BACHELOR OF SCIENCE (BIOTECHNOLOGY)
REGULATIONS

ELIGIBILITY

A pass in Higher Secondary Examination with Life Science stream 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 Biotechnology Degree Examination** of this College after a course study of three academic years.

OBJECTIVES OF THE COURSE

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 micro organisms, plants, animals and Pharma industries.

SCHEME OF EXAMINATION

Subject Code	Subject	Hrs of Instruction	Exam Duration (Hrs)	Max Marks			Credit Points
				CA	CE	Total	
First Semester							
Part - I							
15UTL11U 15UHL11H 15UML11M 15UFL11F	Tamil-I/ Hindi-I/ Malayalam-I/ French – I	6	6	25	75	100	4
Part - II							
15UEG12E	English - I	6	3	25	75	100	4
Part - III							
15UBT13A	Core –I: Cell Biology	6	3	25	75	100	4
15UBT13P	Core Lab- I	3	3	20	30	50	2
15UCY1AA	Allied -I : Chemistry	4	3	20	55	75	3
15UCY1AP	Allied Lab- I	3	3	20	30	50	2
Part - IV							
15UFC1FA	Environmental Studies	2	3	-	50	50	2
		30				**525**	**21**
Second Semester							
Part - I							
15UTL21U 15UHL21H 15UML21M 15UFL21F	Tamil-II/ Hindi-II/ Malayalam-II/ French – II	6	3	25	75	100	4
Part - II							
15UEG22E	English - II	6	3	25	75	100	4
Part - III							
15UBT23A	Core –II: Genetics	6	3	25	75	100	4
15UBT23P	Core Lab- II	3	3	20	30	50	2
15UBT2AA	Allied -II : Biochemistry	4	3	20	55	75	3
15UBT2AP	Allied Lab -II	3	3	20	30	50	2

13/4/16

BoS Chairman/HoD
Department of Biotechnology
Dr. N. G. P. Arts and Science College
Coimbatore – 641 048

Dr. P. R. MUTHUSWAMY
PRINCIPAL
Dr. NGP Arts and Science College
Dr. NGP - Kalapatti Road
Coimbatore - 641 048
Tamilnadu, India

Part - IV							
15UFC2FA	Value Education: Human Rights	2	3	-	50	50	2
		30				**525**	**21**
Third Semester							
Part - I							
15UTL31U 15UHL31H 15UML31M 15UFL31F	Tamil-III/ Hindi-III/ Malayalam-III/ French – III	5	3	25	75	100	4
Part - II							
15UEG32E	English - III	5	3	25	75	100	4
Part - III							
15UBT33A	Core –III: Molecular Biology	6	3	25	75	100	4
15UBT33P	Core Lab- III	3	3	20	30	50	2
15UBT3AA	Allied – III: Microbiology	4	3	20	55	75	3
15UBT3AP	Allied Lab- III	3	3	20	30	50	2
Part-IV							
15UFC3FA 15UFC3FB 15UFC3FC 15UFC3FD 15UFC3FE	Tamil/ Advanced Tamil (OR) Yoga for Human Excellence/ Women's Rights/Constitution of India	2	3	-	50	50	2
	NMEC-I	2	3	-	50	50	2
		30				**575**	**23**
Fourth Semester							
Part - I							
15UTL41U 15UHL41H 15UML41M 15UFL41F	Tamil-IV/ Hindi-IV/ Malayalam-IV/ French – IV	5	3	25	75	100	4

Part - II							
15UEG42E	English - IV	5	3	25	75	100	4
Part - III							
15UBT43A	Core –IV: Immunology	5	3	25	75	100	4
15UBT43P	Core Lab- IV	3	3	20	30	50	2
15UMA4AC	Allied –IV: Basic Mathematics	4	3	20	55	75	3
Part - IV							
15UBT4SA	Skill Based Subject-I: Techniques for Biology	4	3	20	55	75	3
15UFC4FA/ 15UFC4FB/ 15UFC4FC	Tamil/ Advanced Tamil (OR) General Awareness	2	3	-	50	50	2
	NMEC- II	2	3	-	50	50	2
		30				**600**	**24**
Fifth Semester							
Part - III							
15UBT53A	Core – V: Environmental Biotechnology	5	3	25	75	100	4
15UBT53B	Core –VI: Plant Biotechnology	5	3	25	75	100	4
15UBT53C	Core –VII: Animal Biotechnology	5	3	25	75	100	4
15UBT53P	Core Lab-V	5	6	40	60	100	4
	Elective- I	5	3	25	75	100	4
Part - IV							
15UBT5SA	Skill Based subject - II: Food and Beverage Technology	5	3	20	55	75	3

15UBT5ST	Skill Based: Industry/ Institutional Training	-	-	-	50	50	2
		30				**625**	**25**
Sixth Semester							
Part - III							
15UBT63A	Core – VIII: Recombinant DNA Technology	5	3	25	75	100	4
15UBT63B	Core –IX: Fermentation Technology	5	3	25	75	100	4
15UBT63C	Core – X: Bioethics, Bio safety and IPR	5	3	25	75	100	4
15UBT63P	Core Lab-VI	5	6	40	60	100	4
	Elective II	5	3	25	75	100	4
	Elective III	5	3	25	75	100	4
Part -IV							
15UEX65A	Extension Activity	-	-	50	-	50	2
		30				**650**	**26**
					Grand Total	**3500**	**140**

ELECTIVE – I

(Student shall select any one of the following subject as Elective in fifth semester)

S.No	Subject Code	Name of the Subject
1.	15UBT5EA	Medical Biotechnology
2.	15UBT5EB	Pharmaceutical Biotechnology

ELECTIVE – II

(Student shall select any one of the following subject as Elective in Sixth semester)

S.No	Subject Code	Name of the Subject
1.	15UBT6EA	Fundamentals of Bioinformatics
2.	15UBT6EB	Bioprospecting

ELECTIVE – III

(Student shall select any one of the following subject as Elective in Sixth semester)

S.No	Subject Code	Name of the Subject
1.	15UBT6EC	Drug Safety Guidelines
2.	15UBT6ED	Food Biotechnology

NON MAJOR ELECTIVE COURSES (NMEC)

The Department offers the following two papers as Non Major Elective Course for other than the Biotechnology students.

Student shall select the following subject as Non Major Elective Course during their third and fourth semester.

S.No	NMEC	Subject Code	Name of the Subject
1.	I	15UBT33E	Introduction to Plant Tissue Culture
2.	II	15UBT44E	Water Treatment and Waste Management

Total Credit Distribution

Subjects	Credits	Total		Credits	Cumulative Total
Part I: Tamil	4	4 x 100 =	400	16	32
Part II: English	4	4 x 100 =	400	16	
Part III:					
Core	4	12 x 100 =	1200	48	86
Core	2	4 x 50 =	200	08	
Allied-I	3	4 x 75 =	300	12	
Allied –II	2	3 x 50 =	150	06	
Elective	4	3 x 100 =	300	12	
Part IV:					
Skill Based Subjects	3	2 x 75 =	150	06	20
Skill Based Subject	2	1 x50 =	50	02	
Value Education	2	2 x 50 =	100	04	
Environmental studies	2	1 x 50 =	50	02	
General Awareness	2	1 x 50 =	50	02	
NMEC	2	2 x 50 =	100	04	
Part V:					
Extension Activity	1	1 x 50 =	50	2	02
Total			**3500**	**140**	**140**

FOR COURSE COMPLETION

Students have to complete the following Subjects:

1. Language papers (Tamil/Malayalam/French/Hindi, English) in I, II, III and IV semester.
2. Environmental Studies in I semester.
3. Value Education in II and III semester respectively.
4. General Awareness in IV semester.
5. Allied papers in I, II, III and IV semesters.
6. Two Non Major Elective Courses in III and IV semester.
7. Three Skill Based Courses in IV and V semesters
8. Extension activity in VI semester
9. Elective papers in the Fifth and Sixth semesters.

15UTL11U	பகுதி – 1 : தமிழ் தாள் -1	முதல் பருவம்

Total Credit: 4
Hours per week: 6

(இரண்டு ஆண்டுகள் தமிழ் பயிலும் மாணவர்களுக்குரியது)

(கவிதை, சிறுகதை, இதழியல், இலக்கணம், இலக்கிய வரலாறு)

அலகு -1 கவிதைகள்

1. பாரதியார் – செந்தமிழ்நாடு
2. பாரதிதாசன் – புத்தகச் சாலை, நீங்களே சொல்லுங்கள்
3. கவிமணி – ஒற்றுமையே உயிர்நிலை
4. சிற்பி – பெல்ஜியம் கண்ணாடி
5. மு.மேத்தா – மரங்கள்
6. ஆ.வெண்ணிலா – நீரில் அலையும் முகம்

அலகு - 2 சிறுகதைகள்

1. புதுமைப்பித்தன் – கடவுளும் கந்தசாமிப் பிள்ளையும்
2. ஜெயகாந்தன் – யுக சந்தி
3. தி.ஜானகிராமன் - சிலிர்ப்பு
4. நாஞ்சில் நாடன் – சூடிய பூ சூடற்க
5. பட்சி – பெத்த வயிறு

அலகு - 3 நீதி இலக்கியம்

1. திருக்குறள் - அறன் வலியுறுத்தல்
2. ஏலாதி – (பா.எண் : 15,16,26,39,47)
3. கார்நாற்பது – (முதல் 10 பாடல்கள்)

அலகு - 4 இதழியல் கலை

1. இதழியல் விளக்கம் (இதழியல் விளக்கமும் இலக்கணமும், இதழ்களின் பணிகளும் பொறுப்புகளும், இதழ்களின் வகைகள்)
2. தமிழ் இதழ்கள் (நாளிதழ்கள், வார இதழ்கள், மாத இதழ்கள்)
3. தமிழ் ஊடகங்கள் (வானொலி, தொலைக்காட்சி, இணையம்)

அலகு – 5 இலக்கிய வரலாறும் இலக்கணமும்

1. தமிழ்க் கவிதையின் தோற்றமும் வளர்ச்சியும் (மரபுக்கவிதை, புதுக்கவிதை)
2. தமிழ்ச் சிறுகதையின் தோற்றமும் வளர்ச்சியும்
3. பதினெண் கீழ்க்கணக்கு நூல்கள்
4. **இலக்கணம் :** அ)ஒற்றுமிகும் இடங்கள், ஆ) ஒற்று மிகா இடங்கள்

பார்வை நூல்கள்

1 . தமிழ்த்துறை வெளியீடு
2. இலக்கிய வரலாறு – பேராசிரியர் முனைவர் பாக்யமேரி
3. இதழியல் கலை - மா.பா.குருசாமி

15UHL11H	PART-I: HINDI-I	SEMESTER- I

Total Credit: 4
Hours per week: 6

Prose, Non-detailed Text, Grammar & Translation Books Prescribed:

1. PROSE : **Nuthan Gadya Sangrah**

EDITOR: Jayaprakash (Prescribed Lessons – only 4)

Lesson 1 - Razia
Lesson 2 – Makreal
Lesson3- Bahtha Pani Nirmala
Lesson 4 – Rashtrapitha Mahathma Gandhi

PUBLISHER: Sumitra Prakashan Sumitravas,
16/4 Hastings Road,
Allahabad – 211 001.

2. NON DETAILED TEXT: Kahani Kunj.

EDITOR: Dr.V.P.Amithab. (Stories 1 -4 only)
Publisher : Govind Prakashan Sadhar Bagaar,
Mathura,
Uttar Pradesh – 281 001.

3. GRAMMAR : Shabdha Vichar (Sangya, Sarvanam, Karak, Visheshan) ONLY
(Noun, Pronoun, Adjective, Case Endings)
Theoretical & Applied. Book for

REFERENCE : Vyakaran Pradeep by Ramdev.
Publisher : Hindi Bhavan,
36,Tagore Town
Allahabad – 211 002. 4.

4. **TRANSLATION:** English- Hindi only. Anuvadh Abhyas – III
(1-10 lessons Only)

PUBLISHER: Dakshin Bharath Hindi Prachar Sabha
Chennai -17.

5. **COMPREHENSION :** Passage from Anuvadh Abhyas – III
(16- 30)

Dakshin bharath hindi prachar sabha,
Chennai- 17.

15UML11M	PART-I: MALAYALAM-I	SEMESTER-I

Total Credit: 4
Hours per week: 6

Paper I Prose, Composition & Translation

This paper will have the following five units:

Unit I &II - Novel
Unit III & IV - Short story
Unit V **-** Composition & Translation

TEXT BOOKS:

Unit I &II - Naalukettu – M.T. Vasudevan Nair (D.C. Books, Kottayam, Kerala)

Unit III & IV - Manikkianum Mattu Prathana Kathakalum – Lalithampika Antharjanam (D.C.Books, Kottayam, Kerala)

Unit V -Expansion of ideas, General Essay and Translation of a simple passage from English about **100** words) to Malayalam.

REFERENCE BOOKS:

1. **Kavitha Sahithya Charitram** –*Dr. M.Leelavathi* (Kerala Sahithya Academy, Trichur)
2. **Malayala Novel Sahithya Charitram** –*K.M.Tharakan*(N.B.S. Kottayam)
3. **Malayala Nataka Sahithya Charitram-** *G.Sankarapillai*(D.C.Books, Kottayam)
4. **Cherukatha Innale Innu** –*M.Achuyuthan*(D.C. Books, Kottayam)
5. **Sahithya Charitram Prasthanangalilude**-*Dr. K.M. George*,(Chief Editor) (D.C. Books, Kottayam)

15UFL11F	PART-I: FRENCH-I	SEMESTER- I

Total Credit: 4
Hours per week: 6

French Language for Under-graduate Degree Programmes

Compétence Culturelle	Compétence De communication	Compétence grammaticale
UNITÉ 1 – Ici, en France		
• Moi et les Autres • La France Express	• INTERACTION: s'identifier • RÉCEPTION ECRITE: Comprendre une annonce d'aeroport • RÉCEPTION ORALE: comprendre l'ecrit de la rue (Panneaux, plaques, rues...) • PRODUCTION ÉCRITE**:** écrire un SMS	• Le présent des verbes: Je suis, je reste,J'arrive • Le lieu: (je suis) à… (je suis) ici • L'infinitif
UNITÉ 2 – Ici, en classe		
• Moi et le francais • Le francais dane le monde	• INTERACTION: Se présenter • RÉCEPTION ORALE: Comprendre des consignes Orales • RÉCEPTION ÉCRITE: Comprendre une fiche D''inscription • PRODUCTION ÉCRITE: écrire un texte à 'impératif	• Tu/vous • Le present des Verbes en-er et de être:je, tu,vous • La forme Impérative (tu ,vous) Des verbes en-er
UNITÉ 3 - Samedi		
• Le fil du temps	• INTERACTION: S'informer • RÉCEPTION ORALE: Comprendre une annonce • RÉCEPTION ÉCRITE: Comprendre un article (titres et illustrations) • PRODUCTION ÉCRITE: écrire des slogans	• Les articles Défines:le,la,les • A,de+le,la,les: Au,aux,du,des,à l', de l' • Être(présent)I'heure • Ll faut+nom Ll faut+infinitive • Pharses

		verbe+complément, Complément+verbe
UNITÉ 4 - Dimanche		
• Les activités Culturelles des Français	• INTERACTION: Acheter,demander des Informations • RECEPTION ORALE: Comprendre les Titres du journal à la radio • RÉCEPTION ÉCRITE: Comprendre les Informations • PRODUCTION ÉCRITE: Inventer des noms de journaux	• Faire, present • Avior, present • Ll y a • Le présent des verbes en-er: Regarder • Combien? • Quand? • Complément de nom: Tremblement de terre, les noms de pays…. • Du,des,de la(reprise U2) • Les adjectifs possessifs: Mon,ta,son, Ma,ta,sa Mes,tes,ses
UNITÉ 5 – Dommage!		
• Un baby-boom en 2000 et 2001 • L'amour, toujours	• INTERACTION: exprimer la tristesse, la peur, conseiller,encourager • RÉCEPTION ORALE: Comprendre une émission De radio • RÉCEPTION ÉCRITE: Comprendre un sondage • PRODUCTION ÉCRITE: écrire des blogs	• Est-ce que • Le present des verbes pouvoir,Vouloir • Le conditionnel des Verbs pouvoir, Vouloir • Ne…pas

TEXT BOOK:

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

15UEG12E	PART –II: ENGLISH-I	SEMESTER- I

Total Credit: 4
Hours per week: 6

OBJECTIVES:

1. To develop the language competence of the students.
2. To be enriched with functional English.

UNIT - I

PROSE

1. My Financial Career – Stephen Leacock
2. At School – Gandhi
3. Ecology – Barry Commoner

UNIT – II

SHORT STORIES

1. The Gateman's Gift – R.K. Narayan
2. The Open Window – H.H. Munro
3. The Face of Judas Iscariot – Bonnie Chamberlain

UNIT – III

ONE ACT PLAY

1. The Discovery – Herman Ould

UNIT – IV

FUNCTIONAL GRAMMAR

1. Vocabulary Exercises
2. Synonyms, Compound Words, etc
3. Communication Skills – Tasks
4. Different types of sentences
5. The Structure of Sentences
6. Transformation of Sentences

UNIT – V

COMPOSITION TASKS

1. Greeting, Introducing, Requesting, Inviting
2. Congratulating, Thanking, Apologising, Advice
3. Suggestions, Opinions, Permissions.
4. Comprehension

TEXT BOOKS:

1. *Seshasayee. N*. 2001. **Honeycomb.** Anu Chitra Publications, Chennai.
2. *Syamala, V*. 2002. **Effective English Communication for You**. Emerald Publisher, Chennai.

REFERENCE BOOKS:

1. *Rajamanickam. A*. 2001**. Everyman's English Grammar.** Macmillan.
2. *Krishna Mohan and Meera Banerji*. 2005. **Developing Communication Skills.** Macmillan, Chennai.
3. *Wren, P.C. and H. Martin***.** 1998**. High School English Grammar and Composition.** Macmillan.

15UBT13A	CORE –I: CELL BIOLOGY	SEMESTER - I

Total Credits: 4
6Hours / Week

OBJECTIVES:

1. To study the structural features of different types of cells.
2. To study the cellular Organelles & their functions.

CONTENTS

UNIT-I

Discovery of the cells, development of cell theory, classification of cell types, difference between Prokaryotic and Eukaryotic cell organization.

UNIT-II

Membrane architecture. Active transport, Passive transport, diffusion and osmosis. Chemistry of carbohydrates, lipids, proteins and nucleic acids.

UNIT-III

Structure and Function of Ribosome, Mitochondria, Chloroplast, Golgi apparatus, lysosomes, flagellum, microbodies, endoplasmic reticulum, vacuoles, peroxysomes and nuclear compartment. Heterochromatin and euchromatin, polytene chromosomes.

UNIT-IV

Cell cycle, mitosis, meiosis, crossing over. Characteristics of cancer, Apoptosis.

UNIT-V

Microfilaments, microtubules. Specialized cells - nerve cells, sperm cells, muscle cells and cells of vision. Nucleo-cytoplasmic interaction. Cell-Cell signaling and its types.

TEXT BOOKS:

1. *Bruce Alberts*. 1998. **Essential Cell Biology.** 1st edition. Garland Publishers.
2. *De Roberties.* 2003. **Cell and Molecular Biology.** 8th edition. EDP Lippincott Williams.

REFERENCE BOOKS:

1. *Lodish, H. & Baltimore. D.* 1994. **Molecular cell Biology**. 2nd edition.American Scientific Books.
2. *Gerald Karp.* 2002. **Cell and Molecular Biology.** 3rd edition. John Wiley Sons.

15UBT13P	CORE LAB- I	SEMESTER - I

Total Credits: 2
3 Hours / Week

1. Isolation of Chloroplast
2. Cell(Yeast) counting
3. Blood smear preparation for blood cell identification
4. Mitotic preparation of onion root tip
5. Meiotic preparation of grasshopper testis
6. Preparation of permanent slide
7. Simple staining
8. Microscopic observation of Dicot leaf section
9. Staining of plant cells – Onion epidermal cells
10. Staining of starch granules
11. Lignin staining

REFERENCE BOOKS:

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.

15UCY1AA	ALLIED - I: CHEMISTRY	SEMESTER - I

Total Credits: 3
4 Hours / Week

OBJECTIVE:

1. On successful completion of this course the students shall gain knowledge in the basics of chemistry which helps bioscience students to understand chemical bonding in the biomolecules and the techniques involved in the biochemistry.

CONTENTS

UNIT – I

Chemical bonding:

1. Molecular Orbital Theory, bonding, antibonding, and nonbonding orbitals. MO configuration of H_2, N_2, O_2, F_2- bond order – diamagnetism and paramagnetism.
2. Ionic Bond: Nature of ionic bond, structure of NaCl and CsCl, factors influencing the formation of ionic bond.
3. Covalent Bond: Nature of covalent bond, structure of CH_4, NH_3, H_2O, shapes of $BeCl_2$, BF_3, based on VSEPR theory and hybridization.

UNIT – II

Solutions:

1. Normality, molarity, molality, molefraction, moleconcept.
2. Primary and secondary standards – preparation of standard solutions.
3. Principle of Volumetric analysis (with simple problems).
4. Strong and weak acids and bases - Ionic product of water- pH, pKa, pKb, Buffer solution and pH and pOH simple calculations.

UNIT–III

Basic Organic Chemistry:

1. Electron displacement effect in organic compounds - Inductive effect – Electromeric effect - Resonance effect, Hyperconjugation, Steric effect, acidity of organic acids and bases.

2. Isomerism, Symmetry of elements (Plane, Centre and Axis of symmetry), Molecules with one chiral carbon and two adjacent chiral carbons –Optical isomerism of tartaric acid, Enantiomers – Diastereomers – Separation of racemic mixture - Geometrical isomerism (maleic & fumaric acid).

UNIT – IV

1. **Surface Chemistry:**
   Adsorption – Chemisorption - Physisorption. Difference between chemisorption and physisorption - Applications of adsorption - Factors influencing adsorption. Isobar, Isostere.
2. Chromatography - Principle & applications of Column, Paper and Thin Layer Chromatography.

UNIT – V

Dyes:
Terms used – Chromophore,Auxochrome, Bathochromic shift, Hypsochromic shift, Hyperchromic shift, Hypochromic shift. Classification of dyes based on chemical structure & application- Preparation of azo (Methyl orange) and triphenyl methane (Malachite green) dyes.

TEXT BOOKS :

1. *R. D. Madan. 2001.* **Modern Inorganic Chemistry**. S. Chand & Company, New Delhi,.
2. *Puri , Sharma, Pathania. 2004.* **Principles of Physical Chemistry**, Vishal Publishing Company, Jalandhar.
3. *M. K. Jain, S. C. Sharma. 2001*. **Organic Chemistry**, Shoban Lal Nayin Chand, Jalandhar.
4. *Gopalan R. 1991.***Elements of Analytical Chemistry**, Sultan Chand & Sons, New Delhi.

15UCY1AP	ALLIED LAB-I	SEMESTER - I

Total Credits: 2
3 Hours / Week

VOLUMETRIC ANALYSIS:

1. Estimation of sodium Hydroxide using standard sodium carbonate
2. Estimation of Hydrochloric acid using standard oxalic acid
3. Estimation of oxalic acid using standard sulphuric acid
4. Estimation of Ferrous sulphate using standard Mohr salt solution
5. Estimation of oxalic acid using standard ferrous sulphate
6. Estimation of Ferrous ions using Mohr salt solution

ORGANIC ANALYSIS

1. To distinguish between aliphatic & aromatic.
2. To distinguish between Saturated & Unsaturated.
3. Detection of elements(N,S, Halogens)
4. Functional group tests for Phenols, Acids (Mono and Di), aromatic primary amine, Mono amide, Di amide, Carbohydrate.
   Functional group characterized by confirmatory test.

TEXT BOOKS:

1. **Basic Principles of Practical Chemistry,** *V. Venkateswaran, R. Veeraswamy, & A.R. Kulandaivelu* , Second Edition, Sultan Chand & sons.

15UTL21U	பகுதி – 1: தமிழ் தாள் - 2	இரண்டாம் பருவம்

Total Credit: 4
Hours per week: 6

(இரண்டு ஆண்டுகள் தமிழ் பயிலும் மாணவர்களுக்கு உரியது)

சமய இலக்கியங்கள்

அலகு -1 சைவ வைணவ இலக்கியங்கள்

1. திருஞானசம்பந்தர் – தோடுடைய செவியன் (11 பாடல்கள்)
2. குலசேகர ஆழ்வார் – திருவேங்கட மலைத்தொடர்பு வேண்டல்

அலகு -2 கிறித்துவ இசுலாமிய இலக்கியங்கள்

1. கண்ணதாசன் – இயேசு காவியம் – மலைப்பொழிவு
2. உமறுப்புலவர் - சீறாப்புராணம் – மானுக்குப் பிணை நின்ற படலம்

அலகு -3 சமயச் சான்றோர் வரலாறு

1. சைவ சமயச் சான்றோர்

   திருநாவுக்கரசர், மாணிக்கவாசகர்
2. வைணவ சமயச் சான்றோர்

   பெரியாழ்வார் , ஆண்டாள்
3. கிறித்துவ சமயச் சான்றோர்

   கால்டுவெல், ஜி.யூ.போப்
4. இசுலாமிய சமயச் சான்றோர்

   குணங்குடி மஸ்தான் , சவ்வாதுப் புலவர்

அலகு – 4 சமய இலக்கிய வரலாறு

1. சைவம் 2. வைணவம்

அலகு - 5 இலக்கணம்

1. பெயர்ச்சொல், 2. வினைச்சொல், 3. இடைச்சொல், 4. உரிச்சொல் – பொது இலக்கணம்

பார்வை நூல்கள்

1 . தமிழ்த்துறை வெளியீடு
2. தமிழ் இலக்கிய வரலாறு – பேராசிரியர் முனைவர் பாக்யமேரி

15UHL21H	PART-I: HINDI-II	SEMESTER- II

Total Credit: 4
Hours per week: 6

(Modern Poetry, Novel, Translation & Letter Writing)

1. Modern Poetry: Shabari – By Naresh Mehtha

Publishers: Lokbharathi Prakashan I Floor,Duebari Building
Mahathma Gandhi Marg,
Allahabad -1.

2. Novel: Seva Sadhan – By Prem Chand

Publisher:

3.Translation: Hindi – English Only,
(anuvadh abyas – iii) lessons.1 – 10 only publisher:
dakshin bharath hindi prachar sabha chennai – 600 017.

4. Letter Writing: (Leave letter, Job Application, Ordering books, Letter to Publisher, Personal letter).

15UML21M	PART-I: MALAYALAM-II	SEMESTER- II

Total Credit: 4
Hours per week: 6

PAPER II PROSE: NON-FICTION

This Paper will have the following five units:

UNIT I & II

Biography

UNIT III, IV & V

Travelogue

TEXT BOOKS PRESCRIBED:

Unit I & II - *Changampuzha Krishna Pillai:* **Nakshatrangalude Snehabhajanam** – *M.K. Sanu* (D.C. Books, Kottayam)

Unit III, IV & V - **Kappirikalude Nattil –** *S.K. Pottakkadu* (D.C. Books, Kottayam).

REFERENCE BOOKS:

1. **Jeevacharitrasahithyam –***Dr. K.M. George*(N.B.S. Kottayam)
2. **Jeevacharitrasahithyam Malayalathil -** *Dr.NaduvattomGopalakrishnan* (Kerala Bhasha Institute, Trivandrum)
3. **Athmakathasahithyam Malayalathil –***Dr. Vijayalam Jayakumar*(N.B.S. Kottayam)
4. **Sancharasahithyam Malayalathil -** *Prof.Ramesh Chandran*. V, (Kerala Bhasha Institute, Trivandrum)

15UFL21F	PART-I: FRENCH-II	SEMESTER- II

Total Credit: 4
Hours per week: 6

French Language for Under-graduate Degree Programmes

Compétence Culturelle	Compétence De communication	Compétence grammaticale
UNITÉ 6 – Super!		
• L'égalité homme/femme	• INTERACTION: Exprimer des sentiments, exprimer la joie, le plaisir, le bonheur • RÉCEPTION ORALE: Comprendre un jeu radiophonique • RÉCEPTION ÉCRITE: Comprendre des announces • PRODUCTION ÉCRITE: Écrire des cartes postales	• Les noms de professions masculine/feminine • Le verb finir et less Verbes du groupe en-ir • Le present de l'impératif • Savoir(present) • Le participle passé: Fini, aimé, arrive, dit,écrit • Quel(s), quelle(s)..: Interrogatif et Exclamatif • À + infinitive • Les articles: n,une,des
UNITÉ 7 – Quoi?		
• Le 20 siécle: Petits progrés Grand progrés	• INTERACTION: Decrire quelque chose, une personne • RECEPTION ORALE: Comprendre un message publicitaire • RÉCEPTION ÉCRITE: Comprendre un dépliant touristique • PRODUCTION ÉCRITE: Écrire des petites annonces	• On • Plus, moins • Le verbe aller: • Present, impératif • Aller + infinitife • Le pluriel en –x
UNITÉ 8 – Et aprés		
• Nouvelles du jour	• INTERACTION: Raconteur,situer un récit dans le temps • RÉCEPTION ORALE:	• L'imparfait:: quel-Ques forms pour introduire le récit:Il faisait, il y avait, il Était

	Comprendre une description • RÉCEPTION ÉCRITE: Comprendre un test • PRODUCTION ÉCRITE: écrire des cartes postales	• Un peu, beaucoup, trop,Assez • Trés • Le verbe venir: Présent, impératif • En Suisse, au Maroc, aux Etats-Unis
UNITÉ 9 – Mais oui!		
• La génération des 20-30 ans	• INTERACTION: Donner son opinion, Expliquer pourquoi • RÉCEPTION ORALE: Comprendre des informations à la radio • RÉCEPTION ÉCRITE: Comprendre un texte informatif • PRODUCTION ÉCRITE: éncrire un mél de protestation	• Répondre, prendre: Présent, impératif, part Passé • Parce que pourquoi • Tout/tous, toute/s Tous/toutes les… (répétition action)
UNITÉ 10 – Mais non!		
• De la ville à la campagne	• INTERACTION: Débat:: exprimer l'accord, exprimer le Désaccord • RECEPTION ORALE: Comprendre un message sur un répondeur téléphonique • RÉCEPTION ÉCRITE: Comprendre un témoignage • PRODUCTION ECRITE: Rediger des petites Announces immobilieres	• Le verbe devoir: Present et participe passé • Le verbe vivre, present • Aller + infinitive • Venir+ infinitive • Etre pour/contre

TEXT BOOK:

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

15UEG22E	PART-II: ENGLISH-II	SEMESTER II

Total Credit: 4
Hours per week: 6

OBJECTIVES:

1. To develop the language competence of the students.
2. To be enriched with functional English.

UNIT - I

PROSE

1. Words of Wisdom – Chetan Bhagat
2. Forgetting – Robert Lynd
3. My Early Days – Dr. Abdul Kalam

UNIT - II

SHORT STORIES

1. Am I Blue? – Alice Walker
2. Last Leaf – O Henry
3. Selfish Giant – Oscar Wilde

UNIT - III

ONE ACT PLAY

1. Soul Gone Home - Langston Hughes

UNIT - IV

FUNCTIONAL GRAMMAR

1. Lexical Skills and Question Forms
2. Idioms and Phrases – Subject-Verb Agreement
3. Spelling, Antonyms and Synonyms, Infinitives
4. Vocabulary, Report Writing
5. Plurals, Particles in Adjectives
6. Apostrophe, Archaic Words, Art of Persuasion
7. Syllables, Changing Adjectives to Nouns
8. Homonyms, Prepositions
9. Compound Words, Acronyms, Collective Nouns, Degrees of Comparison

UNIT - V

COMPOSITION TASKS

1. Letter Writing - Structure
2. Business Correspondence – Memos, reports, proposals
3. Resume & C.V.
4. Advertisements
5. Notices, Agenda, Minutes
6. Circulars
7. Essay Writing
8. Précis Writing
9. Dialogue Writing
10. Soft Skills, Business English

TEXT BOOKS:

1. *Board of Editors.* 2012. **Radiance – English for Communication**, Emerald Publishers.
2. *Syamala, V*. 2002. **Effective English Communication for You**. Emerald Publisher, Chennai.

REFERENCE BOOKS:

1. *Rajamanickam. A.* 2001**. Everyman's English Grammar.** Macmillan.
2. *Krishna Mohan and Meera Banerji*. 2005. **Developing Communication Skills.** Macmillan, New Delhi.
3. *Wren, P.C. and H. Martin***.** 1998**. High School English Grammar and Composition.** Macmillan

15UBT23A	CORE –II: GENETICS	SEMESTER - II

Total Credits: 4
6 Hours / Week

OBJECTIVES:

1 To learn the basic vocabulary of genetics

2 To Study the Mendelian and Non Mendelian models of inheritance that governs passage of genetic traits across generation.

CONTENTS

UNIT-I

History of Mendel, Mendel's work: Monohybrid Experiment, Dihybrid Experiment, Chromosomal theory of Inheritance, Extra chromosomal Inheritance, Multiple Alleles: Independent assortment (Back Cross and Test Cross), Pseudoalleles, Complementation Test.

UNIT-II

Concept of Gene, Genetic Interactions: Co-Dominance, Incomplete Dominance, Pseudodominance, Epistasis, Lethality and Lethality genes, Maternal effects and maternal effect genes, Transposable elements of Prokaryotes and Eukaryotes.

UNIT-III

Structure of Prokaryote and Eukaryote chromosome, Mitochondrial genome, Chloroplast Genome, Genetics of Haemoglobin, Crossing over: Mechanism of crossing over, Advantages of crossing over, Chromosome mapping. Transformation, conjuction and transduction.

UNIT-IV

Chromosomal Variations: Numerical – euploidy and aneuploidy; Structural – deletion, duplication, inversion and translocation. Hybridization technique and selection; out breeding and heterosis.

UNIT-V

Model organism for genetic analysis of development- Drosophila & Arabidopsis, Population Genetics: Gene frequency, Calculation of Gene frequency, Pedigree analysis, Genetic Counseling.

TEXT BOOKS:

1 *Strickberger, M. W.* 2013. **Genetics.** 3rd edition. Prentice Hall College Division, New Delhi.

2 *Gardner, E.J.* 1991. **Principles of Genetics.** 8th edition. John Wiley and Sons Inc., New York.

REFERENCE BOOKS:

1. *Winter, P.C., Hickey, G. I. and Fletcher, H.L.* 2000. **Genetics.** 1st edition. Viva Books Pvt Ltd.
2. *Brown, T. A.* 1999. **Genetics**. 3rd edition. Chapman and Hall.

15UBT23P	CORE LAB -II	SEMESTER - II

Total Credits: 2
3 Hours / Week

1. Isolation of Auxotrophic Mutants
2. Sex chromatin observation from Buccal smear
3. Effect of UV radiation on bacterial growth
4. Conjugation
5. Plasmid curing
6. Preparation of competent cells
7. Bacterial Transformation
8. Determination of Phage Titer
9. Isolation of Antibiotic resistant Mutants
10. Isolation of DNA from Epithelial cells
11. Determination of Thermal death time

REFERENCE BOOKS:

1. *Joseph Sambrook, Michael R. Green.* 2012**. Molecular Cloning: A Laboratory Manual.** 4th edition. Cold Spring Harbor.
2. *Thomas R. Mertens and Robert L. Hammersmith*. 1997. **Genetics Laboratory Investigations.** 11th edition. Benjamin Cummings.

15UBT2AA	ALLIED Y- II: BIOCHEMISTRY	SEMESTER - II

Total Credits: 3
4 Hours / Week

OBJECTIVES:

1. To learn the structure, function & interrelationship of various bio molecules & consequences of deviation from normal.
2. To study the integration of the various aspects of metabolism & their regulatory pathways.

CONTENTS

UNIT-I

Molecular weight, Molarity, Molality, Normality. pH and buffers. Chemical Bonding: Electrostatic, Covalent, Ionic and Vander waals. Enzymes and co-enzymes, IUB classification and nomenclature of enzymes, regulation of enzyme activity, active sites, activators and inhibitors- Isoenzymes, allosteric enzymes.

UNIT-II

Definition, Nomenclature, Classifications and Structures of sugars. Structural features of polysaccharides. Glycolysis, TCA cycle, Glycogen breakdown and synthesis, Gluconeogenesis, HMP Pathway.

UNIT-III

Definition, Nomenclature, Classifications and Structure of lipids, Metabolism of lipids- Fatty acid biosynthesis and oxidations.

UNIT-IV

Amino acids and peptides – classifications, Structural Organization of protein (primary, secondary, tertiary and Quaternary), Functions of proteins.

UNIT-V

Definition, Nomenclature, Classifications and Structure of nucleic acids, Biosynthesis and degradation of nucleic acids (purines and pyrimidines) Integration of metabolism and regulations.

TEXTBOOKS:

1. *Geoffery L Zubay*. 1995. **Principles of Biochemistry**. 1st edition. WCB publishers.
2. *Ambika Shanmugam*. 2012. **Fundamentals of Biochemistry**, 7th edition. Lippincott Williams & Wilkins.

REFERENCE BOOKS:

1. *Lehninger Albert. L , Nelson David. L and Cox Michael M,1993.* **Principles of Biochemistry.** 2nd edition. CBS Publishers And Distributors, New Delhi.
2. *Voet, D. and Voet, J. G.* 1995. **Fundamentals of Biochemistry.** 2ndedition. John Wiley and sons inc.

15UBT2AP	ALLIED LAB -II	SEMESTER - II

Total Credits: 2
3Hours / Week

1. Estimation of Protein - Lowry's *et al.,* method
2. Estimation of Protein- Bradford's method
3. Estimation of DNA- DPA Method
4. Estimation of RNA - Orcinol method
5. Estimation of Sugars -Anthrone method
6. Estimation of amino acids -Ninhydrin method
7. Estimation of ascorbic acid
8. Determination of Acid Number, Saponification number and Iodine number of Oil
9. Amino acid separation by paper chromatography
10. Amino acid separation by Thin layer chromatography
11. Preparation of Albumin from Egg
12. Estimation of Protease
13. Estimation of Amylase

REFERENCE BOOK:

1. *Sadasivam, S. and Manickam, A.* 1996. **Biochemical Methods,** New Age International.

15UTL31U	பகுதி -1 : தமிழ் தாள் -3	மூன்றாம் பருவம்

Total Credits: 4
Hours/week: 5

காப்பியம் – சிற்றிலக்கியம் – நாடகத்தமிழ்

அலகு -1 காப்பியங்கள்

1. சிலப்பதிகாரம் – மங்கல வாழ்த்துப் பாடல்
2. மணிமேகலை – மலர்வனம் புக்க காதை
3. சீவக சிந்தாமணி – பதுமையார் இலம்பகம் (முதல் 20 பாடல்கள்)

அலகு – 2 சிற்றிலக்கியங்கள்

1. கலிங்கத்துப்பரணி – களம் பாடியது
2. மீனாட்சியம்மை பிள்ளைத்தமிழ் – வருகைப் பருவம்

அலகு – 3 நாடகத்தமிழ்

1. சேர தாண்டவம் – பாரதிதாசன்

அலகு - 4 காப்பியம், சிற்றிலக்கியம் – வரலாறு

1. காப்பியங்களின் தோற்றமும் வளர்ச்சியும்
2. சிற்றிலக்கியத்தின் தோற்றமும் வளர்ச்சியும்
3. நாடகத்தின் தோற்றமும் வளர்ச்சியும்

அலகு- 5 இலக்கணம்

1. எழுத்து ,அசை, சீர், தளை, அடி, தொடை – விளக்கம்
2. அணி – உவமையணி, தற்குறிப்பேற்றஅணி
3. அலுவலகம் சார்ந்த கடிதம் – விண்ணப்பங்கள் , வேண்டுகோள் ,முறையீடு

பார்வை நூல்கள்

1 . தமிழ்த்துறை வெளியீடு
2. இலக்கிய வரலாறு – பேராசிரியர் முனைவர் பாக்யமேரி
3. இதழியல் கலை - மா.பா.குருசாமி

15UHL31H	PART-I: HINDI-III	SEMESTER -III

Total Credits: 4
Hours/week: 5

(Poetry, History of Hindi Literature, Alankar)

1. **Poetry**: Kavya Prasar – By Dr.Balanath Puplisher: Jawahar Pusthakalay Sadar Bazaar, Mathura – U.P. 281 001. (Pracheen – Kabir, Tulsi, Sur & Meera, Aadhunic – Gupt, Prasad, Panth, Nirala, Dinakar, Agneya

Short Notes On Poets -Only the above mentioned.

2. **History Of Hindi Literature**:
(Only Aadi Kaal and Bhakthi Kaal. Only a general knowledge.) ALANKAR: Anupras, Yamak, Slesh, Vakrokthi, Upama, Rupak,

REFERENCE BOOKS:

Hindi Sahithya Ka Saral Ithihass By Rajnath Sharma, Vinod Pustak Mandir, Agra – 282 002. Kavya Pradeep Rambadri Shukla, Hindi Bhavan, 36, Tagore Town, Allahabad – 211 002.

3. **Alankar:** Anupras, Yamak, Slesh, Vakrokthi, Upama, Rupak,

15UML31M	PART-I: MALAYALAM-III	SEMESTER III

Total Credits: 4
Hours/week:5

PAPER III- POETRY

This Paper will have the following five units:

Unit I, II & III

A part of Ezuthachan's Work

Unit IV & V

A Khandakavya of Vallathol

Text Books prescribed:

Unit I, II & III

Karnnaparvam – Ezuthachan
(Poorna Publications, Calicut)

Unit IV & V

Achanum Makalum – Vallathol (D.C. Books, Kottayam)

15UFL31F	PART-I: FRENCH-III	SEMESTER -III

Total Credits: 4
Hours/week: 5

French Language for Under-graduate Degree Programmes

Compétence Culturelle	Compétence de Communication	Compétence Grammatical
UNITÉ 1- Excuses et vœux		
• Convivialité (lieux et société, l'apéritif)	• 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	• Pronoms personnels toniques *moi,je…;toi…tu* • Pronoms personnels objets *Me,te,le…* • Lesverbsen-ercomme appeler,acheter • Lesadjectives possessives *nos,vos,leurs*
UNITÉ 2 – Bravo et merci		
• 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
UNITÉ 3 – Faire et dire		
• 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	• Ce/*cet,cette,ces* • Le verbe voir • Envoyer,appuyer • Les articles partitifs *du,de la (de l)',des,de*

	consommateurs • PRODUCTION ÉCRITE : Écrire un règlement	
UNITÉ 4 – Faire ci ou faire ça		
• 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…*
UNITÉ 5 – Cœur et santé		
• 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

TEXT BOOK:

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

15UEG32E	PART-II: ENGLISH-III	SEMESTER III

Total Credits: 4
Hours/week: 5

OBJECTIVES:

1. To develop the language competence of the students.
2. To be enriched with functional English.

UNIT –I

PROSE

1. On Habits – A. G. Gardiner
2. Men and Women – Virginia Woolf
3. Sweets for Angels – R. K. Narayan

UNIT –II

SHORT STORIES

1. The Ant and the Grasshopper – Somerset Maugham
2. A Day's Wait – Ernest Hemingway
3. The Doll's House – Catherine Mansfield

UNIT III

ONE ACT PLAY

1. The Bishop's Candlesticks- Norman McKinnel
2. A Kind of Justice- Margaret Wood

UNIT -IV

FUNCTIONAL GRAMMAR

1. The Noun
2. The Adjective
3. The Adverb
4. Sentence Structure
5. Sentence Pattern

UNIT -V

COMPOSITION TASKS

1. Human relationships in academic and professional life
2. Deciding on a career
3. Finding a Job
4. Going for an Interview
5. Writing Projects
6. Account of a task completed
7. Recommendation for promotion
8. Writing recording of achievement
10. Story Writing

TEXT BOOKS:

1. *Daniel, James. P.C.* **Focus: A Course in Language and Communication Skills**, Harrows Publications, Bangalore, 560068.
2. *Daniel, James.P.C.* 1989. **English for Career Development, a Course in Functional** English, Orient Longman Private Limited Publications.

REFERENCE BOOKS:

1. *Rajamanickam. A.* 2001**. Everyman's English Grammar.** Macmillan.
2. *Krishna Mohan and Meera Banerji*. 2005. **Developing Communication Skills.** Macmillan, New Delhi.
3. *Wren, P.C. and H. Martin***.** 1998**. High School English Grammar and Composition.** Macmillan.

15UBT33A	CORE - III: MOLECULAR BIOLOGY	SEMESTER - III

Total Credits: 4
6 Hours / Week

OBJECTIVES:

1. To learn the basic vocabulary of molecular biology
2. To study the science of DNA and RNA structure and function

CONTENTS

UNIT- I

Nucleic Acids- structure and functions (DNA and RNA). Watson and Crick model of DNA and other forms of DNA (A and Z). Functions of DNA and RNA including ribosomes. DNA Replication of Prokaryotic and Eukaryotic.

UNIT- II

DNA Repair- Causes and mechanism- photo-reactivation, excision repair, mismatch repair, SOS repair. Recombination in prokaryotes - Transformation, Conjugation and Transduction.

UNIT- III

Transcription in Prokaryotes and Eukaryotes. Mechanism of Promoters and RNA polymerase and transcription factors.

UNIT- IV

Translation. Mechanism of translation in Prokaryotes and Eukaryotes, Post translational modifications of proteins. Regulation of Gene expression in Prokaryotes (Operon concept (*Lac* and *Tryp*)) and in Eukaryotes (galactose metabolism in yeast).

UNIT- V

Gene organization and expression in Mitochondria and Chloroplasts. Transposable elements in maize and drosophila

TEXT BOOKS:

1. *Gardner, E.J.* 1991. **Principles of Genetics**. 6th edition. John Wiley& sons, New York.
2. *David Freifelder.* 2008. **Molecular Biology.** 2nd edition. Naorosa publishing house, New Delhi.

REFERENCE BOOKS:

1. *Lewin, B.* 1997. **Gene VI.** Oxford University Press.
2. *Brown, T.A.* 1999. **Genetics- A Molecular Appoarch.**3rd edition. Chapman& Hall.

15UBT33P	CORE LAB-III	SEMESTER – III

Total Credits: 2
3Hours / Week

MOLECULAR BIOLOGY

1. Preparation of Buffer- Phosphate, Acetate, *Tris* Buffer
2. Preparation of Equilibrated Phenol
3. Sucrose Gradient Centrifugation
4. Isolation of DNA from plant
5. Isolation of DNA from bacteria
6. Isolation of DNA from animal tissue
7. Plasmid isolation from bacteria
8. Separation of DNA by Agarose gel electrophoresis
9. Protein separation by SDS–PAGE
10. Silver staining and CBB staining of Polyacrylamide gel.

REFERENCES BOOKS:

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.

15UBT3AA	ALLIED - III : MICROBIOLOGY	SEMESTER - III

Total Credits: 3
4 Hours / Week

OBJECTIVES:

1. To learn the science of microbiology and to describe some of the general methods used in the study of microorganisms
2. To describe some of the various activities of microorganisms that are beneficial to humans

CONTENTS

UNIT -I

Definition and scope of microbiology - a general account on microbial diversity. Basic principles in microscopy, Types of microscopes- light, dark, phase contrast, fluorescent and electron microscope (Transmission and Scanning electron).

UNIT -II

General structure, growth and reproduction of Bacteria, fungi and Virus. Economic and industrial importance of yeast and moulds.

UNIT-III

Microbiological Media: Types, preparation, methods of sterilization; enumeration of microorganisms in soil, water and air; isolation of microorganisms from environment and infected tissue, Techniques of pure culture, maintenance and Preservation, Staining- stains and its types.

UNIT-IV

Physiology and biochemistry of microbes- Photo- autotrophs, Chemo-autotrophs, Parasitism, Saprophytism, Mutualism and Symbiosis, Commensalisms, endozoic microbes. Role of microbes in biogeochemical cycles.

UNIT-V

Viral pathogens of plants (TMV, Gemini virus), animals (rabies) and humans (HIV), Bacterial Pathogens of man (Tetanus, Tuberculosis, Pneumonia and Cholera).

TEXTBOOKS:

1. *Atlas M, Ronald. 1995.* **Principles of Microbiology.** Mcgraw - hill Inc.
2. *Michael Pelzar Jr.,*. **Microbiology.** 5th edition. McGraw Hill Education (India) Pvt Ltd.

REFERENCE BOOKS:

1. *Prescott, L. M., John P. Harley, Donald A. Klein.* 2004**. Microbiology.** 6th edition. McGraw-Hill Science Publication.
2. *Gerard J. Tortora.*2012. **Microbiology: An Introduction**, 11th edition. Benjamin Cummings Publishers.

15UBT3AP	ALLIED LAB- III	SEMESTER - III

Total Credits: 2
3 Hours / Week

1. Staining of bacteria – Simple, negative, gram staining
2. Fungal Staining (Lactophenol cotton Blue Staining)
3. Isolation of microorganism from soil by serial dilution technique
4. Isolation of microorganism from water by serial dilution technique
5. Different Methods of Streaking
6. Selective and differential Media preparation
7. Bacterial Growth curve
8. IMVIC test
9. Carbohydrate fermentation test
10. Triple Sugar Iron test
11. Catalase and urease test
12. Antibiotic sensitivity test
13. Methylene blue reduction test

REFERENCE BOOKS:

1. *Cappuccino*. 2005. **Microbiology**: **A Laboratory Manual**, Pearson Education.
2. *Kannan, N.* 2002. **Laboratory Manual in General Microbiology.** Panima Publishers.

15UTL41U	பகுதி – 1: தமிழ் தாள் – 4	நான்காம் பருவம்

Total Credits: 4
Hours/week: 5

(இரண்டு ஆண்டுகள் தமிழ் பயிலும் மாணவர்களுக்கு உரியது)

சங்க இலக்கியமும் நாட்டுப்புற இலக்கியமும்

அலகு – 1 எட்டுத்தொகை

1. குறுந்தொகை – (நெய்தல், பாடல் எண் : 57 – சிறைக்குடி ஆந்தையார்)
   (மருதம், பாடல் எண்: 61 – தும்பிசேர்கீரன்)
   (முல்லை, பாடல் எண்: 167 - கூடலூர்கிழார்)
2. கலித்தொகை – (குறிஞ்சிக்கலி, பாடல் எண் :16 – கபிலர்)
3. அகநானூறு – (பாலை, பாடல் எண் : 43 - நல்லந்துவனார்)
4. புறநானூறு – (பா.எண் : 279 – ஒக்கூர் மாசாத்தியார், பா.எண்: 312 - பொன்முடியார்)

அலகு - 2 பத்துப்பாட்டு

1. முல்லைப்பாட்டு – நப்பூதனார்

அலகு - 3 நாட்டுப்புறவியல்

1. நாட்டுப்புறப்பாடல்கள் – அறிமுகம்
2. தாலாட்டுப் பாடல்கள்
3. தொழிற்களப் பாடல்கள்

அலகு - 4 இலக்கிய வரலாறு

1. பத்துப்பாட்டு
2. எட்டுத்தொகை

அலகு - 5 இலக்கணம்

1. அகத்திணை – விளக்கம்
2. புறத்திணை – விளக்கம்

பார்வை நூல்கள்

1 . தமிழ்த்துறை வெளியீடு
2. இலக்கிய வரலாறு – பேராசிரியர் முனைவர் பாக்யமேரி
3. நாட்டுப்புற இயல் ஆய்வு – சு. சக்திவேல்

15UHL41H	PART-I :HINDI-IV	SEMESTER-IV

Total Credits: 4
Hours/week: 5

(**Drama, One Act Play, General Essay**)

1. **Ladai** Sarveshwar Dayal Saksena Publisher : Vani Prakashan New Delhi – 110 002.

2. **One act play :** Ekanki Panchamruth (Excluding Bohr Ka Thara)
Publisher: Govind Prakashan Mathura

3. **General essay**

Book for reference : Aadarsh Nibandh Vinodh Pustak Mandir
Hospital Road, Agra – 28

15UML41M	PART-I: MALAYALAM-IV	SEMESTER IV

Total Credits: 4
Hours / Week: 5

Drama & Folklore Paper IV. Drama & Folklore

Unit I, II & III A Drama

Unit IV & V Folklore

TEXT BOOKS:

1. Unit I, II & III **Lankalakshm**i – *C. N. Sreekantan Nair* (D.C. Books, Kottayam).
2. Unit IV & V **Oru Vadakkanveeragatha** – *M.T. Vasudevan Nair* (Puthariyamkam, Sahithya Kairali Publications, Bhagavathinada P.O.

REFERENCE BOOKS:

1. **Natyasasthram,** *K.P. Narayana Pisharodi*, Trans. (Kerala Sahithya Akademi, Thrissur).
2. **Malayala Nataka Sahithya Charithram**, *G. Sankara Pillai* (Kerala Sahithya Akademi, Thrissur).
3. **Malayala Nataka Sahithya Charithram**, *Vayala Vasudevan Pillai* (Kerala Sahithya Akademi Thrissur).
4. **Natakam – Oru Patanam** (*C. J. Smaraka Prasanga Samithi*, Koothattukulam).
5. **Natakaroopacharcha**, *Kattumadam Narayanan* (NBS, Kottayam)
6. **Folklore** – *Raghavan Payyanadu* (Kerala Bhasha Institute, Trivandrum)

15UFL41F	PART-I: FRENCH-IV	SEMESTER-IV

Total Credits: 4
Hours/week: 5

Prescribed text: ALORS II

Units 6 – 10

Authors : Marcella Di Giura Jean-Claude Beacco
Available at : Goyal Publishers Pvt Ltd 86,
University Block Jawahar Nagar (Kamla Nagar)
New Delhi – 110007.
Tel : 011 – 23852986 / 9650597000

15UEG42E	PART-II: ENGLISH-IV	SEMESTER IV

Total Credits: 4
Hours/week: 5

OBJECTIVE:

To develop the language competence of the students.

1. To be enriched with functional English.

CONTENTS

UNIT -I

1. Mobile and Mixed-up – Anil Darker
2. My Vision for India – Dr. Abdul Kalam
3. Common Sense – Sedgwick, Woodworth

UNIT -II

SHORT STORIES

1. A Room 10 x 8 –K.S. Duggal
2. A Face on the Wall – E.V. Lucas

UNIT -III

SHORT PLAY

1. The Death Trap – H. H. Munro
2. The Never Never Nest – Cedric Mount

UNIT- IV

FUNCTIONAL ENGLISH

1. Communication Skills – Listening, Telephone, Resume & E-Mail
2. Interview & Group Discussion, Parts of the Exercises in each chapter.

UNIT -V

COMPOSITION TASKS

1. Public Speaking – speaking on an official occasion
2. Participating in a meeting
3. Airing grievances
4. Interview Skills

5. Conducting an Interview
6. Interviewing the expert
7. Net equittte
8. Negotiation Skills

TEXT BOOKS

1. *Nandini Nayar.2014* **Treasure Hunt.** Board of Editors, Foundation Books.
2. *Daniel, James.P.C***. 1989. English for Career Development, a Course in Functional English**, Orient Longman Pvt Ltd., Publications.

REFERENCE BOOKS:

1. *Rajamanickam. A.* 2001**. Everyman's English Grammar,** Macmillan.
2. *Krishna Mohan and Meera Banerji.* 2005. **Developing Communication Skills**.Macmillan.
3. *Wren.P.C and Martin***.**1998**. High School Basic Grammar and Composition.** Macmillan.

15UBT43A	CORE – IV: IMMUNOLOGY	SEMESTER - IV

Total Credits: 4
5 Hours / Week

OBJECTIVES:

1. To learn about the Cells of immune system
2. To study about the techniques in Immunology

CONTENTS

UNIT-I

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

UNIT-II

Complement systems - structure and function of MHC class I and II molecules - antigen recognition and presentation - Humoral and Cell mediated immune responses - hypersensitivity reaction - immune suppression and immune tolerance - auto immune disorders.

UNIT-III

Hypersensitivity - IgE mediated - antibody mediated - immune complex mediated and delayed type hypersensitivity- Tumor immunology- tumor associated antigens. Immune response to tumor- Transplantation immunology- Graft rejection.

UNIT-IV

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

UNIT- V

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.
2. *Rao, C.V.* 2002. **Textbook of Immunology.**1st edition. Narosa Publishing House.

REFERENCE BOOKS:

1. *Ivan Riot.* 1988. **Essentials of Immunology.** 6th edition. Blackwell Scientific Publications.
2. *Tizard.* 1995. **Immunology**. 4th edition. Saunders college publishers.

15UBT43P	CORE LAB- IV	SEMESTER - IV

Total Credits: 2
3Hours / Week

1. Animal Handling
2. Methods of immunization
3. Blood grouping and Rh typing
4. Separation of Antigen from Gram Negative Bacteria (O Antigen)
5. Collection of Serum
6. Purification and Concentration of Immunoglobulins
7. Precipitin ring test
8. Immunodiffusion
9. WIDAL Test
10. Haemagglutination test
11. HCG test
12. ELISA

REFERENCE BOOKS:

1. *Ivan Lefkovits*. 1996. **Immunology Methods Manual: The Comprehensive Sourcebook of Techniques.** 1st edition. Academic Press Inch.
2. *Jack Bradshaw,L.* 1995. **Laboratory Immunology.** 2nd Edition. Saunders College Publishings

15UMA4AC	ALLIED – IV: BASIC MATHEMATICS	SEMESTER - IV

Total Credits: 3
4Hours / Week

OBJECTIVE:

1. On successful completion of this course the students shall enrich to solve various problems in bioscience
2. It helps the students to do research problems

CONTENTS

UNIT -I

Binomial, Exponential and Logarithmic series (Statement only) – Application to Summation of series only.

UNIT- II

Quadratic equation –Matrices – Determinant of a matrix – Inverse of a matrix – Characteristic equation of a matrix – Eigen values – Solutions of simultaneous linear equations in three variables using matrices.

UNIT- III

Differentiation of algebraic – Exponential logarithmic and trigonometric functions – Physical interpretations of derivatives with reference to velocity and acceleration – Application of differentiation to maxima and minima (Simple problems).

UNIT- IV

Partial differentiations (Simple problems) – Integration of Simple algebraic, exponential and trigonometric functions – substitution method – Integration by parts.

UNIT -V

Measures of central tendency – Mean, Median , Mode – Measures of dispersion – Quartile deviation - Mean deviation - Standard deviation – Correlation – Karl Pearson's Coefficient of correlation – Rank correlation.

REFERENCE BOOKS:

1. *Manichavasagam Pillai, T.K and Narayanan,S. 2002.* **Calculus – Volume I and II.**Viswanathan Publishers and Printers Pvt.Ltd.
2. *Manichavasagam Pillai, T.K and Narayanan,S. 2002.***Algebra.**Viswanathan Publishers and Printers Pvt.Ltd.
3. *Gupta.S.P.* **Statistical Methods.** 2004. Sultan Chand and Sons.

15UBT4SA	SKILL BASED SUBJECT-I: TECHNIQUES FOR BIOLOGY	SEMESTER - IV

Total Credits: 3
4Hours / Week

OBJECTIVES:

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

CONTENTS

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-V

Radio-isotopic Techniques: 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, S.K. & Randhir Singh.* 2006. **Introductory Practical Biochemistry**. 3rd edition. Narosa publishing House.
2. *Boyer, Rodney F Benjamin and Cummins*. 2001.**Modern Experimental Biochemistry**, 2nd edition. Pearson Education.

REFERENCE BOOKS:

1. *Freifelder, D.* 1982. **Physical Biochemistry**: **Application to Biochemistry and Molecular Biology.** 2nd edition. W. H. Freeman Publishers.
2. *Walker, J. & Wilson, K.* 2000. **Principle & Technique – Practical Biochemistry**, 5th edition. Cambridge university press.

15UBT53A	CORE - V : ENVIRONMENTAL BIOTECHNOLOGY	SEMESTER - V

Total Credits: 4
5Hours / Week

OBJECTIVES:

1. To understand the Basic vocabulary of environmental biology
2. To study about the Hazards of industrial pollutants on environment

CONTETNS

UNIT-I

Scope- Branches of ecology- Abiotic factors- water- soil- temperature- light. Biotic factors- Animal relationship- symbiosis- commensalisms- mutalism- Antagonism- Antibiosis- Parasitism- Predation- competition.

UNIT-II

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-III

Pollution- types- sources- effects- air- water- land- Noise- Thermal- Pesticide- Radioactive- green house effect, ozone and its importance - global warming - Acid rain.

UNIT-IV

Sewage Treatment System- Characteristics, Primary, secondary and tertiary treatment. Solid waste disposal and solid waste Management.

UNIT-V

Introduction to Bioremediation, Methods of Bioremediation, Advantages and Disadvantages of Bioremediation.

TEXT BOOKS:

1. *Agarwal,S.K. 2007.* **Environmental Biotechnology**.1st Edition. APH Publishing.
2. *Chatterji, A.K. 2011. Introduction to Environmental Biotechnology.* 3rd edition. Prentice-Hall of India.

REFERENCE BOOKS:

1. *Dash. M.C.* 1998. **Fundamentals of Ecology.** 2nd edition. Tata McGraw Hill.
2. *Alan Scragg*. 2007. **Environmental Biotechnology**. 2nd edition. Oxford university press.

15UBT53B	CORE – VI: PLANT BIOTECHNOLOGY	SEMESTER - V

Total Credits: 4
5Hours / Week

OBJECTIVES:

1. To learn about the Various *In Vitro* culture techniques
2. To understand about the Gene transferring mechanisms

CONTENTS

UNIT-I

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, Somaclonal variation, artificial seeds, hardening.

UNIT-II

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- virulence genes- Cloning Strategies- Gene transfer methods in plants- Direct DNA transfer methods, Agrobacterium mediated nuclear transformation.

UNIT-III

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

Secondary metabolic pathways in plants. Industrial phytochemical products from plants- Alkaloids, Biodegradable Plastics, Therapeutic proteins, antibodies, plant vaccines, herbal drugs, bioethanol and biodiesel.

UNIT-V

Extraction and purification of phyto-chemicals. phytoremediation; Green house and green home technology.

TEXT BOOKS:

1. *Chawla, H. S.* 2013. **Introduction to Plant Biotechnology.** 3rd edition. Oxford & IBH publishing company.
2. *Razdan, M. K.* 2002. **Introduction to Plant tissue culture.** 2nd edition. Oxford & IBH publishing company.

REFERENCE BOOKS:

1. *Grierson, D.* and *Covey, S.V.* 1988. **Plant Molecular Biology**. 2nd edition. Blackie Publishers.
2. *Bhojwan, S. S.* 1996. **Plant tissue culture - Theory and Practice.** 1st edition. Elsevier Publishers.

15UBT53C	CORE – VII: ANIMAL BIOTECHNOLOGY	SEMESTER - V

Total Credits: 4
5Hours / Week

OBJECTIVES:

1. To study about various *in vitro* culture techniques
2. To learn about preservation of animal cells

CONTENTS

UNIT-I

Animal cell culture basics- Preparation of culture media- Role of carbon dioxide, serum and growth factors in cell culture, Serum and protein free defined media.

UNIT-II

Types of animal cell culture: primary cell culture, organ culture, cell lines. Tissue engineering, cell separation, cryo-preservation. Biology of cells in culture; tissue typing: measurement of cell growth and death, cytotoxicity assays.

UNIT-III

Gene transfer in cells; physical, chemical and biological methods. Production of native and recombinant proteins in animal cell. Applications of animal cell culture – Hybridoma technology and its applications- gene targeting, silencing and knock-out.

UNIT-IV

Fertilization in animals: Blastulation, gastrulation, early embryonic development - fate map. Conventional methods of improvement of animal live stock: artificial insemination, *in vitro* fertilization, embryo culture, embryo sexing, splitting and cloning.

UNIT-V

Production of transgenic animals; applications of producing transgenic animals, Aquaculture, Biotechnology of silk worm - commercial

production of silk, Baculovirus in Biocontrol, Integrated pest management.

TEXT BOOKS:

1. *Ranga,M.M.* 2007. **Animal biotechnology**. 3rd Edition. Agrobios India.
2. *John R. Masters.* 2000. **Animal cell culture**. 3rd edition. Oxford University Press.

REFERENCE BOOKS:

1. *Freshney, R.I.*1996. **Animal cell culture: A practical approach**. 2nd edition. Oxford University Press
2. *Rastogi,V.* 2001. **Developmental Biology**. 1st edition. Kedarnath Ramnath Publishers.

15UBT53P	CORE LAB- V	SEMESTER - V

Total Credits: 4
5Hours / Week

1. Water Quality analysis-Colour, pH, Acidity
2. MPN Test
3. Total hardness by EDTA titrimetric method
4. Estimation of Total alkalinity, carbonate and bicarbonate
5. Determination of Chemical oxygen demand
6. Estimation of Chloride
7. Plant Tissue Culture Media Preparation
8. *In vitro* germination of seeds
9. Callus induction
10. Isolation of protoplast
11. Artificial seed production
12. Micro propagation
13. Qualitative analysis of alkaloids, flavonoids, safonins, tannins and phenolic compounds
14. Preparation of ATC medium and membrane filtration
15. Preparation of primary culture from chick embryo
16. Cell counting and cell viability.

REFERENCE BOOKS:

1. *Satish Kumar Sinha*. 2012**. Plant tissue culture: Theory and Practice**.1st edition. Oxford University Press.
2. *Freshney, R. I.* 2010. **Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications**. 6th edition. Wiley Blackwell.
3. *Choudhary, S. S, Choudhary, P. and Choudhary, S.K.* 2005. **Laboratory Guide in Biosciences.** 2nd edition. Kalyani publishers.

15UBT5SA	SKILL BASED SUBJECT- II: FOOD AND BEVERAGE TECHNOLOGY	SEMESTER - V

Total Credits: 3
5Hours / Week

OBJECTIVES:

1. To Understand the creation and invention toward food and beverage
2. To develop the knowledge of modern concepts of sanitation, safety, and health.

CONTENTS

UNIT-I

Introduction to food Biotechnology - Conventional Biotechnology and non-conventional Biotechnology.

UNIT-II

Technology of conventional and non-conventional fermentation based food products from cereals, legumes, fruits, vegetables, milk, fish and meat. Role of microorganisms in manufacture and spoilage of fermented products.

UNIT-III

Types of beverages and their importance; status of beverage industry in India; Manufacturing technology for juice-based beverages; synthetic beverages; technology of still, carbonated, low-calorie and dry beverages; isotonic and sports drinks; role of various ingredients of soft drinks, carbonation of soft drinks.

UNIT-IV

Specialty beverages based on tea, coffee, cocoa, spices, plant extracts, herbs, nuts, dairy and imitation dairy-based beverages.

UNIT-V

Packaged drinking water- definition, types, manufacturing processes, quality evaluation and raw and processed water, methods of water

treatment, BIS quality standards of bottled water; mineral water, natural spring water, flavoured water, carbonated water.

TEXT BOOKS:

1. *Joshi, V. K & Pandey A*. 1999. **Biotechnology: Food Fermentation**. Vol I&II. Education Publishers and Distributors.
2. *Hui, Y. H.* 2004. **Handbook of Food and Beverage Fermentation Technology**. 1st edition. CRC Press.

REFERENCE BOOKS:

1. *Prescott, S. C & Dunn, C. G.* 1982. **Industrial Microbiology.** 4th edition. AVI Publishing Company.
2. *Doyle, M. P., Beuchat, L. R. and Thoma J. Montvil.* 2001. **Food Microbiology**: **Fundamentals and frontiers.** 2nd edition. ASM press.

15UBT63A	CORE - VIII: RECOMBINANT DNA TECHNOLOGY	SEMESTER - VI

Total Credits: 4
5Hours / Week

OBJECTIVES:

1. To learns the guidelines for Recombinant DNA Technology research which involves all the molecular Biology techniques
2. To study about different Cloning techniques

CONTENTS

UNIT-I

Restriction and Modification systems of Bacteria. Restriction enzyme, DNA Polymerases, RNA polymerase, Taq polymerase, DNA Ligase, methylase, polynucleotide kinase, alkaline phosphatase, reverse transcriptase, DNaseI, S1nuclease, RnaseH, terminal deoxynucleotidyl transferase.

UNIT-II

Plasmids –types of plasmids (F, R and Col), properties of plasmid, plasmid compatibility, copy number control. *E.coli* vectors- pBR322 and their derivatives, pUC vectors and their derivatives, BAC. Cloning in *Bacillus* and *Streptomyces*.

UNIT-III

Molecular biology of lambda and Lambda vectors, cosmid, phagemid, M13. Yeast vectors – YIP, YEP, YRP and YAC. Inducible promoters, selectable markers and expression vectors.

UNIT-IV

Animal vectors- SV40 Vectors, Retero viral and Baculo viral vectors, shuttle vectors. Plant vectors - Ti plasmid as gene vector, Caulimo viruses, Gemini viruses, Transposable elements as vectors Construction of cDNA and genomic DNA libraries.

UNIT-V

Probes - probe construction and labeling. Introduction of cloned genes into cell – transformation, transduction, particle bombardment, liposome mediation, electroporation, and cocultiovation identification of recombinant DNA. Hybridization techniques southern, Western and Northern blotting.

TEXTBOOKS:

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.

REFERENCE BOOKS:

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.

15UBT63B	CORE – IX: FERMENTATION TECHNOLOGY	SEMESTER - VI

Total Credits: 4
5Hours / Week

OBJECTIVES:

1. To recognize the fundamentals of fermentation technology
2. To analyze the bioprocess paradigm: Scale-down, bioprocess simulation and economics, sterilization in biological manufacturing.

CONTENTS

UNIT-I

Advantages of bioprocess over chemical process. Basic function ,design and body construction; Peripheral parts and accessories- Impellers types, sparger, temperature control; pH, control and foam, baffles. Sterilization of fermenter, air supply. Aseptic inoculation and sampling methods.

UNIT-II

Types of fermenters- CSTR, Tower fermenter, Jet loop, Air lift, Bubble column, Packed bed. Enzyme immobilization. Primary and secondary metabolites. Types of fermentation – Solid state fermentation – Tray fermenter, Column fermenter, and Drum fermenter, Submerged fermentation – Batch and continuous, fed batch

UNIT-III

Transport phenomena in bioprocess – Mass transfer resistance, Rate of oxygen transfer. Biological heat transfer for microbial cultivations.

UNIT-IV

Downstream processing: Removal of microbial cells, cell disruption – enzymatic and chemical, physical methods., precipitation methods, filtration, centrifugation, liquid-liquid extraction, membrane filtration, chromatography, crystallization, drying ,lyophilisation, packaging and quality assurance.

UNIT-V

Production of Biomass, Biotechnologically important Exopolymers – Dextran, Xanthan gum , Pullulan – method of Biopol production (Biodegradable plastics)

TEXTBOOKS:

1. *Stanbury, A. H., Whittaker, A and Hall, S. J.* 1995. **Principles of Fermentation Technology**. 2nd edition. S.J. Pergamon Press.
2. *Casida, J.E.* 1968. **Industrial Microbiology**. 1st edition. John Wiley Eastern Publication.

REFERENCES:

1. *Michael L. Shuler, Fikret Karg.* 2001. **Bioprocess Engineering - Basic Concepts.** 2nd edition. Prentice Hall International services.
2. *El-Mansi, E.M.T, Bryce, C. F., A, Arnold L. Demain,* and *Allman, A.R.* 2011. **Fermentation Microbiology and Biotechnology**. 3rd edition.CRC Press.

15UBT63C	CORE –X: BIOETHICS, BIOSAFETY AND IPR	SEMESTER - VI

Total Credits: 4
5Hours / Week

OBJECTIVES:

1. To acquaint students with principles of biosafety and ethical perspectives of Biotechnological systems
2. To sensitize research and development in biotechnology, biosafety, bioethics, and their impact on society

CONTENTS

UNIT-I

Introduction to ethics and bioethics : Personal ethics: profession and professionalism – Moral Reasoning – Ethical theories – person as an experimenter – Moral leadership - framework for ethical decision making.

UNIT-II

Biotechnology and ethics: Biotechnology in agriculture and environment: benefits and risks – benefits and risks of genetic engineering – ethical aspects of genetic testing –biowarfare.

UNIT-III

Ethical implications of cloning: Reproductive cloning , therapeutic cloning ; Ethical, legal and socio-economic aspects of gene therapy, germ line, somatic, embryonic and adult stem cell research- biopiracy – ELSI of human genome project.

UNIT-IV

Patents - Introduction - Basis of Patentability - Non Patentable Inventions - Patent Application Procedure in India - Treaties and Conventions of Patents - Patent Cooperation Treaty - TRIPS and Pharmaceutical Industry - issues and prospects. Patenting of biotechnology products and processes.

UNIT-V

Introduction to intellectual property and intellectual property rights: Types, patents, copy rights, trade marks, design rights, geographical indications – importance of IPR –patenting life – legal protection of biotechnological inventions – world intellectual property rights organization (WIPO).

TEXTBOOKS:

1. *Deepa Goel.* 2013. **IPR Bio safety and Bioethics**. 1st edition. Pearson Education.
2. *Sateesh,M.K.* 2008. **Bioethics and Biosafety.** 1st Edition. I K International Publishing House.

REFERENCE BOOKS:

1. *Srinivasan, K. and Awasthi, H.K.* 1997. **Law of Patents.** 1st edition. Jain Book Agency.
2. *Thomas H. Murray* and *Maxwell J. Mehlman*. 2005. **Encyclopedia of Ethical, Legal and Policy issues in Biotechnology**. 1st edition. Wiley-Interscience.

15UBT63P	CORE LAB- VI	SEMESTER - VI

Total Credits: 4
5Hours / Week

1. Bacterial transformation
2. Southern blotting
3. Western blotting
4. PCR
5. ELISA
6. Restriction Digestion
7. Ligation
8. Screening of Antibiotic producing microorganism
9. Screening of Amylase producing microorganism
10. Screening of protease producing micro organism
11. Wine production
12. Amylase/protease production
13. Immobilization of enzyme

REFERENCE BOOK:

1. *Vyas.S.P.L. 2010.* **Methods in Biotechnology and Bioengineering:**. 1st edition. CBS Publishers.

15UBT5EA	ELECTIVE- I: MEDICAL BIOTECHNOLOGY	SEMESTER - V

Total Credits: 4
5Hours / Week

OBJECTIVES:

1. To learn the role of Biotechnology in healthcare.
2. To study importance of biotechnology in molecular diagnostics.

CONTENTS

UNIT-I

Tools of Medical Biotechnology – Biotechnological revolutions-combinatorial chemistry, insight into basic biology-Areas of application, Diagnosis and prediction of disorders, Limits and approaches.

UNIT -II

Role of biotechnology in healthcare. Worldwide market and work in medical biotechnology. Vaccine production-New developments. Biosensors in clinical diagnosis, monoclonal antibodies for immunotherapy.

UNIT-III

Recent developments in medical biotechnology –Pharming for human proteins and neutraceuticals .Tissue engineering and therapeutic cloning

UNIT-IV

DNA vaccine, Gene Therapy, Use of enzymes in clinical diagnosis, Use of biosensors for rapid clinical analysis.

UNIT-V

Introduction to rational drug design & its history. Methods and applications: Molecular mechanics, QM/MM, Structure and conformation of small molecules, overlay and identification of active conformer, molecular properties, descriptors.

TEXT BOOKS:

1. *Chaechter, M., Medoff, G. and Eisenstein, B.C.* 1993. **Mechanism of Microbial Diseases.** 2nd edition. Williams and Wilkins Publishers.
2. *Collee, J.G., Duguid, J.P., Fraser, A.G., Marimon, B.P(Eds)., Mackie and McCartney.* 1989. **Practical Medical Microbiology**. 13th edition. Churchill Livingstone.

REFERENCE BOOKS:

1. *David Greenwood, Richard, C.D., Slack, John Forrest Peutherer.* 1992. **Medical Microbiology**. 14th edition. Churchill Livingstone.
2. *Hugo, W.B., and Russell, A.D.* 1989. **Pharmaceutical Microbiology**. 4th edition. Blackwell Scientific Publication.

15UBT5EB	ELECTIVE-I : PHARMACEUTICAL BIOTECHNOLOGY	SEMESTER - V

Total Credits: 4
5Hours /Week

OBJCETIVES:

1. To study the mechanism of drug action
2. To learn the production and application of new drugs.

CONTENTS

UNIT-I

Introduction: Pharmaceutical industry & development of drugs; types of therapeutic agents and their uses; economics and regulatory aspects.

UNIT-II

Drug action, metabolism and pharmacokinetics: Mechanism of drug action; physico-chemical principles of drug metabolism; radioactivity; pharmaco kinetics.

UNIT-III

Manufacture of drugs, process and applications: Types of reaction process and special requirements for bulk drug manufacture.

UNIT-IV

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

UNIT-V

Drug development process of protein based therapeutics: Transforming New Molecular Entities into Drugs, Differences between Development of Biotechnology Products of Macromolecules and Chemical Products, Current Trends in Drug Development.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. *Gareth Thomas.* 2000. **Medical Chemistry- An Introduction**. 2nd edition. John Wiley publication.
2. *Goodman and Gilman.* 2006. **The Pharmacological Basis of Therapeutic**s. 11th edition. Mc Graw Hill Medical Publishing Division.

15UBT6EA	ELECTIVE- II: FUNDAMENTALS OF BIOINFORMATICS	SEMESTER - VI

Total Credits: 4
5Hours / Week

OBJCETIVES:

1. To study the role of computers in life sciences.
2. To learn software for Biological data analysis

CONTENTS

UNIT-I

Introduction to Bioinformatics - applications of Bioinformatics Computers and programs - internet - World Wide Web - browsers - EMB net - NCBI.

UNIT-II

Importance of databases - nucleic acid sequence databases - protein sequence databases - structure databases - bibliographic databases and virtual library.

UNIT-III

Sequence analysis of biological data- models for sequence analysis and their biological motivation- methods of alignment - methods for optimal alignments; using gap penalties and scoring matrices- multiple sequence alignment.

UNIT-IV

Gene predictions strategies - protein prediction strategies - molecular visualization- Homology - phylogeny and evolutionary trees - Homology and similarity - phylogeny and relationships.

UNIT-V

Discovering a drug - target identification and validation- identifying the lead compound - optimization of lead compound - chemical libraries.

TEXT BOOKS:

1. Mani,K and Vijayaraj,N. 2002. **Bioinformatics For Beginners**. 1st Edition. Kalaikathir Achchagam
2. *Soundararaja, S.* 2002. **Introduction to Bioinformatics**. 1st edition. Himalaya Publishing House.

REFERENCE BOOKS:

1. *Dan E Krane and Michael L. Raymer.* 2003. **Fundamental Concepts of Bioinformatics**. 1st edition. Benjamin Cummings.
2. *Gladis Helen Hepsyba,S.,* and *Hemalatha, C .R.* 2009. **Basic Bioinformatics**, 1st edition. MJP publisher.

15UBT6EB	ELECTIVE- II: BIOPROSPECTING	SEMESTER - VI

Total Credits: 4
5Hours / Week

OBJCETIVES:

1. To learn the potential applications of Bioresources for Bioprospecting.
2. To study the importance of microbes for Bioprospecting.

CONTENTS

UNIT-I

Major area of Bioprospecting : Chemical prospecting, Bionic prospecting and Gene prospecting. Bioresources mapping, inventorisation and monitoring of biological diversity. Historical context of present bioprospecting, biodiversity prospecting – the InBio experiences, contracts for Bioprospecting.

UNIT-II

Drugs derived from plants, Antitumor agent - Etoposide, Colchicine, Taxol, Vinblastine, Vincristine. Cardiotonic – Convallatoxin, Acetyldigoxin, Adoniside, Antiinflammatory – Aescin, Bromelain, Choleretic – Curcumin. QuinineCinchona-Antimalarial Morphine-Opium plant- analgesic.

UNIT-III

Screening for bioactivity, antimicrobials, pharmacologically active agents of microbial origin, bioprospecting for industrial enzymes, plant growth promoting agents, biotreatment, bioprospecting novel antifoulants and anti-biofilm agents from microbes.

UNIT-IV

Drug discovery and product development: Discovery from traditional medicine. Modern tools in drug discovery. Role of chromatography in drug analysis. Product development procedures and policies.

UNIT-V

Regulatory legistlation and convention in Bioprospecting: rules and regulations in patenting of products and process development and various conventions pertaining to Bioprospecting of products from microorganism, plant and animal products.

TEXTBOOKS:

1. *Joseph Priest*. 2008. **Energy: Principles, Problems, Alternatives**. 6th edition. Kendall and Hunt Pub Co,.
2. *Alan T. Bull.*2004. **Microbial Diversity and Bioprospecting.**1st edition. ASM Press.

REFERENCE BOOKS:

1. *Srinivasan, K. and Awasthi, H.K.* 1997. **Law of Patents.** 1st edition. Jain Book Agency.
2. *Cori Hayden.*2003. **When Nature Goes Public: The Making and Unmaking of Bioprospecting in Mexico.**1st edition. Princeton University Press.

15UBT6EC	ELECTIVE-III: DRUG SAFETY GUIDELINES	SEMESTER - VI

Total Credits: 4
5Hours / Week

OBJCETIVES:

1. To learn the various regulatory aspects of drug development.
2. To study the basics of Clinical trials.

CONTENTS

UNIT-I

Introduction to Pharmaceutical Industry, Preclinical studies - Preclinical technology, Chemistry of manufacturing and controls / Pharmaceutics Pharmacology/Toxicology. Phase I, Phase II A & B, Phase III A & B, Phase IV and Types of Post marketing surveillances.

UNIT-II

History of GCP,FDA Regulations for Clinical Trials, ICH Guidelines for Good Clinical Practice , FDA Guidelines and Information Sheets , FDA Compliance Program Guidance Manuals, NIH Regulated Research, FDA Bioresearch Monitoring Program (BIMO), Good Clinical Practice (GCP).

UNIT-III

Ethical Guidelines for Biomedical Research in Human Subjects, Central Ethics committee on Human Research (CECHR), ICMR 2000, Clinical research regulation DCGI.

UNIT-IV

GCP Guidelines, Central Drugs Standardization and Control Organization, Government of India, Schedule Y.

UNIT-V

Sponsor's responsibilities, Essential documentation and Investigator's Brochure, Protocol design, CRF design, Informed Consent Documents - Subject Information Sheet and Informed Consent Form, Ethics Committee Approvals.

TEXT BOOKS:

1. *Allan Hackshaw.* 2009. **A Concise Guide to Clinical Trials.** 1st edition. Wiley Publishers.
2. *Richard Chin* and *Bruce Y. Lee***.** 2008. **Principles and Practice of Clinical Trial Medicine.** 1st edition. Academic Press.

REFERENCE BOOKS:

1. *Sandy Weinberg. 2009.* **Guide Book for Drug Regulatory Submissions.** 1st edition. *John Wiley & sons .*
2. *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.

15UBT6ED	ELECTIVE- III: FOOD BIOTECHNOLOGY	SEMESTER - VI

Total Credits: 4
5Hours / Week

OBJECTIVES:

1. To study about various alternate foods.
2. To study the various preservation methods.

CONTENTS

UNIT-I

Sources of food- plant, animal and microbial origin. Different foods and groups of foods as raw materials for processing- cereals, pulses, grains, vegetables and fruits, milk and animal foods, sea weeds, algae, oil seeds & fats, sugars, tea, coffee, cocoa, spices and condiments, additives, need and significance of processing these foods.

UNIT-II

Microbes in food industry, Microbial rennet and recombinant chymosin, exogenous free and microencapsulated enzymes, immobilized enzymes- their application in accelerated ripening of cheese.

UNIT-III

General principle of preservation, classification of methods used for preservation, need and importance. Preservation by use of acid, sugar and salt, pickling and curing with microorganisms, use of salt, and microbial fermentation, frying, baking, extrusion cooking, snack foods.

UNIT-IV

Principles of canning and bottling of food. Types, classification and storage of canning. Spoilage of canned and bottled foods. Drying- Traditional and modern method of drying. Type of driers, influence of drying on pigments and enzymes.

UNIT-V

Preservation by ionizing radiations, ultrasonic's, high pressure, fermentation, curing, picking, smoking, membrane technology, hurdle technology, application of infra re microwave, ohmic heating, control of water activity. Basic packing materials, types of packing, packing design packaging for different types of foods, retort pouch packing, costs of packaging and recycling of materials.

TEXT BOOKS:

1. *Lee Byong, H.V.* 1996. **Fundamentals of Food Biotechnology**. 1st edition. C H Publishers.
2. *Roger, A.* 1989. **Food Biotechnology**, 1st edition. Elsevier Applied Sci. Pub.

REFERENCE BOOKS:

1. *Goldberg Israel.* 1994. **Functional Foods**. 1st edition. Chapman & Hall Publishers.
2. *Anthony Pometto, Kalidas Shetty, Gopinadhan Paliyath, Robert E. Levin.* 2005. **Food Biotechnology.** 2nd edition. CRC Publication.

15UBT33E	NMEC –I: INTRODUCTION TO PLANT TISSUE CULTURE	SEMESTER - III

Total Credits: 2
2Hours / Week

OBJECTIVES:

1. To learn about the basics of Plant tissue culture.

2. To study about the isolation and preservation of plant cells.

CONTENTS

UNIT-I

History of Tissue Culture technique. Requirements for a Cell Tissue Culture lab Laminar Air Flow Chamber, sterilisation scheme for culture chamber. Totipotency of plant cells- dedifferentiation and redifferentiation.

UNIT-II

Media Composition: Composition of commonly used culture media with respect to their contents like inorganic chemicals, organic constituents, vitamins, amino acids etc. Sterilization of media.

UNIT- III

Culture of plant materials- explants selection, surface sterilization and culture. Growth conditions. Methods of sub culturing and transfer of regenerated plants to the field.

UNIT-IV

Micro propagation: Proliferation of axillary buds, callus regeneration, somatic embryogenesis, immobilized cultures.

UNIT-V

Isolation of single cells, culture cell viability test. Cryopreservation and slow growth cultures, freezing and storage, thawing, reculture.

TEXTBOOKS:

1. *Kalyan Kumar De.*2008. **An introduction to Plant Tissue Culture.**1st edition.NCBA.
2. *Guptha, P. K.* 2010. **Elements of Biotechnology**. 2nd edition. Rastogi Publications.

REFERENCE BOOKS:

1. *Hamish A. Collin & Sue Edwards.*1998. **Plant Cell Culture**. 1st edition. BIOS Scientific Publishers.
2. *Razdan, M.K.*2003. **An Introduction to Plant Tissue Culture**. 2nd edition. Science Pub Inc.

15UBT44E	NMEC –II: WATER TREATMENT AND WASTE MANAGEMENT	SEMESTER - IV

Total Credits: 2
2Hours / Week

OBJECTIVES:

1. To study the various waste water treatment processes.

2. To study the Solid waste management.

CONTENTS

UNIT-I

Introduction to water characteristics and treatment system- Water quality analysis like colour ,$P^{H,}$ acidity, alkalinity- Water treatment system- Primary, secondary and Tertiary treatment.

UNIT-II

Introduction to waste water management – waste water flow rates, sources of water pollution and prevention.

UNIT-III

Introduction to waste generation: Sources, composition and properties, Collection of waste, transfer and transport, handling methods.

UNIT-IV

Product recovery and recycling- recovery of biological conversion products: compost and biogas. Disposal of solid waste – planning, design and monitoring.

UNIT-V

Introduction to hazardous healthcare waste, infectious wastes, biomedical waste – composition of biomedical waste, sources of healthcare waste, hospitals and healthcare establishments and their sources.

TEXT BOOKS:

1. *Arun Rastogi.*2010. **Environmental Chemistry.** 1st edition. Anmol Publications.
2. *Hari Mohan Singh.*2011. **Solid waste management**.1st edition. Alfa Publications.

REFERENCE BOOKS:

1. *Chandrawati Jee Shagufta.*2007. **Environmental Biotechnology.**1st edition. Aph Publishing Corporation.
2. *Alan Scragg,* 2005. **Environmental Biotechnology**. 2nd edition. Oxford University Press.

15UED34E	NMEC –I: MUSHROOM TECHNOLOGY	SEMESTER - III

Total Credits: 2
Hours Per Week:2

OBJECTIVES:

1. To learn about the basics of Mushrooms.

2. To study about the production and applications of Mushrooms.

CONTENTS

UNIT-I

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

UNIT-II

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

UNIT-III

Isolation and culture of spores, culture media preparation. Production of mother spawn, multiplication of spawn - Inoculation Technique - Cultivation technology - Substrates, composting technology, bed, polythene bag preparation, spawning - Cropping - Mushroom production - Harvest - Storage methods and marketing.

REFERENCE BOOKS:

1. *Krishnamoorthy, A.S et al.,* 1991. **Oyster Mushrooms.** Department of Plant Pathology, Tamil Nadu.
2. *Suman B C, Sharma V P*. 2007. **Mushroom Cultivation in India.** Daya Publishing House.
3. *NIIR Board of Consultants and Engineers.* 2011. **Handbook on Mushroom Cultivation and Processing (with Dehydration, Preservation and Canning).** Asia Pacific Business Press Inc.
4. *Biswas S.* 2012. Mushrooms: A Manual for Cultivation. PHI Learning Private Limited-New Delhi.

15UED44E	NMEC –II: APICULTURE	SEMESTER - IV

Total Credits: 2
Hours Per Week:2

OBJECTIVES:

1. To learn about the basics of honey bees and Honey
2. To study about the production and applications of Honey.

CONTENTS

UNIT-I

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

UNIT-II

Bee colony, Castes. Natural colonies and their yield. Types of bee hives – structure – location, care and management. Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc.

UNIT-III

Bee foraging: Pollen and nectar yielding plants. Honey Extraction, seasonal maintenance. Economics of Apiculture and Management. Honey yield in national and international market. Prospects of apiculture as self employment venture.

REFERENCE BOOKS:

1. *Ghosh G. K.* 1998. **Beekeeping in India.** Ashish Publishers.
2. *Abrol D. P.* 2010. **A Compressive Guide to Bees and Beekeeping.** Scientific Publishers.
3. *Singh Dharm Singh Devender Pratap.* 2006. **A Handbook of Beekeeping**. Agrobios (India).
4. *NPCS Board of Consultants & Engineers.* 2015. **The Complete Book on Beekeeping and Honey Processing.** 2nd edition. NIIR Project Consultancy Services.

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