India.

4 Sharma, OP. 1996. Hills Economic Botany, Tata McGraw Hill co., Ltd., New Delhi.

Course Code	Course Name	Category	L	T	P	Credit
193BT1A6SA	PHARMACEUTICAL BIOTECHNOLOGY	SEC	3			3

PREAMBLE

This course has been designed for students to learn and understand

- The mechanism of drug action
- The production and application of new drugs
- The application of drugs and regulatory aspects

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Learn basic of Biopharmaceutical	K1
CO2	Understand the sources of Biopharmaceutical and therapeutic enzymes	K1, K2
CO3	Know the drug development process	K1, K2
CO4	Learn about Dosage forms, Manufacturing Principles and packing techniques	K1, K2, K3
CO5	Know the regulatory aspects with respect to clinical trails	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	M	S	S
CO5	M	S	S	S	S

S Strong M Medium L Low

193BT1A6SA	PHARMACEUTICAL BIOTECHNOLOGY	SEMESTER VI

Total Credits: 3

Total Instruction Hours: 36 h

Syllabus

Unit I Introduction to Pharmaceuticals 7 h

Introduction- Biopharmaceuticals and pharmaceutical biotechnology; Physico-chemical properties of the drugs; Drug isolation and evaluation; Delivery of biopharmaceuticals-Oral, Pulmonary, Nasal, Transmucosal and Transdermal delivery system; Drug metabolism-Pharmacokinetics: Absorption, Distribution, Metabolism and Excretion (ADME) and Pharmacodynamics.

Unit II Sources of Biopharmaceuticals 8 h

Production of Biopharmaceuticals from Bacteria (E.coli), Yeast (Saccharomycescerevisiae), Fungus(Penicillium Sp.), Insects,Transgenic plants andAnimal cell culture. Therapeutic based pharmaceuticals - Anti-sense oligonucleotides (ASOs) and DNA aptamers, Growth Hormones(rhGH), Blood products(Cryoprecipitated AHF); Therapeutic enzymes(Ribozymes)

Unit III Drug Development Processes 7 h

Discovery and Development, Preclinical Research (Good laboratory practices approach - In-vitro & In-vivo), Clinical Research (Phase studies), Review of the drug, Post-Market Safety Monitoring.

Unit IV Dosage forms and Manufacturing Principles 7 h

Compressed tablets; dry and wet granulation; slugging or direct compression; tablet presses; coating of tablets; capsule preparation; oral liquids, topical applications; preservation of drugs. Packing techniques, quality management.

Unit V BiopharmaceuticalRegulatory Aspects 7 h

Roles and Responsibilities of the National and International Regulatory Authorities. Food and Drug Administration (FDA), Administrative Structure and Functions of Drug Regulatory Authorities in India-Central Drugs Standard Control Organization- Drug Controller General of India.

Text Books

1. ChandrakantKokare. 2019. Pharmaceutical Biotechnology. 1st Edition. NiraliPrakashan, India.
2. Goodman & Gilman. 2006. The Pharmacological Basis of Therapeutics, PermagonPress, New York

References

1. Murugesh, N. 2014. A Concise text book of Pharmacology. 7th edition. Sathya Publications, India
2. Katzung, B.G. 1995. Basic and Clinical Pharmacology. 12th edition. Prentice Hall of Intl.
3. Goodman and Gilman. 2006. The Pharmacological Basis of Therapeutics. 11th edition. McGraw Hill Medical Publishing, India.
4. Lachman L Lieberman, HA, Kanig, J. 1986. Theory and Practice of Industry pharmacy. 3rd Edition. Varghese Publishing & Co, New Delhi.

Course Code	Course Name	Category	L	T	P	Credit
193BT1A6DA	DSE: GENOMICS	DSE	3	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The concepts of gene and its structure
- The basics of bioinformatics
- The techniques of gene sequencing and its importance

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Gatherinformation on basics of gene	K1
CO2	Acquire knowledge on different databases with regard to genes	K2
CO3	Gain insight on sequence alignment and gene finding tools	K2, K3
CO4	Understand gene structures and related databases and visualization tools.	K2
CO5	Highlight the applications of genome sequencing	K2,K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	M	M	S

S Strong M Medium L Low

193BT1A6DA	DSE: GENOMICS	SEMESTER VI

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Biological Databases 10 h

Bioinformatics – Primary and secondary databases – Large scale molecular biology data - Types of biological databases – Nucleic acid sequence data bases (NCBI, EMBL, DDBJ), Protein sequence database - SWISS-PROT.

Unit II Genes and Chromosomes 10 h

Genes, genomes, genomics, chromosomes – characteristics. Genome diversity. Gene Bank – Classification of genomics (structural and functional). Structure, organization and composition of prokaryotic (bacteria), eukaryotic (yeast) and Plant genome

Unit III Genome Analysis 09 h

Access and retrieving genome project information from web – Comparative genomics. Identification and classification of genome using molecular markers, 16S rRNA typing/sequencing, Fragment Assembly andExpressed Sequence Tag (EST)

Unit IV Genome Sequencing 10 h

Sanger and Gilbert method - Next Generation Sequencing – Gene predictions. Gene Expression profiling. GENSCAN. Genomic and cDNA libraries. Northern blotting – In situ hybridization

Unit V Genome Projects and Applications 09 h

Human Genome Projects – HapMap project – ENCODE project. Genetic disorders diagnosis (Duchenne muscular dystrophy (DMD), Haemophilia). Synthetic genomes and their applications

Text Books

1. AH wood, T.K. Parry smith D. 2001. Introduction to Bioinformatics. Pearsoneducation Asia
2. Rastogi S C. 2008. Bioinformatics Methods and Applications: Genomics Proteomics and Drug Discovery. 3rd edition, PHI Learning Pvt. Ltd., India.

References

1. Primrose, S.B. and Twyman, R.M. 2004. Principles of gene manipulation and Genomics, 2nd edition, Blakcwell Publishing Ma, USA
2. Dale, W. J and Schantz M. 2014. From Genes to Genomes. 3rd edition, Wiley, John & sons
3. Ridley, M. 2019. Genome: Autobiography of a species in 23 chapters. 1st edition, Harper Perinnial Publishing, USA
4. Quackenbush, J. 2011. The Human Genome. 1st edition, Curiosity Guides, USA

Course Code	Course Name	Category	L	T	P	Credit
193BT1A6DB	BIOETHICS AND BIOSAFETY	DSE	3	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The issues related to ethical framework
- Legal issues concerning biotechnology products and genes
- Classical examples of patented products

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Gather knowledge about lab safety and committees involved	K1, K2
CO2	Understand the role of bioethics in the field of biotechnology and its products	K2, K3
CO3	Gain insight on types of IPR and its licensing	K3
CO4	Imbibe art of patenting and strategies involved.	K3
CO5	Highlight the global scenario on IPR	K2,K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	M	S	S
CO4	S	S	M	M	M
CO5	S	S	M	M	S

S Strong M Medium L Low

193BT1A6DB	BIOETHICS AND BIOSAFETY	SEMESTER VI

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Biosafety Basics 9 h

Good Lab Practices, Introduction to Biological Safety Cabinets, Primary Containment for Biohazards, Biosafety Levels, GMOs and LMOs and their environmental impact, Roles of Institutional Biosafety Committee, RCGM, GEAC

Unit II Genes and Bioethics 9 h

Bioethical issues related to Healthcare & medicine Food & agriculture. Genetic engineering, Human Genome Project. Genetic Testing, types, pros and cons, informed consent. Socio-economic problems and environmental problems relating to bioethics

Unit III Copyright and Patents 10 h

Definition, Concept of Intellectual Property, Kinds of Intellectual Property Patents, Copyrights, Designs, Trademarks, Geographical Indication, Infringement of IPR, protection and Remedies, Licensing and its types

Unit IV Features of Patenting 10 h

Requirement of patentable novelty, Inventive step, Prior art Classifying products as patentable and non-patentable, Procedure for applying for patent, Patent Infringement and related case studies Biological Patentability. Biopiracy and Bioprospecting. Farmers Rights and Plant breeders rights Biodiversity

Unit V Patented Products 10 h

Traditional knowledge and patent issues with relevance to Indian context. Basmati rice patent case, turmeric patent case, Neem leaves patent, superbug patenting

Text Books

1 DeepaGoel. 2013.IPR Biosafety and Bioethics,1stedition. Pearson Education

2 Sateesh, M.K. 2008.Bioethics and Biosafety. 1st Edition. I.K. International Publishing House

References

1 Catherine J. Holland. 2007. Intellectual Property: patents, trademarks, copyrights, trade secrets. 1st edition. Entrepreneur Press.

2 Srinivasan, K. and Awsthi, H.K. 1997. Laws of Patents. 1st edition. Jain Book Agency.

3 Thomas H. Murray and Maxwell J. Mehlman. 2005. Encyclopedia of Ethical, Legal and Policy issues in Biotechnology. 1st edition. Wiley Interscience.

4 Biosafety Manual by WHO. https://www.who.int/csr/resources/publications/biosafety/LabbiosafeMicrosoft Word - LBM2+ final for pdf.doc (who.int)

Course Code	Course Name	Category	L	T	P	Credit
193BT1A6DC	**DSE** II: DRUG DESIGN & DELIVERY	**DSE**	**3**	**1**	**-**	**4**

PREAMBLE

This course has been designed for students to learn and understand

- The study of drug design, development and delivery systems
- TheCheminformatics and its Application in Drug Development
- The Computer Aided Drug Design (CADD) and its role

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the Drug Design and Development, Role of Organic Chemistry, SAR & SQAR	K1, K2
CO2	Learn the Targets Based Drug Design	K1, K2
CO3	Impartknowledge on the pharmacophore, application of cheminformatics in Lead Compound Discovery	K2, K3
CO4	Know the Computer Aided Drug Design (CADD), tools, SBDD & LBDD	K2, K3
CO5	Learn the Various Target Based Drug Delivery Systems, Challenges and obstacles in drug delivery	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	M	S
CO5	S	S	M	S	S

S Strong M Medium L Low

193BT1A6DC	**DSE II:** DRUG DESIGN & DELIVERY	**SEMESTER VI**

Total Credits: 4
Total Instruction Hours: 48 h

Syllabus

Unit I Introduction to Drug Design 9 h

Introduction to Drug Design and Discovery, History and Evolution of the contemporary drug discovery process. Role of organic chemistry in Drug Discovery, Design and Development. Molecular properties and interactions of drug molecules. Structure Activity Relationships (SAR) and Quantitative SAR (QSAR) techniques in drug design.

Unit II Drug Design 9 h

Types of Drug design and Drug development, difference between drug design and drug development. Classical Targets in Drug Discovery - Enzymes, Inhibition of Enzymes, G-Protein-Coupled Receptors (GPCRs), Ion Channels and Membrane Transport Proteins (Transporters).

Unit III Cheminformatics 10 h

Cheminformatics - Introduction to pharmacophore, concepts in CADD, methods in docking simulations, Applications in ADME-tox and Limitations.Role of Cheminformaticsand Molecular Diversity in Lead Discovery. Sources of Lead Compounds, Screening, Identification, Modification and Lead Optimization.

Unit IV Computer Aided Drug Design (CADD) 10 h

Introduction and classification ofCADD. Drug design based on bioinformatics tools, Molecular docking, De novo design, Structure Based Drug Design (SBDD) and Ligand Based Drug Design (LBDD). Challenges and emerging problems in CADD, Legal & ethical considerations in drug development.

Unit V Drug Delivery & Drug Delivery Systems 10 h

Introduction to drug delivery and targeting systems. Controlled drug release, parenteral and non parenteral routes of drug delivery and targeting - Oral,buccal, sublingual, GI tract, transdermal, nasal and pulmonary drug delivery. Gene delivery systems and Vaccine delivery. Challenges and obstacles to targeted drug delivery.

Text Books

1. MohaneCoumar. S. 2021. Molecular Docking for Computer-Aided Drug Design: Fundamentals, Techniques, Resources and Applications. 1st edition. Academic Press, USA.

2. Anees Ahmad Siddiqui. Harish Kumar. SubuhiKhisal. 2020. Computer-Aided Drug Design. 1st edition. CBS Publishers, USA.

References

1. RamaraoPoduri. 2021. Drug Discovery and Development from Targets and Molecules to Medicines. 1st edition. Springer, USA

2. Tarun Bhatt. SurendraNimesh. 2021. The Design and Development of Novel Drugs and Vaccines. 1st edition. Academic Press, USA

3. Osman F Guner. 2020. Pharmacophore Perception, Development, and Use in Drug Design. 1st edition. TBS Publishers, USA

4. Anya M Hillery. Kinam Park. 2017. Drug Delivery Fundamentals and Applications. 2nd edition. CRC Press, USA

Course Code	Course Name	Category	L	T	P	Credit
193BT1A6DD	DSE:PROTEOMICS	DSE	3	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The fundamentals of Proteomics
- The Quantitative Proteomics and its applications
- The advancements in Proteomics

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Gather knowledge on basics of proteomics	K1
CO2	Acquire knowledge about gel based proteomics and its applications	K1,K2
CO3	Understand the principle and concept of Mass Spectrometry	K2,K3
CO4	Gain insight on methods of Quantitative proteomics	K2,K3
CO5	Highlight the advancements in proteomics	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	M	S
CO5	S	S	S	S	S

S Strong M Medium L Low

193BT1A6DD	DSE: PROTEOMICS	SEMESTER VI

Total Credits: 4
Total Instruction Hours: 48 h

Syllabus

Unit I Introduction to proteomics 9 h

Introduction to amino acids – structure and isomerism, ionisation state, cis and trans forms. Introduction to proteins – Structural levels and Ramachandran Plot, X- Ray Crystallography, 3D structure determination through amino acid sequence. Properties of protein, Prediction of Protein structure, folding, misfolding and Molecular Chaperones.

Unit II Gel based Proteomics 9 h

Sample preparation and pre-analytical factors, Protein fractionation, extraction and quantification, One- dimensional electrophoresis, 2-DE: Second dimension, Gel analysis and Applications. 2D-DIGE: Basics, Data Analysis and Applications. Systems biology and proteomics.

Unit III Mass Spectrometry 10 h

Chromatography technologies, Liquid chromatography, Mass spectrometry-Fundamentals, Ionization sources, Mass analyzers, MALDI sample preparation and analysis. Hybrid mass spectrometry configurations, in-gel & in-solution digestion

Unit IV Quantitative Proteomics 10 h

Introductiontoquantitativeproteomics – Relative and Absolute Quantification, Label Free Quantification- Spectral Counting. Gel based quantitative proteomics – Fluorescence 2-D Difference Gel Electrophoresis (FDIGE) and Labelled Quantification - In vivo labeling (SILAC& TAILS) and In vitro labeling (iTRAQ& TMT).

Unit V Advancements in Proteomics 10 h

Functional Proteomics, Interaction proteomics- Biochemical approaches: Direct analysis, affinity purification and protein chips. Applications of proteomics in OMICS and its translational research (Transcriptomics, Metabolomics, Metabonomics and Neutriproteomics). Challenges in Proteomics.

Text Books

1 Twyman, RM. 2004. PrinciplesofProteomics, BioScientificPub.

2 Liebler, DC. 2002. IntroductiontoProteomics:ToolsfortheNew Biology. Humana Press, USA.

References

1 Veenstra, TD and Yates, JR. 2006. Proteomicsfor BiologicalDiscovery. John Wiley&Sons, USA.

2 Hubert,R. 2006.ProteinBiochemistryandProteomics(TheExperimenterSeries),Academic Press, USA

3 Westermeier, R. Naven,T. Höpker, HR. 2008. ProteomicsinPractice:AGuidetoSuccessfulExperimental Design. Wiley-VCH, USA.

4 Twyman, R. 2014.Principles of Proteomics. 2nd Edition. Taylor and Francis Group, UK.

Course Code	Course Name	Category	L	T	P	Credit
193BT1A6DE	BIOMARKER TECHNOLOGY	DSE	3	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The application of markers in biology
- The biosensing devices and their working
- The technological advancement in biomarkers

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the concepts on markers	K2
CO2	Value the importance of proteomics and genomics	K2,K3
CO3	Comprehend the transcriptome and its role	K3
CO4	Diagnose the diseases and cures using biomarkers	K3
CO5	Understand the applications of biomarkers	K2,K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	M	S	S
CO4	S	S	M	M	M
CO5	S	S	M	M	S

S Strong M Medium L Low

193BT1A6DE	BIOMARKER TECHNOLOGY	SEMESTER VI

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Basics about Biomarkers 09 h

Introduction - history - milestones - biomarkers. Types of biomarkers in the biological sciences. Genomics - Proteomics - Transcriptomics - Metabolomics relating to biomarkers

Unit II Types of Biomarkers 09 h

Analysis of proteins - Analysis of transcripts - study of RNA profiling - identification of genomic DNA - comprehension of metabolites and intermediary products

Unit III Biomarkers Databases 10 h

Biomarker Databases - MarkerDB -clinical and therapeutic decision making - gobiomdbplus (comprehensive database) - Charles River database

Unit IV Biomarkers in Drug Development 10 h

Screening markers - toxicity markers - efficacy markers - drug development using biomarkers - disease management with examples

Unit V Applications of biomarkers 10 h

Prediction of diseases - diagnostics uses - prognostic applications - staging markers - safety biomarker - susceptibility biomarker - case studies relating to different types of biomarkers in diseases

Text Books

1. Veenstra, TD and Yates, JR. 2006. Proteomics for Biological Discovery. John Wiley & Sons, USA
2. Hubert,R. 2006. Protein Biochemistry and Proteomics (The Experimenter Series), Academic Press, USA

References

1. Dale, W. J and Schantz M. 2014. From Genes to Genomes. 3rd edition, Wiley, John & sons
2. Ridley, M. 2019. Genome: Autobiography of a species in 23 chapters. 1st edition, Harper Perinnial Publishing, USA
3. James Watson D, 2001, "Recombinant DNA technology". 2nd Edition, WH Freeman and company, United Kingdom
4. Campbell, A.M. and L. J. Heyer, 2007,"Discovering Genomics, Proteomics and Bioinformatics", 2nd Edition, Pearson Education

Course Code	Course Name	Category	L	T	P	Credit
193BT1A6DF	DSE: STEM CELL TECHNOLOGY	DSE	3	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The features of Stem Cell, Pluripotency and Reprogramming of stem cells
- The differentiation and tools to study stem cells
- The clinical applications of Stem Cell Biology

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Lean the establishment of embryonic stem cells	K1, K2
CO2	Understand in vitro differentiation, specification and computational tools	K2
CO3	Comprehend the regulatory mechanism in stem cells	K3
CO4	Highlight clinical application of stem cell technologies	K3
CO5	Know the ethics of premature translation of stem cell interventions	K2,K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	M	M
CO5	S	S	M	M	S

S Strong M Medium L Low

193BT1A6DF	DSE :STEM CELL TECHNOLOGY	**SEMESTER VI**

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Introduction to stem cell 9 h

Introduction to Stem cells - In vivo and In vitro. Development of stem cells- Early development, Gastrulation and lineage commitment, cell fate, Specification and development of primordial germ cells. Human stem cells and plasticity of human stem cell research, cord blood stem cell and stem cell marker.

Unit II Pluripotency and Reprogramming 9 h

In vitro stem cell regeneration - Establishment of embryonic stem cells (ESCs), Characterization of pluripotent stem cells (PSCs), Molecular mechanisms underlying pluripotency, Induction of pluripotency, Potential of induced pluripotent stem cells (iPSCs) in basic and clinical applications, Alternative PSCs. Reprogramming using defined factors and mechanisms of reprogramming.

Unit III Differentiation of Stem cells and its tools 10 h

In vitro differentiation, Specification during development in adults, Trans differentiation and direct programming. Computational tools to dissect stem cell heterogeneity, In vitro cultures of adult stem cells to analyze differentiation capacity.

Unit IV Regulatory mechanism in Stem cells technology 10 h

Core regulatory circuitry, DNA methylation, Histone modifications, histone modifiers, chromatin remodelers, Spatial organization of genome during ESC development and differentiation. Generation of chimeric animals and animal cloning; Pro-nuclear injection of blastocysts, transplantation of blastocysts into pseudo- pregnant mice and generation of chimeric and knockout animals.

Unit V Clinical Applications of stem cell technology and ethics 10 h

Clinical application of stem cell technologies with reference to adult stem cell disease modeling and therapy. Stem cell therapy guidelines and clinical trials. Embryo ethics - ethics of egg donation, premature translation of stem cell interventions, fetal tissue.Access to future stem cell therapies and awareness to the public.

Text Books

1. Meshorer, E and Plath, K. 2010. The Cell Biology of Stem Cells. Springer Science+ Business media. LLC.Landes Biosciences, Germany.
2. Kallosm M.S. 2011. Embryonic Stem Cells - Basic Biology to Bioengineering. Intech Open Access Publisher, UK

References

1. Clarke, M. and Frampton, J. 2020. 1st Edition. Core Concepts in Stem Cell Biology. Routledge Taylor & Francis Group, UK.
2. Lanza, R. and Atala, A. 2014. Essentials of Stem Cell Biology. Elsevier, Netherlands.
3. Li, S., Herureux, N.L.,Elisseeff, J. 2011. Stem Cell and Tissue Engineering. 1st Edition. World Scientific Publishers, Singapore.
4. Slack, J.M.W. 2017. The Science of Stem Cells. John Wiley & Sons, Inc., USA

Course Code	Course Name	Category	L	T	P	Credit
193BC1A6AA	INNOVATION, IPR AND ENTREPRENEURSHIP	AECC	2	-	-	2

PREAMBLE

This course has been designed for students to learn and understand

- The role of Entrepreneurship in Economic Development and basics of Intellectual Property Rights, Copy Right Laws, Trade Marks and Patents
- Ethical and professional aspects related to intellectual property law context
- Intellectual Property(IP) as an career option

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the concept of innovation, IPR, entrepreneurship and its role in economic development	K2
CO2	Know the value , purpose and process of Patent	K2
CO3	Understand the basics of trademarks and industrial designs	K2
CO4	Acquire knowledge about copyright and copyright law	K2
CO5	Identify Geographical Indications	K2

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	M
CO2	S	M	M	M	M
CO3	S	M	M	M	M
CO4	S	M	M	M	M
CO5	S	M	M	M	M

S Strong M Medium L Low

193BC1A6AA	INNOVATION, IPR AND ENTREPRENEURSHIP	SEMESTER VI

Total Credits: 2

Total Instruction Hours: 24 h

Syllabus

Unit I Introduction to Innovation, IPR and Entrepreneurship 05 h

Meaning of Creativity, Invention and innovation - Types of Innovation - Introduction and the need for Intellectual Property Right (IPR) - Kinds of IPR – National IPR Policy. Entrepreneurs-Concept, characteristics, Functions, need and types, Entrepreneurial decision process. Role of Entrepreneurship in Economic Development.

Case Study: Jayabharati Viswanath: A case of Ladel to Leather.

Unit II Patents 05 h

Introduction and origin of Patent System in India- Conceptual Principles of Patent Law in India - Process for obtaining patent - Rights granted to a Patentee - Infringement of Patent.
Case Study: When Google was used for Patent Infringement.

Unit III Trademarks 05 h

Origin of Trade Marks System - Types - Functions - Distinctiveness and Trademarks - Meaning of Good Trademark - Rights granted by Registration of Trademarks - Infringement of trademark.
Case Study: Trademark mismanagement by Cadbury's.

Unit IV Copyright 05 h

Introduction and Evolution of Copyright - Objectives and fundamentals of Copyright Law - Requirements for Copyrights - Works protectable under Copyrights - Authorship and Ownership - Rights of Authors and Copyright owners - Infringement of Copyright.
Case Study: Copyright Case of Napster and Grokster.

Unit V Geographical Indications 04 h

Introduction and Concept of Geographical Indications - History - Administrative Mechanism - Benefits of Geographical Indications - Infringement of registered Geographical Indication.
Case Study: The story of the Tirupati Laddu.

Note: Case studies related to the above topics to be discussed (Examined internal only)

Text Book

1 Nithyananda, K V. 2019, "Intellectual Property Rights, Protection and Management", Cengage Learning India Private Limited, New Delhi, India.

2 Dr. S. S. Khanka, 2020,"Entrepreneurial Development", S Chand and Company Limited, New Delhi, India.

References

1 Ahuja, V K. 2017, "Law relating to Intellectual Property Rights", 3rd Edition, Lexis Nexis, Gurgaon, India.

2 Neeraj, P., & Khusdeep, D., 2014, "Intellectual Property Rights", 1st Edition, PHI Learning Private Limited, New Delhi, India.

3 http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf.

4 https://knowledgentia.com/knowledgeate.

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