RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

(Affiliated to Bharathiyar University, Re-Accredited by NAAC, Approved by AICTE & ISO9001:2008 Certified)

Eachanari, Coimbatore – 641021

DEPARTMENT OF BIOTECHNOLOGY

Syllabus for

B.Sc. Biotechnology

(I,II,III,IV,V & VI Semester)

2021 to 2022 Batch on wards

RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

Eachanari, Coimbatore – 641021

DEPARTMENT OF BIOTECHNOLOGY

VISION AND MISSION OF THE INSTITUTION

VISION

To emerge as a world renowned Institution that is integrated with Industry to impart knowledge, Skills, Research Culture and Values in youth who can accelerate the overall development of India.

MISSION

The impart superior quality education at affordable cost, nurture academic and research excellence, maintain eco-friendly and future ready infrastructure, and create team of well qualified teaching professionals who can build global competency and employability.

VISION AND MISSION OF THE DEPARTMENT

VISION

To create a competent center of excellence in Biotechnology research and provide technically sound graduates to serve as valuable resource for Industry and society; towards excellence and pride to be an Indian.

MISSION

To impart a holistic education and impetus to research through implementation of an integrated approach in the design of a global curriculum.

PROGRAMME EDUCATIONAL OBJECTIVE (PEO)

PEO 1: To produce graduate in Biotechnology with strong technical sounds in Bioscience.

PEO 2: To promote the students towards research aspect to resolve the social problems.

PEO 3: To generate potential knowledge to identify, assess and formulate the needs of biotechnology industries.

PEO 4: Recognition of the need for and an engage in lifelong learning process for productive career.

PEO 5: To inculcate the capability to work as Researcher and entrepreneur with strong ethics.

PROGRAMME OUTCOMES (PO)

PO1: Ability to gain the knowledge fundamental fields of biotechnology

PO2: To empower the students to acquire technological knowhow by connecting disciplinary and interdisciplinary aspects of biotechnology.

PO3: To learn research based knowledge including design of experiments, analysis and interpretation of data and valid conclusions.

PO4: Create, select and apply appropriate techniques, resources with an understanding of the limitations.

PO5: Able to think originally, conceptualize and solve different field of biotechnology problems, evaluate a wide range of potential solutions for the core area of expertise.

PO6: To distinguish the need for and have the preparation and ability to engage in lifelong learning independently with a high level of enthusiasm and commitment to improve knowledge and competence continuously.

PO7: Apply ethical principles and commit to professional ethics and responsibilities and norms of the research practice.

PO8: Recognize the importance of Bioethics, IPR, and entrepreneurship so as to usher next generation of Indian Industrialists.

PROGRAM SPECIFIC OUTCOME (PSO)

PSO1: Understand and apply biotechnology concepts in various contexts related to science, technology, business and industry

PSO2: Acquire the knowledge to apply analytical and theoretical skills to model and solve biotechnology problems

PSO3: Formulate and develop biotechnology arguments in a logical manner

PSO4: Apply the critical thinking ability to carry out extended investigation and involvement of biotechnology formulations

Correlation between the PEO's, PO's and PSO's

Programme outcomes	**PEO1**	**PEO2**	**PEO3**	**PEO4**	**PEO5**
PO1	3	2	1	1	
PO2		3	2	2	1
PO3		3	3	2	
PO4		2	3	2	
PO5		2		3	1
PO6		1		3	2
PO7		1		2	3
PO8	1		2		3
PSO1	3		2	1	
PSO2	2	3	1		
PSO3	2	2	3		1
PSO4		2	3	1	3

Mapping of PEO's, PO's and PSO's Components are:

3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Components consider for Course Delivery is listed below:

1. Class room Lecture
2. Laboratory class and Demo
3. Assignments
4. Case study
5. Project
6. Online Course
7. External Participation
8. Seminar
9. Internship

Correlation between PO's with Course Delivery

Programme outcomes	**Course Delivery**								
	1	2	3	4	5	6	7	8	9
PO1	3	2	2	1	1			1	1
PO2	3	3	2	2	1	1		2	1
PO3		3	2		2	2	1	1	2
PO4	2	3		2	3	1	1	1	2
PO5	1		1		3	2			3
PO6	3	1	2		2	1		2	
PO7	3	1	1	2		2		1	
PO8	3		2	1	2	2		2	

Mapping of PO's and Course Delivery Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

S.No.	Sem	Part	Sub Type	Sub Code	Subject	Credit	Hours	INT	EXT	Total
1	1	1	L1	21BGE1BT	Language – I	4	4	50	50	100
2	1	2	L2	21BGE1BE	English for Communication – I	4	4	50	50	100
3	1	3	Core	21BBT1CA	Core - Cell Biology	4	4	50	50	100
4	1	3	Core Practical	21BBT1CP	Core Practical - Lab in Cell Biology	2	4	25	25	50
5	1	3	DSC	21BBTC01	Principles of Genetics	4	4	50	50	100
6	1	3	DSC Practical	21BBTCP1	Lab in Genetics	2	4	25	25	50
7	1	3	Allied-I	21BCHA01	Chemistry I	4	4	50	50	100
8	1	4	AEC	21BCSAFC	Environmental Studies	2	2	50		50
9	1	6	VAC	21BBT1VA	Good Lab Practice	2	-	50		50
						28	**30**			
1	2	1	L3	21BGE2BT	Language – II	4	4	50	50	100
2	2	2	L4	21BGE2BE	English for Communication – II	4	4	50	50	100
3	2	3	Core	21BBT2CA	Core – Fundamentals of Microbiology	4	4	50	50	100
4	2	3	Core Practical	21BBT2CP	Core Practical - Lab in Microbiology	2	4	25	25	50
5	2	3	DSC	21BBTC02	Bioinstrumentation	4	4	50	50	100
6	2	3	DSC Practical	21BBTCP2	Lab in Bioinstrumentation	2	4	25	25	50
7	2	3	Allied-II	21BBTA01	Bioentrepreneurship, Innovation & Design Thinking	4	4	50	50	100
8	2	4	AEC	21BPYAFC	Human Rights	2	2	50		50
9	2	6	VAC	21BBT2VA	Food Adulteration	2	-	50		50
						28	**30**			
1	3	3	Core	21BBT3CA	Core - Plant Biotechnology	4	5	50	50	100
2	3	3	Core Practical	21BBT3CP	Core Practical - Lab in Plant Biotechnology	2	4	25	25	50
3	3	3	DSC	21BBTC03	Biochemistry	4	5	50	50	100
4	3	3	DSC Practical	21BBTCP3	Lab in Biochemistry	2	4	25	25	50
5	3	3	Allied-III	21BBTA02	Biostatistics and Computer Application	4	5	50	50	100
6	3	4	SEC	21BBTS01	Human Anatomy & Physiology	2	5	25	25	50
7	3	4	AEC	21BENAFC	Communicative English	2	2	50		50
8	3	6	VAC	21BBT3VA	Value Added - TNPSC I	2	-	50		50
9	3	6	ITR		Industrial Training Report I	2	-	50		50
10	3	6	IDL	21BBT3IS	Nature Medicine	2	-	50		50
						26	**30**			
1	4	3	Core	21BBT4CA	Core – Immunology and Immunotechnology	4	5	50	50	100

2	4	3	Core Practical	21BBT4CP	Core Practical - Lab in Immunology and Immunotechnology	2	4	25	25	50
3	4	3	DSC	21BBTC04	Animal Biotechnology	4	5	50	50	100
4	4	3	DSC Practical	21BBTCP4	Lab in Animal Biotechnology	2	4	25	25	50
5	4	3	Allied-IV	21BBTA02	Pharmaceutical Biotechnology	4	5	50	50	100
6	4	4	SEC	21BBTS02	Research Methodology	2	5	25	25	50
7	4	4	AEC	21BMAAFC	Quantitative Aptitude	2	2	50		50
8	4	6	VAC	21BBT4VA	Value Added – TNPSC II	2	-	50		50
9	4	6	IDL	21BBT4IS	Food Processing & Preservation	2	-	50		50
						24	**30**			
1	5	3	Core	21BBT5CA	Core – Genetic Engineering	4	4	50	50	100
2	5	3	Core Practical	21BBT5CP	Core Practical - Lab in Genetic Engineering	2	4	25	25	50
3	5	3	DSC	21BBTC05	Molecular Biology	4	4	50	50	100
4	5	3	DSC Practical	21BT5CP	Lab in Molecular Biology	2	4	25	25	50
5	5	3	Elective I	DSE – I	Elective - I – DSE 1E	4	5	50	50	100
6	5	3	Elective II	DSE - II	Elective - II – DSE 2E	4	5	50	50	100
7	5	4	SEC	21BBTS03	Bioinformatics	2	4	25	25	50
8	5	6	ITR		Industrial Training Report II	2	-	50		50
9	5	6	VAC	21BBT5VA	Techniques in Molecular Markers	2	-	50		50
						26	**30**			
1	6	3	Core	21BBT6CA	Core - Environmental Biotechnology	4	6	50	50	100
2	6	3	Core Practical	21BBT6CP	Core Practical - Lab in Environmental Biotechnology	2	4	25	25	50
3	6	3	Elective III	DSE – III	Elective – III – DSE 3E	4	6	50	50	100
4	6	3	Elective-IV	DSE – IV	Elective – IV – DSE 4E	4	6	50	50	100
5	6	3	Core Course - XI	DSC	Core Project	8	4	100	100	200
6	6	4	SEC	21BBTS04	Nanoscience & Nanotechnology	2	4	25	25	50
7	6	5	EX		Extension Activity- EX %	2	-	50		50
						26	**30**	**2325**	**1625**	**3950**
					Total credit	**158**				

Core					
S.No	**Course Code**	**Course**	**Pre-requisite**	**Offering Department**	**Mandatory**
1	21BBT1CA	Cell Biology	Nil	Biotechnology	Yes
2	21BBT2CA	Fundamentals of Microbiology	Nil	Biotechnology	Yes
3	21BBT3CA	Plant Biotechnology	Nil	Biotechnology	Yes
4	21BBT4CA	Immunology & Immunotechnology	Nil	Biotechnology	Yes
5	21BBT5CA	Genetic Engineering	Nil	Biotechnology	Yes
6	21BBT6CA	Environmental Biotechnology	Nil	Biotechnology	Yes

Discipline Specific Core					
S.No	**Course Code**	**Course**	**Pre-requisite**	**Offering Department**	**Mandatory**
1	21BBTC01	Principles of Genetics	Nil	Biotechnology	Yes
2	21BBTC02	Bioinstrumentation	Nil	Biotechnology	Yes
3	21BBTC03	Biochemistry	Nil	Biotechnology	Yes
4	21BBTC04	Animal Biotechnology	Nil	Biotechnology	Yes
5	21BBTC05	Molecular Biology	Nil	Biotechnology	Yes

Allied					
S.No	**Course Code**	**Course**	**Pre-requisite**	**Offering Department**	**Mandatory**
1	21BCHA01	Chemistry-1	Nil	PHYSICE	Yes
2	21BBTA01	Bio- entrepreneurship, Innovation & Design Thinking	Nil	Biotechnology	Yes
3	21BBTA02	Biostatistics and Computer Application	Nil	Biotechnology	Yes
4	21BBTA03	Pharmaceutical Biotechnology	Nil	Biotechnology	Yes

Skill Enhancement Course					
S.No	**Course Code**	**Course**	**Pre-requisite**	**Offering Department**	**Mandatory**
1	21BBTS01	Human Anatomy & Physiology	Nil	Biotechnology	Yes
2	21BBTS02	Research Methodology	Nil	Biotechnology	Yes
3	21BBTS03	Bioinformatics	Nil	Biotechnology	Yes

Discipline Specific Elective					
S.No	**Course Code**	**Course**	**Pre-requisite**	**Offering Department**	**Mandatory**
1	21BBTE01	Food Biotechnology	Nil	Biotechnology	No
2	21BBTE02	Cancer Biology	Nil	Biotechnology	No
3	21BBTE03	Neurobiology and Cognitive	Nil	Biotechnology	No
4	21BBTE04	Medical Biotechnology	Nil	Biotechnology	No
5	21BBTE05	Agriculture Biotechnology	Nil	Biotechnology	No
6	21BBTE06	Stem Cell Technology	Nil	Biotechnology	No
7	21BBTE07	Industrial Biotechnology	Nil	Biotechnology	No
8	21BBTE08	Herbal Technology	Nil	Biotechnology	No
9	21BBTE09	Lifestyle Diseases	Nil	Biotechnology	No
10	21BBTE10	Bioethics, IPR and Biosafety	Nil	Biotechnology	No
11	21BBTE11	Biodiversity and Ecology	Nil	Biotechnology	No
12	21BBTE12	Biofuel	Nil	Biotechnology	No

Ability Enhancement Course					
S.No	**Course Code**	**Course**	**Pre-requisite**	**Offering Department**	**Mandatory**
1	21BCSAFC	Environmental Studies	Nil	CS	Yes
2	21BCMAFC	Women Studies	Nil	Commerce II	No
3	21BCCAFC	Constitution of India	Nil	Commerce I	No
4	21BPYAFC	Human Rights	Nil	Psychology	Yes
5	21BTAAFC	Yoga	Nil	Tamil	No
6	21BVCAFC	NCC	Nil	Viscom	No
7	21BENAFC	Communicative English	Nil	English	No
8	21BMAAFC	Quantitative Aptitude	Nil	Mathematics	No

Course Code	Course Name	Program Outcome							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	Core I - Cell Biology	3	2	1	1	2	3	3	1
	Core II – Principles of Genetics	3	3	2	2	3	3	3	3
	Core III –Fundamentals of Microbiology	3	2	3	2	1	3	3	1
	Core IV - Bioinstrumentation	3	3	2	3	2	3	3	2
	Core V – Plant Biotechnology	3	3	3	2	3	3	3	2
	Core VI – Biochemistry	3	3	3	2	3	2	3	3
	Core VII – Immunology & Immuno-technology	3	3	2	3	1	3	3	3
	Core VIII – Animal Biotechnology	3	2	3	3	2	3	1	3
	Core IX- Genetic Engineering	3	2	3	3	3	2	3	3
	Core X – Molecular Biology	3	3	2	3	2	2	3	2
	Core XI - Environmental Biotechnology	2	3	2	1	1	3	2	3
	Core XII – Nanoscience & Nanotechnology	3	3	2	3	2	1	3	3

முதற்பருவம்

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BGE11T	Part I Tamil	3	6	1	0	Theory

Introduction: பகுதி முதல் பாடமாக அமையும், தமிழ்ப்பாடம் கவிதைகள், இலக்கணம், இலக்கியவரலாறு ஆகியவைகள் கொண்டு அமைந்து உள்ளது. ஐந்து அலகுகளாக பகுக்கப்பட்டுள்ளது.

Course Outcome:

CO1 : பாரதியார், பாரதிதாசன், சிற்பி, சுரதா ஆகிய கவிதைகளின் விளக்கத்தை மாணவர்கள் அறிந்து கொள்ளுவதால், தன்னம்பிக்கையை வெளிக்கொணரும் வகையில் உள்ளது.

CO2 : பெண் கவிஞர்களின் படைப்பு கவிதையை அறிவதன் மூலம் வாழ்வியல் செய்திகளையும், யதார்த்த நிலையும் அறிய உதவுகிறது.

CO3 : திரு.வி க. மற்றும் மு.வா கட்டுரைகளை அறிவது படைப்பையும், படைப்பின் சிறப்பையும் சங்க கால இலக்கிய செய்திகளையும் அறிய முடிகிறது.

CO4 : படைப்புத்திறனை வெளிப்படும் விதமாகவும், இலக்கணத்தை அறிய பயனுள்ளதாக அமைகிறது.

CO5 : இலக்கியவரலாறு பற்றியச் செய்திகளை கொண்டு அதன் வளர்ச்சி நிலையை அறிவும் வகையில் உள்ளது.

Unit I: [12 Periods]

பாரதியார் - பெண் விடுதலை, பாரதிதாசன் • வீரத் தமிழன், சிற்பி • நிலவுப்பூ சுரதா • நாடு ஆகியவற்றின் விளக்கம் தருதல்.

Unit II: [12 Periods]

பூ.அ இரவிந்திரன் • தாகம் தீர்க்காத தண்ணீர், அ. வெண்ணிலா • நீரிலலையும் முகம் மாலதி மைத்ரி - கன்னியாகுமரி, க்ருஷாங்கினி • புன்னை மரம் ஆகிய கவிதைகளின் செய்திகளை அறிவதால் வாழ்வியல் சூழலையும், யாதர்த்த நிலையையும் விளக்குதல்.

Unit III: [12 Periods]

திரு.வி.கா •பெண்ணின் பெருமை மு.வ • கற்பனை முனைவர் சித்ரா–தமிழ் தரமுயர்த்தலும், நிலைப்படுத்தலும், இரணியன் நா.கு பொன்னுசாமி – சங்க இலக்கியத்தில் சமூக அறம் ஆகியவற்றின் கட்டுரைகளின் செய்திகளை விளக்கம் தருதல்.

Unit IV: [12 Periods]

பெயர் சொல், வினைச்சொல், இடைச்சொல், உரிச்சொல், எச்சம் •இலக்கணத்திற்கு விளக்கம் அளித்தல்• படைப்பிலக்கியப் பயிற்சி, கவிதை எழுதல் வானொலித் தமிழ், தொலைக்காட்சித் தமிழ் பயன்பாட்டுத்தமிழ், இலக்கண நோக்கில் பயிற்றுவித்தல் எழுதுதல் கவிதை+வானொலி பேச்சுத்திறன் வளர்த்தல். ஆகியவைகள் கொண்டு திறன் வளர்க்க உதவுதல்.

[12 Periods]

Unit V:

நவீனக் கவிதை இலக்கிய வடிவங்களான ஹைக்கூ, குக்கூ, சென்ட்ரியூ, கஜல், கணினித் தமிழ் • கலைச்சொற்கள் ஆகியவைகளின் வளர்ச்சி நிலைகளை அறிய உதவுதல்.

Textbook:

பாடநூல்கள்

1. பாரதியார் கவிதைகள்
2. பாரதிதாசன் கவிதைகள்
3. சுரதா கவிதைகள்
4. சிற்பி கவிதைகள்
5. அ. வெண்ணிலா

பார்வை நூல்கள் :

1. இலக்கியவரலாறு – பாக்கியமேரி,
2. இலக்கண நூல்,
3. மு.வ. •தமிழ் இலக்கிய வரலாறு

முதற்பருவம்

(கவிதை, கட்டுரை, இலக்கணம், படைப்பிலக்கியம், இலக்கியவரலாறு)

அலகு 1

1. பாரதியார் - பெண் விடுதலை
2. பாரதிதாசன் - வீரத் தமிழன்
3. சிற்பி - நிலவுப்பூ
4. சுரதா - நாடு

அலகு 2

1. பூ.அ இரவிந்திரன் - தாகம் தீர்க்காத தண்ணீர்
2. அ. வெண்ணிலா - நீரிலையும் முகம்
3. மாலதி மைத்ரி - கன்னியாகுமரி
4. க்ருஷாங்கினி - புன்னை மரம்

அலகு 3 உரைநடை

1. திரு.வி.கா -பெண்ணின் பெருமை
2. மு.வ - கற்பனை
3. முனைவர் சித்ரா – தமிழ் தரமுயர்த்தலும், நிலைப்படுத்தலும்
4. இரணியன் நா.கு.பொன்னுசாமி – சங்க இலக்கியத்தில் சமூக அறம்

அலகு 4

I பெயர் சொல், வினைச்சொல், இடைச்சொல், உரிச்சொல், எச்சம்

படைப்பிலக்கியப் பயிற்சி - 1. கவிதை எழுதல்
2. வானொலித் தமிழ்
3. தொலைக்காட்சித் தமிழ்

பயன்பாட்டுத்தமிழ் - இலக்கண நோக்கில் பயிற்றுவித்தல்
1. எழுதுதல்- கவிதை+வானொலி
2. பேச்சுத்திறன் வளர்த்தல்

அலகு 5 இலக்கிய வரலாறு

நவீனக் கவிதை இலக்கிய வடிவங்கள்

1. ஹைக்கூ 2. குக்கூ 3. சென்ட்ரியூ 4. கஜல்..
2. கணினித் தமிழ் - கலைச்சொற்கள்

பயிற்சிக்குரியன

பாடநூல்கள்

1. பாரதியார் கவிதைகள்
2. பாரதிதாசன் கவிதைகள்
3. சுரதா கவிதைகள்
4. சிற்பி கவிதைகள்
5. அ. வெண்ணிலா

பார்வை நூல்கள் : 1. இலக்கியவரலாறு – பாக்கியமேரி,
2. இலக்கண நூல்,
3. மு.வ. -தமிழ் இலக்கிய வரலாறு

SEMESTER I

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BGE11F	PART I French	3	6	1	0	Theory

Prescribed Text: **LATITUDES I**

Units: 1 – 4

Authors: Régine Mérieux

Yves Loiseau

Available at: Goyal Publishers Pvt Ltd 86,

University Block Jawahar Nagar (Kamla Nagar)

New Delhi – 110007

Tel : 011 – 23852986 / 9650597000

SEMESTER I

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BGE11H	PART I Hindi	3	6	1	0	Theory

(Prose, Non-detailed, Grammar & Translation, Comprehension)

1.PROSE : NUTHAN GADYA SANGRAH
Editor : Jayaprakash
(Prescribed Lessons – only 6)
Lesson 1 – Bharathiya Sanskurthi
Lesson 3 – Razia
Lesson 4 – Makreal
Lesson 5 – Bahtha Pani Nirmala.
Lesson 6 – Rashtrapitha Mahathma Gandhi
Lesson 9 – Ninda Ras.

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

2. NON DETAILED TEXT : KAHANI KUNJ
Editor : Dr. V.P. Amithab.
(Stories 1-6 only)

Publisher : Govind Prakashan Sadhar Bagaar,
Mathura,
Uttar Pradesh – 281 001.

3. GRAMMAR : SHABDHA VICHAR ONLY

(NOUN, PRONOUN, ADJECTIVE, VERB, TENSE, CASE ENDINGS)
Theoretical & Applied.
Book for Reference : Vyakaran Pradeep by Ramdev
Publisher : Hindi Bhavan, 36,
Tagore Town Allahabad – 211 002.

4. TRANSLATION : English – Hindi only.
ANUVADH ABHYAS – III
(1-15 lessons only)
Publisher : DAKSHIN BHARAT HINDI PRACHAR SABHA
CHENNAI – 17.

5. COMPREHENSION : 1 Passage from ANUVADH ABHYAS – III (16-30)
DAKSHIN BHARATH HINDI PRACHAR
SABHA CHENNAI-17.

SEMESTER I

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BGE11M	PART I Malayalam	3	6	1	0	Theory

(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 prescribed:

Unit I & II Pathummayude Aadu - Vaikam Muhammed Basheerr
(D.C.Books, Kottayam, Kerala)

Unit III & IV Ente Priyappeta Kadhakal – Akbar Kakkattil)
(D.C. Books, Kottayam, Kerala)

Unit V Expansion of ideas, General Eassay and Translation.

(A simple passage from English about 100 works to Malayalam)

Reference Books: 1.Malayala Novel Sahithya Charitram-K.M.Tharakan
(N.B.S.Kottayam)
2. Cherukatha Innale Innu-M.Achuyuthan (D.C Books, Kottayam)

4. Sahithya Charitram Prasthanangalilude- Dr.K.M George, (D.C.Books Kottayam)

5.Malayala Sahithya vimarsam-Sukumar Azhee kode (D.C.books)

SEMESTER I

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BGE11A	PART I Arabic	3	6	1	0	Theory

PAPER-I: PROSE AND GRAMMAR–I

Books Prescribed: 1. Duroos Al-Lugha Al-Arabiyya Part-I (Lesson 1 to 12)
By Dr. V. Abdur Rahim, IFT, Perambur, Chennai-12.

2. An-Nahwu Al-Wadeh Part-I (Al-Ibtidaiyyah - Selected Lessons) By Ali Alijarim and Mustafa Ameen, Al-Huda Book Stall, Calicut, Kerala

(Lessons: Al-Jumlah Al-Mufeedha, Ajza Al-Jumlah, Al-Fi'l al-Madhi, Al-Fi'l-al-Mudhari', Fi'l al-Amr, Al-Fa'il, Al-Maf'uool, Al-Mubthdha Wal- Khabar)

SEMESTER I

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BGE11U	PART I Urudu	3	6	1	0	Theory

(PROSE, GRAMMER & TRANSLATION)

Book Prescribed: **Faizan-e-Adab** - Edited by Dr.K.Habeeb Ahmed
[Published by Ansaar Educational & Welfare Society,
Melvisharam- Contact No.9994965700,9443818785]

[a] Prose:
The following lessons only
1. SAIR PAHLAY DARWESH KI - Meer Amman Dehalvi
2. UMEED KI KHUSHI – Sir Syed
3. MIRZA GHALIB KE AKHLAQ WA ADAT – Moulana hali
4. ZUBAIDA KHATOON – Abdul Haleem Sharar
5. NOOR JHAN – Mohamed Hussain Azad
6. MARHOOM DI YAAD MEIN – PATRAS BUKHARI
7. SIR SYED MARHOOM AUR URDU LITERATURE – Shibi
8. KHAJA MOHINUDEEN SHITHI- Shabaz Hussain

[b] Grammar: 1. ISM AUR USKI KHISMEIN
2. ZAMEER AUR USKI KHISMIEN
3. SIFAT AUR USKI KHIMEIN
4. FE'L AUR USKI KHIMEIN
5. LAWAZIM-E-ISM
6. ALAMAT-E-FAEL "NAY" AUR ALAMAT-E-MAFO'OL "KO" KE QUAIDE BOOK FOR REFERENCE Urdu Grammar by Yaqoob Aslam
[c] TRANSLATION: A GENERAL PASSAGE FOR TRANSLATION FROM ENGLISH TO URDU

Semester :I

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
Core I 21BBTC01	**Cell Biology**	**4**	**4**	**0**	**0**	**Theory**

Course Objective: Understanding the structural and functional aspects of the cell, provide the student with a strong foundation in the cellular organization and function.

Course Focus on: Skill Development

Course Outcome
CO1: To become skillful the basics of cell structure and classification.
CO2: To understand the component and functions of cells.
CO3: To learn the functional activity of cells.
CO4: To become familiar with cell multiplication and action.
CO5: Examine the characteristics of cellular organelles and interpret how it is involved in cell activity and communication.

Unit I: [12 Periods]
Introduction: Advent of cell biology; three historical strands; cell theory; protoplasm theory; organismal theory; Primitive earth; setting stage of chemical evolution. Prokaryotic and Eukaryotic cell organization.

Unit II: [12 Periods]
Cell transport phenomenon: Membrane architecture. Active, Passive, diffusion and osmosis.
Chemistry of carbohydrates, lipids, proteins and nucleic acid.

Unit III: [12 Periods]
Structure and functions of cytoplasmic components of the cell: Ribosome and protein synthesis, energy flow through mitochondrion, chloroplast and photosynthesis, Golgi apparatus, lysozymes and microbodies, endoplasmic reticulum, cytoskeleton, vacuoles, peroxysomes, lysozomes and Nuclear compartment. Heterochromatin and euchromatin, polytene chromosomes.

Unit IV: [12 Periods]
Cell growth, cell cycle and Mitosis: Types of cell division, Amitosis; Cell growth – factors regulating cell growth, Mitogen and types, function. Cell cycle – Mitosis – cytokinesis, Process of Meiosis.
Unit V: [12 Periods]
Reproduction – Asexual reproduction; fission, budding, gemmule formation, regeneration, sexual reproduction, syngamy, conjugation, automixis, parthenogenesis.

Text Book:
1. Cell Biology by P S Verma and V K Agarwal, 2016
2. Cell Biology- cytology, Biomolecules and Molecular Biology by P S Verma, V K Agarwal, 2020.

References:

1.Cell and molecular biology, 3rd edition, Philip Sheeler, Donal E Bianchi, John Wiley
2. Molecular biology of cell, Albert et al
3. Molecular cell biology, Lodish, Baltimore, Scientific American books, 1994

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2							3	2		1
CO2			3	2		1			2	3	1	
CO3	3	2			1				3		2	1
CO4		3		2	2	1			2	3	1	
CO5		3					2	1	2	1		3

Mapping of CO's and PO's Components are:

3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester :I

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
21BBT2CA	**Principles of Genetics**	**4**	**4**	**0**	**0**	**Theory**

Introduction: This course present the various ways in which characters get transferred through different generations and methods to analyze and modify them.

Course Focus on: Skill Development

Course Objectives

CO 1: Understand the significance of Genetic materials and Mendel's law

CO2: Recognize differences between the biological sexual mechanisms

CO3: Analyze the genetic material based on their confirmation

CO4: Evaluate the nature and action of mutation

CO5: Predict the nature of gene frequency in a population.

Unit I: [12 Hours]

Genetic Material: DNA is a Genetic Material, Structure, Semiconservative replication, Overview of DNA replication. The replisome: a remarkable replication machine, replication ignition, replication termination.

Unit II: [12 Hours]

Mendel's experiment and principle of segregation, monohybrid cross- Dominance, Recessiveness, Codominance and Lethals; Principle of independent assortment – Dihybrid crosses, multiple alleles.

Unit III: [12 Hours]

Mechanism of sex determination, sex differentiation and sex linked inheritance, linkage, crossing over and chromosomal mapping.

Unit IV: [12 Hours]

Mutation: General properties of mutation – Molecular Basis of Mutation – Spontaneous mutations – Induced mutation. Mechanism of DNA repair – Reverse mutation and Suppressor mutation and Recombination

Unit V: [12 Hours]

Population and Evolutionary Genetics: Genetic variation, Hardy Weinberg law and applied to human population, Natural selection, migration, Genetic drift, Nonrandom mating, Geneflow, Phylogenetic tree.

Text Books:

1. Principles of Genetics – Gardner/Simmons/Snustad, 8th edition (1991), John Wiley & Sons, Inc.

Reference Books:

1. Principles of Genetics – Robert Tamarin 7th Ed. WMC Brown publication, Boston, 2004.
2. Gene IX – Benjamin Lewin (2007), Jones & Bartlett Learning, New Jersey.
3. Genetics – Danial L.Hartl, Elizabeth W. Jones (2006), Jones and Bartlett public. New Jersey.
4. Molecular Cell Biology – Harvey Lodish, Arnold Berk, et al., 8th edition (2016), Published by W.H freeman and company, New York.
5. Microbial Genetics – Friefelder (1994), Jones and Bartett public.
6. William S.Klug et al., Concept of Genetics, Pearson India, 2020.

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1					3	2	1	
CO2			3	2		1			2	3	1	
CO3	3	2			1				3		1	2
CO4		3		2	2	1			2	3	1	
CO5		3					2	1	2	1		3

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester: I

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
21BCHA01–	Chemistry I	4	4	1	0	Theory

Course Focus on: Skill Development

Course Objectives:

CO 1: To understand the fundamental chemistry applied in Biotechnology
CO 2: To know the industrial processing of agriculture chemistry
CO 3: To aware of the metals on industrial application
CO 4: To become skillful amino acids and their properties.
CO 5: To learn the principles of Electrochemical properties.

Unit 1: [12 Hours]

Industrial Chemistry Synthesis, properties and uses of silicones. Fuel gases: natural gas, water gas, semi water gas, carburetted water gas, producer gas, oil gas (manufacturing details not required). 2. fertilizers urea, ammonium sulphate, ammonium nitrate, potassium nitrate NPK fertilizer. Triple superphosphate.

Unit II: [12 Hours]

Stereoisomerism Optical isomerism: symmetry, elements of symmetry. Cause of optical activity, tartaric acid, Racemisation, Resolution. Geometric isomerism of maleic and fumaric acids. Unit I: 1. Metals General methods of extraction of metals. Types of ores. Methods of ore dressing.. Reduction methods, electrical methods, types of refining Van Arkel Zone refining.

Unit III: [12 Hours]

Terms: chromophore, auxochrome, bathochromic shift, hypsochromic shift, hyperchromic effect, hypsochromic effect. 2. Dyes: azo and triphenylmethane dyes- Preapration one example. Solutions types. Liquid in Liquid. Raoult's law. Fractional distillation. 2. Kinetics Rate, order, moleculality, pseudo first order, determination of order.Energy of activation. Chromatography: column, paper, thin layer

Unit IV: [12 Hours]

Amino Acids: Classification, preparation and properties, preparation of peptides. Classification of proteins by physical properties and by biological functions. 2. Carbohydartes: classification, preparation and properties of glucose and fructose. Discussion of open chain ring structures of glucose and fructose.

Unit V: [12 Hours]

Electrochemistry: Measurement of conductance. Kohlraush's law .pH determination. Conductometric titrations. Hydrolysis of salts: pH and buffer in living systems. Galvanic cells, e.m.f. standard electrode potentials, reference electrodes. Electrochemical series, its applications. Pricnciples of electroplating.

Text Book

Dr. V. Veeraiyan.,"Text book of Ancillary chemistry", Volume I, High mount Publishing house, Chennai-14,Edition-2008 (Unit-I to Unit-V)

References

P.L. Soni, "Text Book of Inorganic Chemistry", Sultan Chand &Sons, New Delhi, 2013
Puri and Sharma, "Text book of Inorganic Chemistry", Vishal publishing, 2014

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	1				3	2		1
CO2			3	2		1			2	3	1	
CO3		3		2	1				3		1	2
CO4		3		2	2	1			2	3	1	
CO5		3					2	1	2	1		3

Mapping of CO's and PO's Components are:

3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester I

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
Core I– 21BBT1CP	**Lab in Cell Biology**	**2**	**0**	**0**	**4**	**Practical**

Course Objective: This practical session students able to know the cell divisions and various stages 1. 1.
Course Focus on: Skill Development & Employability

1. Mitosis in onion (*Allium cepa)* Root tip
2. Meiosis in Flower Buds of *Allium cepa*
3. Buccal Epithelial Smear and Barr Body
4. Differential Staining of Blood
5. Determination of Blood group and Rh Factor

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
DSC I – 21BBTCP1	**Lab in Genetics**	**2**	**0**	**0**	**4**	**Practical**

Course Objective: This practical session students able to know the identify the morphological characters of Drosophila sp.
Course Focus on: Skill Development & Employability

1. Breeding Experiments in Drosophila Melanogaster
2. Preparation of Salivary Gland Chromosomes
3. Mounting of The Sex Comb in Drosophila Melanogaster
4. Study of Drumsticks in The Neutrophils of Females
5. Karyotyping

References

1. Laboratory Manual for Biotechnology Verma, Ashish S./ Das Surajit & Singh Anchal
S. Chand Publishing, 2014

2.Biotechnology Procedures And Experiments Handbook, S. Harisha, Ph.D. Infinity Science Press Llc, Hingham, Massachusetts, New Delhi, India

இரண்டாம் பருவம்

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BGE21T	Part I Tamil	3	6	1	0	Theory

Introduction: இரண்டாம் பருவ பாடத்திட்டம் அற இலக்கியம், சிற்றிலக்கியம், சிறுகதைகள், இலக்கணம், இலக்கிய வரலாறு ஆகியவைகள் கொண்டு உருவாகியுள்ளது.

Course Outcome:

CO1 : நீதிநெறி கருத்துக்களை அறிந்து கொள்ளுவதால், வாழ்க்கையில் பண்புகளை பின்பற்றவும், அறநெறிவோடு வாழவும் பயனுள்ளதாக அமையும்.

CO2 : சிற்றிலக்கியத்தின் செய்திகள் மாணவர்கள் தெளிவாக அறிந்துகொள்ளுவது அன்பின் மேன்மை, பண்பு ஆகியவைகள் அறிந்து கொள்ள முடிகிறது.

CO3 : அணி இலக்கணம் அறிவதால் இலக்கணத்தின் சிறப்பு முக்கியம் என்பதை அறியலாம்.

CO4 : சிறுகதைகளில் உள்ள கதைகளில் உள்ள மையக்கருத்துகளைத் தெரிந்து கொள்ளுவது சமுதாயச் சிந்தனையையும், விழிப்புணர்வும் உருவாக்க உதவுகிறது.

CO5 : நீதி சிற்றிலக்கியங்கள் ஆகியவற்றின் செய்திகளை அறிவது தமிழின் வரலாற்றையும், படிநிலைகளையும் அறிய பயன் உள்ளது. களப்பணிகளை அறியலாம்.

Unit I: [12Periods]

அற இலக்கியம் திருக்குறள், அன்புடைமை,அறிவுடைமை, நாலடியார், பழமொழி நானூறு• ஆகியவைகள் நீதியின் கருத்துக்கள் கொண்டு பாடமாக உள்ளது.

Unit II: [12Periods]

முக்கூடற்பள்ளு•பள்ளி ஏசல், குற்றலாக் குறவஞ்சி – மலைவளம், கலிங்கத்துப்பரணி காடு பாடியது, அழகர் கிள்ளை விடு தூது, கலிங்கத்துப்பரணி–கோயில் பாடியது, கிள்ளை விடு தூது ஆகிய சிற்றிலக்கியங்களின் கருத்துக்களை தெளிவாக எடுத்துரைத்தல்.

Unit III: [12 eriods]

உருவக அணி, தற்குறிப்பேற்றணி, சொற்பொருள் பின்வரு நிலை அணி, உவமை அணி அணி இலக்கணம் • விளக்கத்துடன் கற்பிக்கப்படும்.

Unit IV:. [12 eriods]

தேர்ந்தெடுக்கப்பட்ட 4 •சிறுகதைகள் • மாணவர்களின் தனித்திறனை வளர்க்கும் பொருட்டு எடுக்கப்படும். சமுதாய செய்திகளை பற்றி விளக்கம் தருதல்.

Unit V: [12 eriods]

நீதி இலக்கியம், சிற்றிலக்கியம், ஆகியவைகளின் தோற்றத்தையும், வளர்ச்சியும் எடுத்துரைக்கப்படும். தொல்லியல் அகழாய்வு அண்மைப் பதிவுகள் • திட்டக்கட்டுரை ஒப்படைப்பு, களப்பணிகளைப் பார்வையிடல், தரவுகளைப் பட்டியலிடல். விளக்கத்துடன் கூறுதல்.

Textbook:

பாடநூல்கள்

1. பதினெண்கீழ்க்கணக்கு நூல்கள்
2. முக்கூடற்பள்ளு நூல்
3. குற்றலாக்குறவஞ்சி
4. கலிங்கத்துப்பரணி

பார்வை நூல்கள்

1. ஜெயகாந்தன் சிறுகதை
2. புதுமைப்பித்தன் சிறுகதை
3. சூடாமணி சிறுகதை
4. அம்பை சிறுகதை
5. மு.வ. -தமிழ் இலக்கிய வரலாறு
6. டாக்டர் கே.கே பிள்ளை – தமிழக வரலாறு மக்களும் பண்பாடும்.
7. பேரா.முனைவர் பாக்யமேரி - இலக்கணம் இலக்கிய வரலாறு மொழித்திறன்.

இரண்டாம் பருவம்

(அற இலக்கியம், சிற்றிலக்கியம், இலக்கணம், சிறுகதை, இலக்கிய வரலாறு)

அலகு I அற இலக்கியம்

1. திருக்குறள் - 2 அதிகாரங்கள்
   1. அன்புடைமை 10 குறள்கள் அதிகாரம் -8
   2. அறிவுடைமை 10 குறள்கள் அதிகாரம் -43
2. நாலடியார் -5 பாடல்கள் (132,133,135,136,139)
3. பழமொழி நானூறு - 5 பாடல்கள் (90,91,93,95,100)

அலகு II சிற்றிலக்கியம்

1. முக்கூடற்பள்ளு - பள்ளி ஏசல்
2. குற்றலாக் குறவஞ்சி – மலைவளம்
3. கலிங்கத்துப்பரணி – காடு பாடியது
4. அழகர் கிள்ளை விடு தூது

அலகு III இலக்கணம்

அணி இலக்கணம் - விளக்கத்துடன் கற்பித்தல்.

1. உவமை அணி
2. உருவக அணி
3. தற்குறிப்பேற்றணி
4. சொற்பொருள் பின்வரு நிலை அணி

அலகு IV சிறுகதைகள்

1. ஜெயகாந்தன் 2. புதுமைப்பித்தன் 3. சூடாமணி 4. அம்பை - (4 சிறுகதைகள்)

அலகு V இலக்கிய வரலாறு

1. நீதி இலக்கியம்
2. சிற்றிலக்கியம்
3. தொல்லியல் அகழாய்வு அண்மைப் பதிவுகள் - திட்டக்கட்டுரை ஒப்படைப்பு களப்பணிகளைப் பார்வையிடல், தரவுகளைப் பட்டியலிடல்.

பாடநூல்கள்

1. பதினெண்கீழ்க்கணக்கு நூல்கள்
2. முக்கூடற்பள்ளு நூல்
3. குற்றலாக்குறவஞ்சி
4. கலிங்கத்துப்பரணி

பார்வை நூல்கள்

1. ஜெயகாந்தன் சிறுகதை
2. புதுமைப்பித்தன் சிறுகதை
3. சூடாமணி சிறுகதை
4. அம்பை சிறுகதை
5. மு.வ. -தமிழ் இலக்கிய வரலாறு
6. டாக்டர் கே.கே பிள்ளை – தமிழக வரலாறு மக்களும் பண்பாடும்.
7. பேரா.முனைவர் பாக்யமேரி - இலக்கணம் இலக்கிய வரலாறு மொழித்திறன்.

SEMESTER II

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BGE21F	PART I French	3	6	1	0	Theory

Prescribed Text: **LATITUDES I**

Units: 5 – 8

Authors: Régine Mérieux

Yves Loiseau

Available at: Goyal Publishers Pvt Ltd 86,

University Block Jawahar Nagar (Kamla Nagar)

New Delhi – 110007

Tel : 011 – 23852986 / 9650597000

SEMESTER II

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BGE21H	PART I Hindi	3	6	1	0	Theory

(Modern Poetry, One Act Play, Translation & Letter Writing, Conversation)

1. MODERN POETRY : BHOOMIJA by NAGARJUN
   Publishers : Rajkamal Prakashan
   1B Nethaji Subash Marg,
   New Delhi.

2. ONE ACT PLAY :
   NAVEEN EKANKI SANGRAH
   By Dr. Smt. MALATI THIVARI
   SUMITHRA PRAKASHAN
   ASHOK NAGAR
   ALLAHABAD – 1.

3. TRANSLATION : HINDI-ENGLISH ONLY
   (ANUVADH ABYAS-III)
   Lessons – 1-15 only

   PUBLISHER : DAKSHIN BHARATH HINDI PRACHAR SABHA
   CHENNAI – 600 017.

4. LETTER WRITING : (Leave Letter, Job Application, Ordering Books, Letter to Publisher, Personal Letter)

5. CONVERSATION : (Doctor & Patient, Teacher & Student, Storekeeper & Buyer, Two Friends, Booking Clerk & Passenger at Railway Station, Autorickshaw driver and Passenger)
   Ref : Bolchal Ki Hindi Aur Sanchar by Dr. Madhu Dhavan Vani Prakashan, New Delhi.

SEMESTER II

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BGE21M	PART I Malayalam	3	6	1	0	Theory

(Prose: Non-Fiction)

This paper will have the following five units:

Unit I & II Autobiography

Uinit III,IV & V Travelogue

Text Books prescribed: Unit I & II Vazhithiruvukal-Dr.A.P.J.Abdulkalam
(D.C.Books, Kottayam)

Unit III,IV & V Alkoottathil Thaniyae - M.T Vasudhevan Nair
(D.C.Books, Kottayam)

Reference books:

1. Athmakathasahithyam Malayalathil-Dr.Vijayalam Jayakumar (N.B.S.Kottayam)
2. Sancharasahithyam Malayalathil –Prof.Ramesh chandran. V,(Kerala Bhasha Institute, Trivandrum)

SEMESTER II

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BGE21A	PART I Arabic	3	6	1	0	Theory

PAPER-II: COMMUNICATIVE ARABIC

Books Prescribed: 1. **Arabic Conversation Book (Lesson 1 to 19)**

By Mohd. Harun Rashid and Khalid Perwez, Published by Good word Books

SEMESTER II

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BGE21U	PART I Urudu	3	6	1	0	Theory

(POETRY, GHAZALITH & LETTER WRITING)
Urudu Language

Book Prescribed: **Faizan-e-Adab** - Edited by Dr.K.Habeeb Ahmed
[Published by Ansaar Educational & Welfare Society,
Melvisharam- Contact No.9994965700,9443818785]
Part- I Urudu Language (Colleges) 2014-15

Annexure : **13F** Page 2 of 4 SCAA DT. : 6-2-2014

[a] MANZOOMATH

1. BARQ-E-KALESA – AKBAR ALLAHBADI
2. SHIKWA – ALLAMA IQBAL

(Selected four stanzas from each of the above)

3. JAWAB-E-SHIKWA – ALLAMA IQBAL

(Selected four stanzas from each of the above)

4. SUBH-E-AZADI – FAIZ AHMED FAIZ
5. TAJ MAHAL – SAHIR LUDHYANWI

[b] GHAZALITH:

1. MEER TAQI MEER
2. KHAJA MEER DARD
3. SHAIK IBRAHIM ZAUQ
4. MIRZA GHALIB
5. MOMIN KHAN MOMIN
6. JIGAR MURADABADE
7. HASRATH MOHANI
8. FANI BADAYUNI
9. DANISH FARAZI
10. SHAKIR NAITHI

[c] LETTER WRITING:

1. LETTER TO THE PRINCIPAL SEEKING LEAVE
2. LETTER TO THE MANAGER OF A FIRM SEEKING EMPLOYMENT
3. LETTER TO A PUBLISHER OT BOOK SELLER PLACING ORDER FOR BOOKS
4. LETTER TO THE MUNICIPAL COMMISSIONER DRAWING HIS ATTENTION
5. LETTER TO THE FATHER / GUARDIAN ASKING MONEY FOR PAYMENT OF COLLEGE FEES
6. LETTER TO A FRIEND INVITING HIM TO YOUR SISTER'S MARRIAGE

Semester :II

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
21BBT1CA	**Fundamentals of Microbiology**	**4**	**4**	**0**	**0**	**Theory**

Course Objective : The successful completion of this course students able to know the isolation, identification and characterization microbes from environmental samples.

Course Focus on: Skill Development & Research

Course Outcome

CO 1: To gain insights on how the subject area developed over a period of time.
CO 2: To impart knowledge on the working of different types of Microscopes.
CO 3: To internalize the techniques used to observe microorganisms by different staining techniques.
CO 4: To identify the different types of medium and techniques used for the growth and cultivation of microorganisms.
CO 5: Able to aware of microbial Disease caused by Human.

UNIT I: (12 Hours)
Introduction to microbiology; Historical perspective and notable milestones in microbiology. Classification, nomenclature and taxonomy. Major characteristics of microorganism.

UNIT II: (12 Hours)
Morphology and fine structure of Bacteria: Size, shape and arrangement, Bacterial structure, Structures external to the cell wall, structure and chemical composition of cell wall, cytoplasmic membrane, Protoplast, spheroplast, cytoplasmic inclusions and vacuoles, Nuclear material.

UNIT III: (12 Hours)
Microbial Nutrition: Nutrient requirements, Growth factors, Culture media, Isolation of pure culture. Microbial growth: Growth curve, Measurement of microbial growth, continuous culture of microorganisms, Balanced and unbalanced growth.

UNIT IV: (12 Hours)
Antimicrobial Chemotherapy: Development of Chemotherapy, General characteristics of Antimicrobial drugs, Determination the level of Antimicrobial activity, Antibacterial drugs, Antifungal drugs, Drug resistance.

UNIT V: (12 Hours)
Human Disease caused by microbes: Airborne Disease, Arthropod Borne disease, Direct contact disease, food borne and water borne disease. Human disease caused by fungi and protozoa. Human disease caused by viruses.

Text Book

Microbiology: Concepts and Applications Michael J, Pelczar JR; 1993. McGraw Hill Inc.
References
Microbiology: Prescott, L.M; J.P. Harley and D.A.Klein. 2004. 6th edition Brown publisher.

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2			3	2		1			2	3	1	
CO3		3		2	1				3		1	2
CO4		2		3	2	1			2	3	1	
CO5		3					2	1	2	1		3

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester :II

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
Core Paper – 21BBTC02	**Bioinstrumentation**	**4**	**4**	**0**	**0**	**Theory**

Introduction: This course present the various instrumentation Principle, operation and applications.

Course Focus on: Employability

Course Outcome

CO1: Able to understand the principles of spectroscopy.
CO2: Analyze the application of chromatography techniques.
CO3: Apply the techniques for biomolecule separation process.
CO4: Evaluate the DNA and protein through Electrophoresis techniques.
CO5: Know the techniques for Gene amplification and sequencing.

Unit I: [12 Hours]

Microscopy: Basic principles in microscopy - Types of microscopes, light, dark, phase contrast, fluorescent. Electron microscope- TEM & SEM .

Unit II: [12 Hours]

Spectroscopy- UV Visible spectroscopy- – Beer – Lambert law Applications – Instrumentation Applications. Vibrational spectroscopy - infrared Absorption spectroscopy , Raman spectroscopy –, instrumentation, applications. Fluorescence spectroscopy instrumentation – Applications.

Unit III: [12 Hours]

Separation technique – chromatography – column chromatography, Thinlayer chromatography – paper chromatography – ion exchange chromatography, exclution chromatography - Reversed phase chromatography. Affinity chromatography – HPLC , Equipment, Application. Advanced chromatography techniques.

Unit IV: [12 Hours]

Electrophoresis – polyacrylamide gel electrophoresis applications - SDS PAGE. Agarose Gel Electrophoresis – pulsed field gel electrophoresis. 2D gel electrophoresis . Molecular Biology Methods – Radioactivity – – Geiger Muller counter – Autoradiography – Applications.

Unit V: [12 Hours]

Polymerase chain reaction – DNA synthesis in PCR – Variations of the basic PCR methods. Quantitative PCR – Nested PCR – Reverse transcription PCR- Inverse PCR. Protein Sequencing – tRNA sequencing- DNA sequencing – sequencing by selective cleavage Maxam Gilbert method – Sanger sequencing, - genome sequencing – sequencing of single DNA molecules.

Reference:

1. Bioanalytical techniques by Sekhar Tallar (2009)- IK International Publishing House Pvt Ltd.
2. Biophysical Chemistry- Avinash Upadhyay, Nirmalendu Nath, Kakoli Upadhyay, (2014), Himalaya publishing House
3. Practical Biochemistry- Wilson & Walker – Vth edition (2009)Cambridge University Press
4. Practical Biochemistry- David Plummer- Tata McGraw Hill 3rd edition.

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	Programme outcomes								Programme Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	1			1		3	2		1
CO2		2	3	2		1			2	3	1	
CO3		3		2	1				3		1	1
CO4		2		3	2	1			2	3	1	
CO5		3	2				2		2	1		

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester :II

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
Allied	**21BBTA01 Bio- Entrepreneurship, Innovation & Design Thinking**	**4**	**5**	**0**	**0**	**Theory**

Introduction: To build the necessary competencies and creativity and prepare them to undertake entrepreneurship as a desirable and feasible career option

Course Focus on: Entrepreneurship

Course Objectives:

CO 1: To create a challenging of design thinking to solve the more complex issues.
CO 2: To provide tools and methods in order to make use of entrepreneurial thinking to develop a business project.
CO 3: Students will be able to define, identify and/or apply the principles of new venture financing, growth financing, and growth financing for existing businesses.
CO 4: Able to think new strategies to apply for innovative business model.
CO 5: To understand difference between Micro, small and medium Enterprises.

Unit I: [12 Hours]

Design Thinking (DT) – Systematic & Integrated Thinking, Design tools and Management, Innovation approach of DT, Scholarly Description and Perspectives of DT research.

Unit II: [12 Hours]

Holistic approach to challenges of Innovation, Human centered Innovation, Understanding Upstream and downstream of design thinking, Discovery – Incubation – Acceleration.

Unit III: [12 Hours]

Innovation and entrepreneurship in bio-business - Introduction and scope in Bio-entrepreneurship, Types of bio-industries and competitive dynamics between the sub-industries of the bio-sector (*e.g.* pharmaceuticals *vs.* Industrial biotech), Strategy and operations of bio-sector firms: Factors shaping opportunities for innovation and entrepreneurship in bio-sectors, and the business implications of those opportunities, Alternatives faced by emerging bio-firms and the relevant tools for strategic decision, Entrepreneurship development programs of public and private agencies (MSME, DBT, BIRAC, Make In India), strategic dimensions of patenting & commercialization strategies.

Unit IV: [12 Hours]Finance and Accounting - Business plan preparation including statutory and legal requirements, Business feasibility study, financial management issues of procurement of capital and management of costs, Collaborations & partnership, Information technology.

Unit V: [12 Hours]

Technology management - Technology – assessment, development & upgradation, Managing technology transfer, Quality control & transfer of foreign technologies, Knowledge centers and Technology transfer agencies, Understanding of regulatory compliances and procedures (CDSCO, NBA, GCP, GLA, GMP).

Text Book:

1. Robert D. Hisrich, Mathew J Manimala, Michael P Peters, Dean A Shepherd, "Entrepreneurship", McGraw Hill Education, 2014.
2. Adams, D. J., & Sparrow, J. C. (2008). *Enterprise for Life Scientists: Developing Innovation and Entrepreneurship in the Biosciences*. Bloxham: Scion.
3. Shimasaki, C. D. (2014). *Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies*. Amsterdam: Elsevier. Academic Press is an imprint of Elsevier.

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	Programme outcomes								Programme Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1		1		3	2		1		3	2		1
CO2			1	2		1		3	2	3	1	
CO3		1		2	1			3	3		1	2
CO4		1		2	1	1		3	2	3	1	
CO5		1					2	3	2	1		3

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester :III

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
Core-21BBT2CP	**Lab in Microbiology**	**2**	**0**	**0**	**5**	**Practical**

Course Focus on: Employability & Research

1. Media Preparation and Sterilization
2. Isolation of microorganism from soil , water and Air
3. Pure culture Techniques
4. Selective and Differential Media Preparation
5. Measurement of Bacterial Growth
6. Staining of Microorganism
7. IMVIC test
8. Carbohydrate fermentation test
9. TSI
10. H2S production test
11. Antibiotic sensitivity test

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
DSC- 21BBTCP2	**Lab in Bioinstrumentation**	**2**	**0**	**0**	**5**	**Practical**

Course Focus on: Employability & Research

1. Microscopy
2. Spectrophotometer - Protein Quantification
3. Electrophoresis – Age & Page (Demo)
4. Column Chromatography (Demo)
5. Polymerase Chain Reaction – PCR (Demo)

References

1. Laboratory Exercises in Microbiology by Harley and Prescott, 5th edition,
2. Laboratory Manual in General Microbiology by Benson, 8th edition

Semester :III

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
Core-21BBT3CA	**Plant Biotechnology**	**4**	**5**	**0**	**0**	**Theory**

Introduction: This course presents the Basics of Plant tissue culture and quality enhance the plant based products.

Course Focus on: Skill Development, Employability & Entrepreneurship

Course Outcome
CO1: To become familiar with plant tissue culture techniques and preparations.
CO2: To know the techniques for plant gene transformation and process.
CO3: To learn the functional activity of vectors for transformation.
CO4: To become familiar with transgenic plant with regulations.
CO5: To learn about Quality analysis of plant based products.

Unit I: [12 Hours]
Plant Tissue Culture: Introduction, Plasticity and totipotency, Culture environment, plant cell culture media, growth regulators. Culture types: Callus, Cell suspension culture, Protoplast, Root culture, Shoot tip and meristem culture, Embryo culture, Microspore culture. Plant regeneration – Somatic embryogenesis and Organogenesis.

Unit II: [12 Hours]
Techniques for plant transformation: Introduction, Agarobacterium mediated gene transfer, Crown gall disease. Ti plasmid and T DNA, The process of T DNA transfer and integration. Practical applications of Agrobacterium mediated plant transformation. Methods of Transformations.

Unit III: [12 Hours]
Vectors for Plant transformation: Introduction, Desirable features of Plasmid vector, Basic features of vector for plant transformation, promoters and terminators, Selectable Markers, Reporter genes, Arrangement of Gene in vectors.

Unit IV: [12 Hours]
Transgenic Plants: Genetic manipulation of herbicide tolerance – Genetic manipulation of pest resistance – Plant disease resistant – engineering of stress tolerance – improvement of crop yield and quality – Regulations of GM crops in India, EU and USA.

Unit V: [12 Hours]
Quality analysis of Plant and Plant Product: Extraction plant product - Phytochemical constituent – Antioxidant Properties – Antimicrobial Properties.

Text Book
1.Plant Biotechnology - Ramawat, K.G. 2008. Second Edition, S.Chand &Co., New Delhi.

2. An introduction to Plant tissue culture - Razdan. M.K 2003. Oxford & IBH Publishing Co, New Delhi.

3.An Introduction to Plant Biotechnology- Chawla, H.S.2009. 3r edition, science Publishers, Inc, Enfield, NH, USA.

4. Plant Biotechnology – the genetic manipulation of plants second edition –Adrian Slater, Nigel W.Scott and Mark R. Fowler. Oxford University press-2010.

5.Molecular Biotechnology – Glick, B.R and J.J .Pasternak 1998. Second Edition. ASM Press, Washington.

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	Programme outcomes								Programme Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2			3	2		1			2	3	1	
CO3		3		2	1				3		1	2
CO4		2		1	2	1		3	2	3	1	
CO5		2					1	3	2	1		3

Mapping of CO’s and PO’s Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester :III

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
DSC-21BBTC03	**Biochemistry**	**4**	**5**	**0**	**0**	**Theory**

Introduction: This course presents the Basic structure and functions of Biomolecules and their Metabolic activities.

Course Focus on: Skill Development & Research

Course Outcome
CO1: To become skillful the basics structure and functions of Amino acids and Proteins.
CO2: To understand the enzyme classification and activities.
CO3: To learn the functional activity of Carbohydrates.
CO4: To become familiar with Metabolism of carbohydrates.
CO5: To learn about Nucleic acid structure and functions.

Unit I: [12 Hours]
Amino acids & Proteins: Structure & Function. Structure and properties of Amino acids, Types of proteins and their classification, Forces stabilizing protein structure and shape. different Level of structural organization of proteins. Fibrous and globular proteins.

Unit II: [12 Hours]
Enzymes: Nomenclature and classification of Enzymes, Holoenzyme, apoenzyme, Cofactors, coenzyme, prosthetic groups, metalloenzymes, monomeric & oligomeric enzymes, activation energy and transition state, enzyme activity, specific activity, common features of active sites,Role of: NAD+, NADP+, FMN/FAD, coenzymes A, Thiamine pyrophosphate, Pyridoxal phosphate,lipoic-acid, Biotin vitamin B12, Tetrahydrofolate and metallic ions.

Unit III: [12 Hours]
Carbohydrates: Structure, Function and properties of Monosaccharides, Disaccharides and Polysaccharides. Homo & Hetero Polysaccharides, Mucopolysaccharides, Bacterial cell wall polysaccharides, Glycoprotein's and their biological functions.
Lipids: Structure and functions –Classification, nomenclature and properties of fatty acids, essential fatty acids. Phospholipids, sphingolipids, glycolipids, cerebrosides, gangliosides, Prostaglandins, Cholesterol.

Unit IV: [12 Hours]
Carbohydrates Metabolism: Reactions, energetics and regulation. Glycolysis: Fate of pyruvate under aerobic and anaerobic conditions. Pentose phosphate pathway and its significance, Gluconeogenesis, Glycogenolysis and glycogen synthesis. TCA cycle, Electron Transport Chain, Oxidative phosphorylation. ß-oxidation of fatty acids.

Unit V: [12 Hours]
Nutrition – study of human nutrition, energy consideration in nutrition. Energy metabolism- factors affecting basal metabolism; Measurement of energy requirements, Nutritional requirements of human, Dietary reference intakes, Recommended dietary allowances for Indians; Malnutrition – Assessment of nutritional status.

Reference Book

1. Lehninger Principles of Biochemistry By: David L. Nelson and Cox
2. Harper's Biochemistry By: Robert K. Myrray
3. Enzymes By:Trevor Palmer
4. Principles of Biochemistry By: Donald J. Voet, Judith G.Voet, Charlotte W.Pratt
5. Principles and techniques of Biochemistry and Molecular Biology Edited By Keith Wilson and John Walker

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2	3			2		1			2	3	1	
CO3	2	3		1	1				3		1	2
CO4	3	2		2	2	1			2	3	1	
CO5		3					2	1	2	1		3

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester :III

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BMAA12	**Biostatistics and Computer Application**	**4**	**4**	**0**	**0**	**Theory**

Course Focus on: Skill Development

Course Outcome

CO1: Able to understand the Basic statistical approach.
CO2: Analyze the application of various statistical calculations .
CO3: Apply the techniques for ANOVA.
CO4: Able to understand the Basics of Computer operation.
CO5: Know to access the windows operation.

Unit I: [12 Hours]

Measures of central tendency – Mean, Median, Mode- Measures of Dispersion – Range, Mean Deviation, and Standard deviation.

Unit II: [12 Hours]

Measures of relationship – Covariance, Karl Pearson coefficient of Correlation, Rank correlation – Sampling distribution – Mean, proportion, students t –Distribution, Chi-square Distribution, F-Distribution. Degree of freedom, Standard error.

Unit III: [12 Hours]

Analysis of variance: Anova technique – principles of ANOVA - One way ANOVA – Two way ANOVA – Analysis of co-variance.

Unit IV: [12 Hours]
INTRODUCTION TO COMPUTER : What is Computer – Evolution – Basic Components – Memory – Software Components - Input / Output Devices - External Storage Devices – Personal Computer – Work Station - Mainframes

Unit V: [12 Hours]

MS – WORD - MS-EXCEL - MS-POWER POINT - MS-ACCESS

References:

1. Research Methodology methods and Techniques 3rd edition, C R Kothari and Gaurav Garg, New age international publisher.
2. Biostatistic, Danniel, W.W., 1987. New York, John Wiley Sons.

3. An introduction to Biostatistics, 3rd edition, Sundarrao, P.S.S and Richards, J. Christian Medical College, Vellore

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2			3	2		1			2	3	1	
CO3		3		2	1				3		1	2
CO4		2		3	2	1			2	3	1	
CO5		3					2	1	2	1		3

Mapping of CO's and PO's Components are:

3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester :III

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
SBC 21BBTS01	**Human Anatomy & Physiology**	**2**	**2**	**0**	**0**	**Theory**

Introduction: This course presents the Basics of Anatomy and Physiology of Human Structure.

Course Focus on: Skill Development

Course Outcome
CO1: To understand the structure of Human Body
CO2: To able to know the tissue level of Organization.
CO3: To become familiar with structure and functions of Nervous system.
CO4: To know the cardiovascular systems.
CO5: To learn about the respiratory and digestive system .

Unit I: [12 Hours]
An Introduction to the Human Body: Overview of Anatomy and Physiology – Structural Organization of the Human Body – Functions of Human Life – Requirements of Human Life – Homeostasis.

Unit II: [12 Hours]
Tissue Level of Organization: Types of Tissues – Epithelial Tissues – Connective Tissue Supports and Protects – Muscle tissue and Motion – Nervous Tissue Mediates perception and Response – Tissue Injury and Aging.

Unit III: [12 Hours]
Nervous System and Nervous Tissue: Basic structure and Function of the Nervous System – Functional Divisions of the Nervous System – Nervous Tissue – Neurons – Parts of Neurons and types of Neurons – Glial Cells - Functions of the Nervous tissue.

Unit IV: [12 Hours]
The Cardiovascular System: Heart – Anatomy, Location, Shape and Size – Heart valves and circulation of Blood; Cardiac cycle and heart sound; Disorders of cardiovascular system.

Unit V: [12 Hours]
Organs and Structure of the Respiratory System: Conducting Zone - Nose, Pharynx, Larynx, Trachea – Respiratory Zone – Gross Anatomy of the Lung. Digestive System – Overview of the Digestive System – Digestive system process and Regulation.

Reference:
J. Gordon Betts – "Human Anatomy and Physiology", OpenStax, Rice Universiy

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2	3		2	2		1			2	3	1	
CO3	3	1		2	1				3		1	2
CO4	3	2		1	2	1			2	3	1	
CO5	3	2					2		2	1		3

Mapping of CO's and PO's Components are:

3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester :III

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
IDC – 19BBT3IS	**Indian Traditional Medicinal Practices and Systems**	**2**	**2**	**0**	**0**	**Theory**

Introduction: This course presents the available of Natural Medicine in common Disease and Health improvement through nutrient supplements.

Course Focus on: Skill Development

Course Outcome
CO1: To understand the principles and practice of nature cure.
CO2: To know the importance of vitamins and Amino Acids.
CO3: To become familiar with importance of Dietary.
CO4: To know the Common Disease and their Natural Treatments I.
CO5: To know the Common Disease and their Natural Treatments II.

UNIT I [5 Hours]

Globalisation of traditional medicinal systems –importance of scientific evidence, siddha, an Indigenous medicinal system, Rejuvenation of interests, an Ethnobotanical survey of medicinal plants, scientific basis for ayurvedic medicinal plants.

UNIT II [5 Hours]

Integrating Indigenous Systems of Medicines in the Healthcare System- Medical systems in India with existing status, AYUSH as independent medical systems, historical, government policies, research and development, allopathy medicine and AYUSH, practices, administrative and quality issues.

UNIT III [5 Hours]

Home Herbal Garden for Promotion of Herbal Health Care System – concept of home herbal garden, traditional healing practices,species composition in home herbal garden, Initiatives and preferences, participatory appraisal.

UNIT IV [4 Hours]

Cultivation of Medicinal Plants- Important Medicinal Plants of India, Yam, sarpagandha, opium, periwinkle, aloe, guggle, senna, stevia,acorus, ocimum,amla,coleus.

UNIT V [5 Hours]

Scientific Validation of Herbal Medicine - Introduction, European Union guidelines, food and drug administration, Indian phytopharmaceutical guidelines, issues in scientific validation.

REFERENCES:

1. Herbal Medicine in India: Indigenous Knowledge, Practice, Innovation and its Value by Saikat Sen, RajaChakraborty (Author,Editor) Format: Kindle Edition.
2. Ayurvedic Herbs: A Clinical Guide to the Healing Plants of Traditional Indian Medicine by Virginia M Tyler (Author), M.S.Premila (Author) Format: Kindle Edition.

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2	3		1	2		1			2	3	1	
CO3		3		2	1				3		1	2
CO4	3	2		2	2	1			2	3	1	
CO5	2	3					2	1	2	1		3

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester :III

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
Core-21BBT3CP	**Lab in Plant Biotechnology**	**2**	**0**	**0**	**5**	**Practical**

Course Focus on: Employability & Research

Introduction: This course presents the Basic and advanced plant tissue culture techniques and enhance the plant based product.

1. Extraction of plant materials
2. Preparation of complex nutrient medium (Murashige & Skoog's medium).
3. To selection, Prune, sterilize and prepare explants for culture.
4. Significance of growth hormones in culture medium.
5. Callus induction and regeneration of plant.

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
Core-21BBTCP3	**Lab in Biochemistry**	**2**	**0**	**0**	**5**	**Practical**

Course Focus on: Employability & Research

1. Quantification of carbohydrates and proteins.
2. Quantification of Sugar by DNS method.
3. Phytochemical analysis.
4. Antioxidant properties.
5. Partial purification of protease enzyme.
6. Compound separation from TLC.
7. Protein separation from SDS PAGE.
8. Identification of plant compounds using GCMS.

References:

1. Plant Tissue Culture Theory and Practicals 2nd edition, T.Pullaiah, M.V. Subba Rao and E.Sreedevi, Scientific publishing

2. Plant tissue culture by K. Lindsey, 1997, Springer, Dordrecht

Semester IV:

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
Core – 21BBT4CA	Immunology and Immunotechnology	4	5	0	0	Theory

Course Focus on: Employability & Skill Development

Course Outcome
CO 1: To understand the basic history of Immunology
CO 2: To know the antigen and antibody classes and function.
CO 3: To apply the techniques for antigen and antibody interaction.
CO 4: To analyze the MHC molecules and complement system of our immunity.
CO 5: To understand the Hypersensitivity classes and reactions.

Unit I : [12 Hours]

History and scope of Immunology – Cell and organs involved in immune system – Organization and structure of lymphoid organs – Primary lymphoid organs – Secondary lymphoid tissues.

Unit II: [12 Hours]

Antigen – Immunogenicity versus Antigenicity – Biological system contributes to Immunogenicity – Epitopes – Antibody : Basic structure of Antibody – Antibody classes and biological functions. Antigenic Determinants on Immunoglobulins.

Unit III: [12 Hours]

Antigen – Antibody Interaction – Cross Reactivity, Precipitation Reactions, Agglutination Reaction, Radioimmunoassay, ELISA, Western Blotting, Monoclonal Antibody production. Flow cytometry.

Unit IV: [12 Hours]

Major Histocompatibility Complex: General Organization and inheritance of the MHC – MHC Molecules and Genes. Cytokines and Properties – Complement System: Functions of complement and Complement Components.

Unit V: [12 Hours]

Hypersensitive Reaction: Introduction – IgE Mediated Hypersensitivity, Antibody Mediated cytotoxic Hypersensitivity, Immune complex mediated Hypersensitivity, Delayed type hypersensitivity.

References:

1. Immunology – Kuby., J - 5th Edition
2. Immunology – Tizard
3. Introductory Practical Biochemistry – S. K. Sawhney and Randhir Singh. Narosa Publishing House
4. Principles of Applied Biomedical Instrumentation- Gedder A and L. E. Balsar,John Wiley and Sons.
5. Modern Experimental Biochemistry 2nd Edition- Boyer, Rodney F.Benjamin and Cummins

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2	3		1	2		1			2	3	1	
CO3		3		2	1				3		1	2
CO4	3	2		2	2	1			2	3	1	
CO5		3					2	1	2	1		3

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester IV:

Subject	Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
DSC	**-21BBTC04**	**Animal biotechnology**	**4**	**5**	**0**	**0**	**Theory**

Course Focus on: Employability & Research

Course Outcome
CO 1: To understand the basic mechanism of mammalian cell
CO 2: To get an idea for designing the tissue culture laboratory area.
CO 3: To know the preparation and handling of primary culture
CO 4: To become a familiar with Stem cell culture.
CO 5: To know the applications and safety measures of Animal Biotechnology.

Unit I: [12 Hours]

Biology of Cultured Cells – The culture Environment – Cell Adhesion – Cell Proliferation and Differentiation. Cell Signaling – Energy metabolism – Initiation of the culture – Evolution and Development of Cell Lines - Origin of cultured cell.

Unit II: [12 Hours]

Laboratory Design and Layout – Requirement of a tissue culture Laboratory– Specialized equipments. Tissue culture Media – Development of Media, Physiochemical Properties, Balanced Salt Solution – Complete Media – Serum – Selection of Medium and Serum. Preparation of Serum free media.

Unit III: [12 Hours]

Primary culture - Types of Primary culture – Isolation of the Tissue – Mouse embryo, Chick embryo, Human Biopsy materials – Enzymatic Disaggregation – Trypsinisation – Mechanical Disaggregation – Subculture, culture age – Cell Line. Cell Viability Assay, Cytotoxicity Assay, Assay to detect Apoptosis, Counting of cell in Haemocytometer, Application of cell culture.

Unit IV : [12 Hours]

Stem Cells – Embryonic stem cells and grown in laboratory – Adult stem cell and differentiation – Transdifferentiation – Similarities and Differences between Embryonic and adult stem cells. Induced pluripotent stem cells – Potential uses of Human stem cells and the obstacles.

Unit V: [12 Hours]

Animal Breeding and Transgenic animals – Methods of genetic manipulation in animals – Cloning – Applications of Transgenic animals – Econamic impact in developing countries – Ethical Issues; Biosafty and Ethics – Biosafty levels – Biopiracy -

References:

1. Animal cell culture – a practical approach, 4th ED., Freshney. John Wiley Pub.
2. Mammalian Cell Biotechnology- A practical approach. ED Butler. Oxford UNI Press.
3. Methods in Cell Biology. VOL 57 Animal methods, ED Mather & Barnes, Academic Press.
4. Exploring Genetic mechanisms. ED Singer & Berg.

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	Programme outcomes								Programme Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2			3	2		1			2	3	1	
CO3		3		2	1				3		1	2
CO4		2		3	2	1			2	3	1	
CO5		3					2	1	2	1		3

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester IV :

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
21BBTA02	**Pharmaceutical Biotechnology**	**4**	**5**	**0**	**0**	**Theory**

Course Focus on: Skill Development & Entrepreneurship

Course Outcome
CO 1: To understand the biopharmaceuticals current status and future prospects
CO 2: To know the impact of genomes in drug discovery
CO 3: To apply the preclinical studies of drug development
CO 4: To analyze the purification of recombinant protein
CO 5: To understand the patents in the pharmaceutical industry

Unit I: [12 Hours]

Biopharmaceuticals - Introduction to Biotechnology with reference to Pharmaceutical Sciences. Introduction to pharmaceutical products - History of the pharmaceutical industry - The age of biopharmaceuticals; Biopharmaceuticals: current status and future prospects.

Unit II: [12 Hours]

Drug development process – Introduction, Discovery of biopharmaceuticals - The impact of genomics and related technologies upon drug discovery - Gene chips - Proteomics - Structural genomics – Pharmacogenetics - Initial product characterization Delivery of biopharmaceuticals. Genetic engineering applications in relation to production of pharmaceuticals.

Unit III: [12 Hours]

Preclinical studies - Pharmacokinetics and pharmacodynamics - Toxicity studies – Cytokines in interferon family – Growth factors – Therapeutic hormones. Importance of Monoclonal antibodies in Industries.

Unit IV: [12 Hours]

Upstream and Downstream Processing: Sources of biopharmaceuticals – E.coli, animal cell culture, Yeast, fungal, Transgenic animal and plant – cell banking system – microbial cell fermentation – Mammalian cell culture system – Purification of recombinant proteins – final product formulation. Biosensors - Working and applications of biosensors in Pharmaceutical Industries.

Unit V: [12 Hours]

Patents in the Pharmaceutical Biotechnology Industry: The concept of intellectual property law. Introduction to patents, trademarks, copyrights and trade secrets, and the differences between these forms of protection. Patent Law – Patent obtain – subject matter – Types of patents in pharmaceutical Biotechnology – Ethical policy issues in Biotechnology patent - role and remit of regulatory authorities.

Reference:

1. Pharmaceutical Biotechnology Concepts and Applications Gary Walsh University of Limerick, Republic of Ireland.
2. Pharmaceutical Biotechnology, Drug Discovery and Clinical Applications. Edited by O. Kayser and R.H. Muller.
3. Pharmaceutical Biotechnology Fundamentals and Applications Third Edition, Daan J. A. Crommelin and Robert D. Sindelar.

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2	3		2	2		1			2	3	1	
CO3		3		2	1				3		1	2
CO4		3		1	2	1			2	3	1	
CO5	1					2	3	3	2	1		3

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester IV

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
21BBTS02:	Research Methodology	4	2	0	0	Theory

Course Focus on: Skill Development

Course Outcome
CO 1: To understand the research and research methods in bioscience.
CO 2: To know the design of experimental research
CO 3: To apply the sampling technique and survey
CO 4: To analyze the data and interpretation
CO 5: To understand the report writing and presentation of research report.

Unit I : [12 Hours]

Research Methodology: Introduction , Meaning and objective of Research – Types of research – significance of research – research methods – scientific methods – research process – criteria of Good research.

Unit II: [12 Hours]

Research Design – Meaning of Research design – Need for research design – Important concepts relating to research design – Different research design – Basic principles of experimental design – Important experimental design.

Unit III: [12 Hours]

Sample surveys: Sample design – Sampling and Non sampling error – Sample survey Vs. Census Survey – Types of sampling - measurement and Scaling: Quantitative and qualitative data- Classification of measurement scale – Goodness of measurement scale – scaling - Scaling techniques.

Unit IV : [12 Hours]

Data collection and Preparation: Experiment and survey – Collection of primary data – collection of secondary data – selection of method for data collection – Data preparation process –Types of analysis - statistics in research.

Unit V: [12 Hours]

Interpretation and Report writing: Meaning, techniques and precautions in interpretation - Significance of report writing – Types of report – oral presentation – Mechanics and precautions for writing research report.

Reference:

Research Methodology methods and Techniques 3rd edition, C R Kothari and Gaurav Garg, New age international publisher.

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	1	1		1		3	2		1
CO2			3	2		1			2	3	1	
CO3	1	3		2	1				3		1	2
CO4		2		2	2	1	3		2	3	1	
CO5	2	3					2	1	2	1		3

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester :IV

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
IDC - 21BBT4IS	**Food Processing And Preservation**	**2**	**2**	**0**	**0**	**Theory**

Introduction: This course presents the Food quality and safety has become a major concern to governments, industry and consumers

Course Focus on: Employability & Skill Development

Course Outcome
CO1: To understand the methods of food preservation
CO2: To know the safety measure on food preservatives.
CO3: To become familiar packaging of food products
CO4: To know the exploitation of microorganisms in food industry
CO5: To learn the applications of HACCP in small food business.

Unit I: [5 Hours]

Methods of Food Preservation - Introduction, Why Do We Need to Preserve?, Conventional Food Preservation Methods, Preservation by modified and controlled atmospheres, Irradiation preservation of the foods. Preservation by low temperatures. Potential Food Preservation Methods.

Unit II: [4 Hours]

Preservative Measures for Food Safety: Introduction, Hygienic Design, Cleaning Validation.

Unit III: [5 Hours]
Food Packaging – Introduction, Food Packaging Techniques, Packaging Systems, Packaging Materials and Food Applications. Safety Aspects on Active and Modified Atmosphere Packaging

Unit IV: [5 Hours]

Exploitation of Microorganisms by the Food and Beverage Industry – Introduction, Why Fermented Products?, Bacteria, Starter Culture Production, Yeast, Value added products from the microorganisms.

Unit V: [5 Hours]

Application of HACCP in small food Businesses – Introduction, Present Status of HACCP Implementation, Food Safety Law, Food Safety Training, Management of HACCP Programmes.

Text Book:

Food Safety A Practical and Case Study Approach by Kristberg Kristbergsson, *University of Iceland Reykjavík, Iceland*

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	Programme outcomes								Programme Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2			3	2		1			2	3	1	
CO3	3	2		2	1				3		1	2
CO4	3	2		2	1	1			2	3	1	
CO5		1					2	3	2	1		3

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester IV:

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
21BBT4CP	**Lab in Immunology**	**2**	**0**	**0**	**5**	**Practical**

Course Focus on: Employability & Research

1. Antigen-Antibody reactions – Agglutination (Blood grouping testing).
2. Ouchterlony Double Diffusion
3. Immuno-electrophoresis,
4. Dot ELISA
5. DNA Isolation Animal tissue/Blood
6. SDS PAGE
7. Western Blotting

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
21BBTCP4	**Lab in Animal Biotechnology**	**2**	**0**	**0**	**5**	**Practical**

Course Focus on: Employability & Research

1. Preparation of cell culture media
2. Isolation of cells from Chick embryo
3. Establishment and maintenance of primary cell cultures
4. Subculture of monolayer cells
5. Subculture of suspension cells
6. Determination of viable cells by trypan blue test

References

1. Laboratory Manual for Biotechnology Verma, Ashish S./ Das Surajit & Singh Anchal
S. Chand Publishing, 2014

2.Biotechnology Procedures And Experiments Handbook, S. Harisha, Ph.D. Infinity Science Press Llc, Hingham, Massachusetts, New Delhi, India

Semester V:

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
Core – 21BBT5CA:	**Genetic Engineering**	**4**	**5**	**0**	**0**	**Theory**

Course Focus on: Employability & Skill Development

Course Outcome

CO 1 : To understand the role of restriction enzymes
CO 2 : To know the properties of recombinant vectors
CO 3 : To apply the screening of cDNA library
CO 4 : To analyze the PCR based molecular marker
CO 5 : To understand the bacterial transformation and conjugation

Unit I : [12 Hours]

Restriction Enzymes: History, origin of Restriction endonuclease – Ligation – Alkaline phosphate – Digestion –Modification of Restriction Fragment ends.

Unit II: [12 Hours]

Recombinant vectors: Plasmid vector – Vector based on the Lambda Bacteriophage – Cosmids – M13 Vector - Expression vectors - Vector for Cloning and expression in Eukaryotic cells - Super vectors; YACs and BACs.

Unit III: [12 Hours]

Genomic and cDNA libraries : Genomic libraries – Growing and storing libraries – cDNA libraries – Screening Libraries with Gene probes – Screening expression Libraries with antibodies – characterization of plasmid clone.

Unit IV: [12 Hours]

Molecular Markers – PCR- Principle, Mechanism and application, Ligase chain reaction, RAPD, RFLP, AFLP, Site Directed Mutagenesis – DNA Sequencing – Maxam Gilbert and Sanger's dideoxynucleotide method, Next generation sequencing (NGS), Gene mapping.

Unit V: [12 Hours]

Transgenic – Bacterial transformation – Conjugation – Transduction - Transgenic plants – Transgenic animals – DNA finger printing in forensic application - ethical issues involved in rDNA technology.

Text Book

1. Introduction to gene cloning – 7th Ed, (2016), Brown T A , Stanley Thomas Pub ltd, Germany.
2. Principles of gene manipulation – 7th Ed (2005), Primrose S.B, Black well Sci ld, Germany.
3. Gene Biotechnology (2009), Jogdand, Himalaya publishing House, Mumbai.
4. Genetic Engineering (1996), Mitra, S, MacMillan India Ltd. New Delhi

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2			1		1		3	2		1
CO2	3	2		2		1			2	3	1	
CO3		3		2	1				3		1	2
CO4	3	2		1	2	1			2	3	1	
CO5	2	3		1					2	1		3

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester V

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
21BBTC05	**Molecular Biology**	**4**	**5**	**0**	**0**	**Theory**

Course Focus on: Research

Course Outcome

CO 1: To understand the genome organization in Prokaryotes and Eukaryotes
CO 2: To know the central Dogma of the organisms.
CO 3: To apply the mechanisms of gene regulation.
CO 4: To analyze the DNA repair mechanism of bacterial genetics
CO 5: To understand the chromosomal variation and mapping.

UNIT I – [12 Hours]
Genome Organization : Genome organization – Prokaryotic and Eukaryotic; Chromosome structure and function, chromatin; Chloroplast DNA; Mitochondrial DNA; Gene families; Gene Clusters

UNIT II – [12 Hours]
Central Dogma : Prokaryotic and Eukaryotic DNA replication, Transcription, Translation and regulation mechanisms – Post transcriptional modification– Post translational modifications - Ribosomes, protein biosynthesis and transportation- Different mechanisms of Signal transduction.

UNIT III – [12 Hours]
Gene Regulation Mechanisms: General aspects of Regulation, The lactose operon model, The Galactose operon, The Arabinose operon, The Tryptophan operon, Relative positions of Promoters and Operators, Feedback Inhibition

UNIT IV – [12 Hours]
DNA Repair Mechanisms: DNA repair mechanisms; Mutagenesis, Mutations - Types and Mutants, Biochemical Basis of Mutants, Mutagenesis, Mutational Hot Spots, Reversion. Transposable elements - Insertion sequence and transposons, Integrons and Antibiotic-Resistance cassettes; Bacterial Genetics (Conjugation, Transformation, Generalized transduction, Specialized Transduction)

UNIT V – [12 Hours]
Chromosomal Variations And Mapping : Chromosomal variation in Number & Structure – Chromosomal aberrations & evolution. Chromosome Mapping - Haploid mapping, Diploid mapping - Oncogenesis: Development and causes of cancer, Types of cancer, Oncogenes: Retro viral, proto, tumour suppressor gene.

References

1. Harvey Lodish, Baltimore. Arnold Berk et al. "*Molecular cell biology"* 7th edition. *Publisher*: W. H. Freeman, 2011.
2. DeRobertis, EDP, E.M.F Robertis,. Cell and molecular biology, Saunders Company, 2006.

3. David Freifielder, *"Molecular Biology*", 3rd edition Jones & Bartlett publications, 2009.
4. Cooper M,. *"The cell molecular approach*", ASM Press, 2004.

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2	3		1	2		1			2	3	1	
CO3	2	3		1					3		1	2
CO4	1	2	3			1			2	3	1	
CO5	2	3	1		1				2	1		3

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester V

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
Elective I – 21BBTE01:	**Food Biotechnology**	**4**	**5**	**0**	**0**	**Theory**

Course Focus on: Employability & Skill Development

Course Outcome

CO 1: To understand the associated microorganisms of food industry
CO 2: To know the natural food products and their control.
CO 3: To apply the food preservation methods.
CO 4: To analyze the principle and operations of packing
CO 5: To understand the methods and importance of quality control.

UNIT-I: [12 Hours]
History of microbiology of food - microbial growth pattern, physical and chemical factors influencing structure of micro-organisms - types of micro-organism normally associated with food - mold, yeast and bacteria.

UNIT-II: [12 Hours]
Micro-organisms in natural food products and their control - contaminants of foods - stuffs, vegetables, cereals, pulses, oilseeds, milk and meat during handling and processing - biochemical changes caused by micro-organisms - deterioration of various types of food products - food poisoning and microbial toxins.

UNIT-III: [12 Hours]
Scope and importance of food processing - principles and methods of food preservation - freezing, heating, dehydration, canning, additives, fermentation, irradiation, extrusion cooking, hydrostatic pressure cooking, dielectric heating, microwave processing.

UNIT-IV: [12 Hours]
Introduction to packaging - packaging principles and operation - package functions and design - deteriorative changes in foodstuff and packaging methods for prevention - shelf life of packaged foodstuffs - methods to extend shelf life.

UNIT-V: [12 Hours]
Objectives, importance and functions of quality control - methods of quality - assessment of food materials - fruits, vegetables, cereals, dairy products, meat, poultry, egg and processed food products - sampling and specification of raw materials and finished products - statistical quality controls - food regulations, grades and standards - food adulteration, food safety and evaluation.

REFERENCES

1. Rsdel W.B., Copley, M.J. and Morgen, A.I. 1973. Food Dehydration, 2nd Edn. (2 Vol. Set). AVI, Westport.
2. Der, A.E. 1978. Food Processing and Nutrition. Academic Press, London.
3. Lows, P. and Ellis H. 1990. Food Processing. Prentice Hall, Reston Virginia, USA.
4. Jelen, P. 1985. Introduction to Food Processing. Prentice Hall, Reston Virginia, USA.
5. Branen A.L. and Davidson, P.M. 1983. Antimicrobials in Foods. Marcel Dekker, New York.
6. Jay J.M. 1986. Modern Food Microbiology. 3rd Edn. VNR, New York

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2	2	3	2	2		1			2	3	1	
CO3	1	3	1	2	1				3		1	2
CO4	2	2	3	3	2	1			2	3	1	
CO5	1	3		2					2	1		3

Mapping of CO's and PO's Components are:
3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester V

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
Elective II – 21BBTE02:	**Cancer Biology**	**4**	**5**	**0**	**0**	**Theory**

Course Focus on: Research

Course Outcome
CO 1: To understand the fundamentals of cancer biology
CO 2: To know the principles of Carcinogenesis
CO 3: To apply the molecular tools to indentify the cancer gene
CO 4: To analyze the genetic characters of cancer gene
CO 5: To understand the gene therapy cancer.

UNIT I: [12 Hours]
Fundamentals of Cancer Biology : Regulation of Cell cycle, Mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes, Modulation of cell cycle-in cancer, Different forms of cancers, Diet and cancer.

UNIT II: [12 Hours]
Principles of Carcinogenesis : Chemical Carcinogenesis, Metabolism of Carcinogenesis, Natural History of Carcinogenesis, Targets of Chemical Carcinogenesis, Principles of Physical Carcinogenesis, X-Ray radiation – Mechanism of radiation Carcinogenesis.

UNIT III: [12 Hours]
Principles of Molecular Cell Biology of Cancer :Oncogenes, Identification of Oncogenes, Retroviruses and Oncogenes, detection of Oncogenes, Growth factor and Growth factor receptors that are Oncogenes. Oncogenes / Proto Oncogenes activity. Growth factors related to transformations.

UNIT IV: [12 Hours]
Principles of Cancer Metastasis : Clinical significances of invasion, heterogeneity of metastatic phenotype, Metastatic cascade, Basement membrane disruption, Three step theory of invasion, Proteinases and tumour cell invasion.

UNIT V: [12 Hours]
New Molecules For Cancer Therapy : Different forms of therapy, Chemotherapy, Radiation Therapy, Detection of Cancers, Prediction of aggressiveness of Cancer, Advances in Cancer detection.

REFERENCES :

1. Maly B.W.J., *Virology a practical approach*, IRL press, Oxford, 1987.
2. Dunmock.N.J and Primrose S.B., *Introduction to modern Virology*, Blackwell Scientific Publications.
3. Ruddon.R.W., *Cancer Biology*, Oxford University Press, Oxford, 1995.
4. King R.J.B., *Cancer Biology*, Addision Wesley Longmann Ltd, U.K., 1996.

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2	2	3	2	2		1			2	3	1	
CO3	1	3	1	2	1				3		1	2
CO4	2	2	3	3	2	1			2	3	1	
CO5	1	3		2					2	1		3

Mapping of CO's and PO's Components are:

3-Strong Correlation 2 – Medium Correlation 1- Low Correlation Blank – No correlation

Semester V

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
Elective III – 21BBTE03:	**Neurobiology and Cognitive Sciences**	**4**	**5**	**0**	**0**	**Theory**

Course Focus on: Skill Development & Research

Course Outcome

Upon completion of this course, students will be able:

CO 1: To know the anatomy and organization of nervous systems.

CO 2: To understand the function of nervous systems.

CO 3: To analyze how drugs affect cellular function in the nervous system.

CO 4: To understand the basic mechanisms associated with behavioral science.

CO 5: To know the application of research in Neuroscience.

UNIT I : [12 Hours]

NEUROANATOMY - What are central and peripheral nervous systems; Structure and function of neurons; types of neurons; Synapses; Glial cells; myelination; Blood Brain barrier; Neuronal differentiation; Characterization of neuronal cells; Meninges and Cerebrospinal fluid; Spinal Cord.

UNIT II: [12 Hours]

NEUROPHYSIOLOGY - Resting and action potentials; Mechanism of action potential conduction; Voltage dependent channels; nodes of Ranvier; Chemical and electrical synaptic transmission; information representation and coding by neurons.

UNIT III: [12 Hours]

NEUROPHARMACOLOGY - Synaptic transmission, neurotransmitters and their release; fast and slow neurotransmission; characteristics of neurites; hormones and their effect on neuronal function.

UNIT IV: [12 Hours]

APPLIED NEUROBIOLOGY - Basic mechanisms of sensations like touch, pain, smell and taste; neurological mechanisms of vision and audition; skeletal muscle contraction.

UNIT V : [12 Hours]

BEHAVIOUR SCIENCE - Basic mechanisms associated with motivation; control of feeding, sleep, hearing and memory; Disorders associated with the nervous system.

REFERENCE:

1. Mathews G.G. Neurobiology, 2nd edition, Blackwell Science, UK, 2000.

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2	2	3	2	2		1			2	3	1	
CO3	1	3	1	2	1				3		1	2
CO4	2	2	3	3	2	1			2	3	1	
CO5	1	3		2					2	1		3

Semester V

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
Elective IV – 21BBTE03:	**Medical Biotechnology**	**4**	**5**	**0**	**0**	**Theory**

Course Focus on: Employability & Skill Development

Course Outcome
CO 1: To understand the associated reproductive technology and animal cell culture
CO 2: To know the chromosomal disorders and disease
CO 3: To apply the methods of diagnosis used in microbial disease
CO 4: To analyze the prevention and treatment of bacterial disease.
CO 5: To understand the modern medicine system and stem cell therapy.

UNIT I: [12 Hours]

Art and Acc : Assisted reproductive technology- Pregnancy diagnosis - Animal cell culture-media, maintenance and culture of primary, secondary and continuous cell lines- organ culture- applications- cancer cell lines- apoptosis.

UNIT II : [12 Hours]

Chromosomal Disorders: Chromosomal disorders – Gene controlled diseases –Identification of disease genes- Haemophilia, DMD, Alzheimer's – Molecular basis of human diseases: Pathogenic mutations – Oncogenes - Loss of function - Tumour Suppressor Genes- Immunopathology: Hepatitis, Autoimmune Disorders.

UNIT III : [12 Hours]

Diagnostics Methods: Prenatal diagnosis - Invasive techniques and Non-invasive techniques – Diagnosis of pathogenic microbes: Classical and modern methods- Diagnosis using protein and enzyme markers, DNA/RNA based diagnosis - Molecular markers - Microarray technology - genomic and cDNA arrays.

UNIT IV : [12 Hours]

Prevention and Treatment: Vaccines-conventional, recombinant, synthetic peptide, anti-idiotype, DNA vaccines- Deletion mutant and vaccinia vector vaccine- Antibiotics-mode of action- antibacterial, antifungal, antiviral, antitumor antibiotics- synthetic chemotherapeutic agents- development of microbial resistance to antibiotics.

UNIT V : [12 Hours]

Modern Medicine: Hybridoma technique for MAb production and applications- Gene therapy: Exvivo, Invivo, Insitu- Cell and tissue engineering- Stem cell therapy- Nanomedicines- Gene products in medicine – Humulin, Erythropoietin, Growth Hormone/Somatostatin, tPA, Interferon.

References

1. Jogdand, S. N.. Medical Biotechnology, Himalaya Publishing house, Mumbai, 2005.
2. Click, B. R. and Pasternak.. Molecular Biotechnology: Principle and applications of recombinant DNA. ASM Press, 2010.
3. Ramasamy, P.. *"Trends in Biotechnology*", University of Madras, Pearl press, 2002.
4. Trevan.. "*Biotechnology"*. Tata McGraw-Hill, 2005

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2	2	3	2	2		1			2	3	1	
CO3	1	3	1	2	1				3		1	2
CO4	2	2	3	3	2	1			2	3	1	
CO5	1	3		2					2	1		3

Semester V

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
Elective V – 21BBTE04:	Agriculture Biotechnology	4	5	0	0	Theory

Course Focus on: Employability & Skill Development

Course Outcome

CO 1: To understand the history of Indian agriculture.
CO 2: To know the microbes in agriculture and foods
CO 3: To apply the production and utilization of essential amino acid
CO 4: To analyze the genetic engineering for crop improvement
CO 5: To understand the major crops and major disease in India.

UNIT – I [12 Hours]

History of Indian Agriculture, Green Revolution in India, Cropping patterns in India, Soil, Rainfall Patterns in India.

UNIT - II [12 Hours]

Microbes in Agriculture and Food: microbial enzymes and their applications in food processing and agro-chemical industries, agro-waste utilization, biodegradable polymers and their applications.

UNIT - III [12 Hours]

Production and utilization of essential amino-acids, chemicals from micro-algae, Micorrhiza: Applications in agriculture and forestry.

UNIT - IV [12 Hours]

Genetic Engineering for Crop Improvement: Plant cell and tissue culture, gene transfer techniques into plant cells, application in agricultural and food industries.

UNIT - V [12 Hours]

Plant Pathology – Major crops and major diseases in India. Developing diseases, Drought, Salinity, Cold tolerant crops in India and its economic importance. Post harvest and storage of grains.
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REFERENCE BOOKS

1. Agricultural Biotechnology Edited by Arie Altman, Pub. Marcel Dekker, Inc., 1998
2. Biotechnology – Expanding Horizons. B. D. Singh. Kalyani Publishers, 2004.
3. Plant Genetic Engineering by J. H. Dodds, Cambridge University Press, 1983.
4. Biotechnology and Utilization of Algae – The Indian Experience. Venkataraman, V. and E.W. Becker 1985.
5. Agricultural Microbiology by Rangaswami G., Bagyaraj D.J. PHI; 2 edition, 1992.
6. Textbook of Agricultural Biotechnology by Dr. Ahindra Nag, PHI Learning Private Ltd., New Delhi, 2009

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2	2	3	2	2		1			2	3	1	
CO3	1	3	1	2	1				3		1	2
CO4	2	2	3	1	2	1			2	3	1	
CO5	1	3		2					2	1		3

Semester V

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
Elective VI – 21BBTE04:	Stem Cell Technology	4	5	0	0	Theory

Course Focus on: Research

Course Outcome:

CO 1: able to learn various kind of cells involved in stem cell technology

CO 2: able to understand the stem cell therapy.

CO 3: able to learn the invitro cultivation of cells.

CO 4: able to know the differentiation of normal cells and stem cells.

CO 5: able to find the applications of stem cell technology

UNIT I [12 Hours]

STEM CELLS AND TYPES - Stem cells: Definition, Classification, Sources and Properties –Types of stem cells: methods of isolation, study of stem cells and their viability IPSC, embryonic stem cells, cancer stem cells. – Preservations of Stem cell. Embryonic stem cell: Isolation, Culturing, Differentiation, Properties – Adult stem cell: Isolation, Culturing, Differentiation, Trans-differentiation, Plasticity, and Properties

UNIT II [12 Hours]

STEM CELLS IN PLANTS AND ANIMALS - Stem cell and founder zones in plants –particulary their roots – stem cells of shoot meristems of higher plants. Skeletal muscle stem cell – Mammary stem cells – intestinal stem cells – keratinocyte stem cells of cornea – skin and hair follicles –tumour stem cells.

UNIT III [12 Hours]

STEM CELLS DIFFERENTIATION - Factors influencing proliferation, physical, chemical and molecular methods for differentiation of stem cells – hormonal role in differentiation.

UNIT IV [12 Hours]

REGENERATION AND EXPERIMENTAL METHODS - Germ cells, hematopoietic organs, and kidney, cord blood transplantation, donor selection, HLA matching, patient selection, peripheral blood and bone marrow transplantation, - Stem cell Techniques: fluorescence activated cell sorting (FACS), time lapse video, green fluorescent protein tagging

UNIT V [12 Hours]

APPLICATION AND ETHICAL ISSUES - Stem cell Therapy for neurodegenerative diseases, spinal cord injury, heart disease, diabetes, burns, skin ulcers, muscular dystrophy and orthopaedic applications. Stem cell policy and ethics, stem cell research: Hype, hope and controversy.

TEXT BOOKS:

1. Stem cells by C.S Potten., Elsevier, 2006.
2. Essentials of Stem Cell Biology by Robert Lanza., fourth edition. Elsevier 2014.

REFERENCES:

1. Stem cell biology and Gene Therapy by Peter Quesenberry., First Edition, Wiley-Liss, 1998.
2. Embryonic Stem cells – Protocols by KursadTurksen., Second Edition Humana Press, 2002.
3. Stem Cells: From Bench to Bedside by AriffBongso, EngHinLee., World Scientific Publishing Company, 2005.
4. Stem cells in clinic and Research by Ali Gholamrezanezhad., Intech, 2013

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2	2	3	2	2		1			2	3	1	
CO3	1	3	1	2	1				3		1	2
CO4	2	2	3		2	1		1	2	3	1	
CO5	1	3		2				2	2	1		3

Semester V

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
SBC – 21BBTS03:	**Bioinformatics**	**2**	**5**	**0**	**0**	**Theory**

Course Focus on: Employability & Skill Development

Course Outcome

CO 1: To understand the major database in bioinformatics
CO 2: To know the central dogma of molecular biology
CO 3: To apply the tools for web search and retrieval tools
CO 4: To analyze the alignment of multiple sequence and phylogenetic analysis.
CO 5: To understand the protein identification and characterization.

Unit I: [12 Hours]

Bioinformatics : Introduction – History overview – Bioinformatics application – Major Databases in Bioinformatics – Data Management and Analysis.

Unit II: [12 Hours]

Genome Analysis: Molecular Biology and Bioinformatics – Central Dogma of Molecular biology – Genome Analysis – Genetic mapping and linkage analysis.

Unit III: [12 Hours]

Information search and Data retrieval: Introduction - Tools for web search – Data Retrieval tools – Data mining of biological Databases.

Unit IV: [12 Hours]

Alignment of Pairs of sequences: Biological motivation of Alignment problems – methods of sequence alignment – Alignment of Multiple sequence and phylogenetic analysis – Tools for similarity search and sequence alignment.

Unit V: [12 Hours]

Protein Structure Prediction: Protein identification and characterization – primary structure analysis and prediction – secondary structure analysis and prediction – Motifs, Profiles, Patterns and Fingerprints search.

Reference:

1. Bioinformatics Methods and Applications third edition, S.C Rastogi, N.Mediratta, P.Rastogi.
2. Arthur Lesk "Introduction to Genomics" 2nd edition. Oxford University Press 2007.
3. 2. Andreas D Baxevanis, B F Francis Oullette *"Bioinformatics: A practical guide to the analysis of genes and proteins*". 2nd edition. Wiley publishers, 2005.
4. Jin Xiong *"Essential Bioinformatics*", 1st edition Cambridge University Press, 2006.
5. 2. David Mount *"Bioinformatics: sequence and genome analysis*" 3rd edition. Cold Spring Harbor Laboratory Press, 2004.

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2	2	3	2	2		1			2	3	1	
CO3	1	3	1	2	1				3		1	2
CO4	2	2	3	3	2	1			2	3	1	
CO5	1	3		2					2	1		3

Semester V:

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
21BBT5CP	**Lab in Genetic engineering**	**2**	**0**	**0**	**5**	**Practical**

Course Focus on: Employability & Research

1. Bacterial DNA Isolation.
2. Plasmid DNA Isolation
3. Restriction Digestion
4. Ligation
5. Polymerase chain Reaction (PCR)

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
21BBTCP5	**Lab in Molecular Biology**	**2**	**0**	**0**	**5**	**Practical**

Course Focus on: Employability & Research

1. Competent cell preparation
2. Transformation of plasmid
3. RAPD
4. Polyacrylamide gel electrophoresis (PAGE) with silver staining
5. Southern Hybridization

References

1. Laboratory Manual for Biotechnology Verma, Ashish S./ Das Surajit & Singh Anchal
S. Chand Publishing, 2014

2.Biotechnology Procedures And Experiments Handbook, S. Harisha, Ph.D. Infinity Science Press Llc, Hingham, Massachusetts, New Delhi, India

Semester VI:

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
21BBT6CA	**Environmental Biotechnology**	**4**	**5**	**0**	**0**	**Theory**

Course Focus on: Skill Development

Course Outcome

CO 1: To understand the ecosystem structure and function
CO 2: To know the solid waste management system
CO 3: To apply the engineered bioremediation process
CO 4: To analyze the indication of water pollution.
CO 5: To understand the microorganisms and energy requirement of mankind.

Unit I: [12 Hours]

Ecosystem : Ecosystem structure and functions, abiotic and biotic component, Energy flow, food chain, food web, Ecological Pyramids-types, biogeochemical cycles.

Unit II: [12 Hours]

Solid waste Management: Introduction, Reduce, Reuse and Recycle – Waste reduction and reuse – recycling – waste collection – treatment and disposal – thermal treatment – Dumps and landfills – Biological waste treatment – Integrated solid waste management.

Unit III: [12 Hours]

Bioremediation :Introduction, constraints and priorities of Bioremediation, Biostimulation of Naturally occurring microbial activities, Bioaugmentation, in situ, ex situ, intrinsic & engineered bioremediation.

Unit IV: [12 Hours]

Indicators of water pollution: Introduction – BOD & COD – pH, Acidity, Alkalinity – Nutrients – Electric conductivity and Dissolved solids – Metals and pesticides – Sediment and substrate – Temperature – overall water quality –Eutrophication.

Unit V: [12 Hours]

Biofuels : Microorganisms and energy requirements of mankind; Production of non conventional fuels - Methane (Biogas), Hydrogen, Alcohols and algal hydrocarbons, Use of microorganisms in augmentation of petroleum recovery.

References

1. Agarwal S. K., *"Advanced Environmental Biotechnology*", APH Publishing, 2005.
2. Thakur S, "*Environmental Biotechnology: Basic Concepts and Applications"*, I K International Publishing House, 2006.
3. Chandrawati Jee, Shagufta, , *"Environmental Biotechnology"*, APH Publishing, 2007.
4. Hans-Joachim Jördening, Josef Winter, *"Environmental Biotechnology: Concepts and Applications*", Wiley, 2006.

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2	2	3	2	2		1			2	3	1	
CO3	1	3	1	2	1				3		1	2
CO4	2	2	3	3	2	1			2	3	1	
CO5	1	3		2				2	2	1		3

Semester VI

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
21BBTE07	**Industrial Biotechnology**	**4**	**5**	**0**	**0**	**Theory**

Course Focus on: Employability & Skill Development

Course Outcome

CO 1: To understand the biotechnology based commercial product.
CO 2: To know the industrially importance microorganisms
CO 3: To apply the fermentor for batch and continuous culture.
CO 4: To analyze the downstream processing.
CO 5: To understand the industrial process of amino acid and organic acid.

UNIT-I [12 Hours]

Introduction to biotechnology and products. Major classes of commercial products using micro organisms- enzymes, amino acids, vitamins, antibiotics, organic solvents, organic acids, food and beverages.

UNIT-II [12 Hours]

Industrially important microorganisms: screening techniques - detection & assay of fermentation products- strain improvements - mutations, protoplast fusion and rDNA techniques for strain development.

UNIT-III [12 Hours]

Bioreactors / Fermentor: Types, features, operation: sterilization (Batch and Continuous), inoculation and sampling. Control of bioprocess parameters. Microbial growth and media formulation. Microbial culture - batch, fed batch, semi-continuous, continuous. Growth kinetics of microorganisms.

UNIT-IV [12 Hours]

Down stream processing: Solid-liquid separation, flotation, flocculation, filtration, centrifugation, cell disruption, concentration, evaporation, liquid-liquid extraction, membrane filtration, precipitation, adsorption. Product purification by chromatography.

UNIT-V [12 Hours]

Industrial process of beverages - enzymes - amino acid - organic acids - organic solvents - antibiotics.

References:

1. Manual of industrial microbiology and Biotechnology, Demain A.L. Solomon, J.J., 1986. ASM press.
2. Industrial Microbiology, Reed C., Prescott and Dann's, 1982. Macmillan publishers.
3. Fundamentals of Biotechnology, Prave. P. Faust, V. Sitih. W., Sukatsh, DA, 1987. ASM press.
4. Biotechnology, Satyanarayana, U., 2006. Books and Allied (P) Ltd.
5. AN introduction to Genetic Engineering, Desmond, S.T., Nicholl, 1994. Cambridge press.

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1	2	3	2		1
CO2	2	3				1		2	2	3	1	
CO3	1	3	1	2	1				3		1	2
CO4	2	2	3		2	1			2	3	1	
CO5	1	3		2					2	1		3

Semester VI

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
21BBTE08	**Bioethics, IPR and Biosafety**	**4**	**5**	**0**	**0**	**Theory**

Course Focus on: Skill Development

Course Outcome
CO 1: To understand the legal and ethical impact of biotechnology
CO 2: To know the intellectual property rights
CO 3: To apply the concept of patent system and law
CO 4: To analyze the bio-safety of good lab practice
CO 5: To understand the biodiversity and concepts

UNIT I – [12 Hours]
Bioethics - legal and socioeconomic impacts of biotechnology- ethical concerns of biotechnology research and innovation, Bioethics committees.

UNIT II - [12 Hours]
Intellectual property rights - patent, copyright, trade mark, TRIPS- GATT and PBR, WTO.

UNIT III - [12 Hours]
Patent system – patenting laws - Legal development- Patentable subjects and protection in biotechnology - patenting living organisms.

UNIT IV – [12 Hours]
Bio-safety GLP - Containment facilities – Biosafety levels - Genetically modified organisms - Genetically modified foods, Biosafety guidelines – National and International.

UNIT V – [12 Hours]
Biodiversity -Basic concepts of Biodiversity - Elements of Biodiversity - Ecosystem Diversity, Genetic Diversity, Species Abundance & Diversity.

REFERENCES

1. Shaleesha A, Stanley, Bioethics, Wisdom educational service, 2008.
2. Das H.K., Text book of Biotechnology, Wiley Publishers, 2010.
3. Singh B.D., Biotechnology, kalyani publishers, 2009.
4. Chawla H.S., Introduction to plant Biotechnology, Science publishers, 2004.

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1		2		1	1		1	3	3	2		1
CO2	2		2	2		1		3	2	3	1	
CO3	1		1	2	1			3	3		1	2
CO4	2	2			2	1		3	2	3	1	
CO5	3			2				1	2	1		3

Semester VI

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
21BBTE09	**Biodiversity and Ecology**	**4**	**5**	**0**	**0**	**Theory**

Course Focus on: Skill Development

Course Outcome
CO 1: To understand the fundamentals of Ecology
CO 2: To know the Diversity of species
CO 3: To apply the population and community based research
CO 4: To analyze the aquatic and terrestrial communities
CO 5: To understand the practical and field experiments using standard methods.

UNIT-I [12 Hours]

Introduction to Ecology & environmental sciences; Flow of energy and cycling of materials; water, carbon, nitrogen and phosphorus. Trophic pyramids and food webs; Alterations of ecosystem function: acid rain, nuclear winter, global warming and ozone hole.

UNIT-II [12 Hours]

Diversity of life; origin of life on earth; Evolution od early life and changes in earth's atmosphere. Mendelian genetics – and Darwin Wallace theory of inheritance. Five kingdoms overview; Monera, Protists, Fungi, plant and animal kingdoms.

UNIT-III [12 Hours]

Populations and communities; Birth, death and population size, age structure; Trends in human population growth; Malthusian growth. Intraspecific interactions and density dependence. Interspecific interactions; Commensalism, mutualism, competition and predation. Species diversity, community stability and disturbance.

UNIT-IV [12 Hours]

Aquatic and terrestrial communities; rare communities; deep earth, deep sea floor, volcanoes. Primary productivity; basic concepts. Ecological succession inland, water; concepts. Invasive species and control.

UNIT-V [12 Hours]

Practical and Field Experiments using standard methods; Estimation of density and relative abundance of species using quadrats and plotless methods. Estimation of species diversity: introduction to indices. Estimation of primary productivity. Ecological adaptations of the Plant and animal species in the hydrophytes, mesophytes and xerophytes.

References:

1. Chapman, J.L. & M.J. Reiss. 1998. Ecology: Principles and Applicatiions. Cambridge Univ. press. 2nd edition. 336 pgs.

2. Krebs, C.J. 2008. Ecology: The experimental Analysis of Distribution and Abundance (6th Edition), Benjamin Cummings Publ. 688pgs.

3. Miller. G.T. 2004. Environmental Science. Thomson, California. 538 pgs.

4. Singh, J.S., Singh, S.P & Gupta, S.R. 2006. Ecology, Environment and Resource conservation. Anamaya Publ., New Delhi, 688 pp.

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3			1	1		1		3	2		1
CO2	2	3	2			1			2	3	1	
CO3	1	3	1	2	1				3		1	2
CO4	2		3		2	1			2	3	1	
CO5	3			2				2	2	1		3

Semester VI

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
21BBTE10	**Herbal Technology**	**4**	**5**	**0**	**0**	**Theory**

Course Focus on: Employability & Skill Development

Course Outcome
CO 1: To understand the history and scope of herbal medicines
CO 2: To know the systematic use of Pharmacognosy studies
CO 3: To apply the phytochemistry through medicinal plant
CO 4: To analyze the drug adulteration and screening
CO 5: To understand the medicinal plant biotechnology in pharma industry

UNIT-I: [12 Hours]

Herbal medicines: history and scope - definition of medical terms - role of medicinal plants in Siddha systems of medicine; cultivation - harvesting - processing - storage - marketing and utilization of medicinal plants.

UNIT-II: [12 Hours]

Pharmacognosy - systematic position - chemical constitution and medicinal uses of the following herbs in curing various ailments; Tulsi, Ginger, Fenugreek, Indian Goose berry and Ashoka.

UNIT-III: [12 Hours]

Phytochemistry - active principles and methods of their testing - identification and utilization of the medicinal herbs; Catharanthus roseus (cardiotonic), Withania Somnifera (drugs acting on nervous system), Clerodendron Phlomoides (anti-rheumatic) and Centella asiatica (memory booster).

UNIT-IV: [12 Hours]

Analytical pharmacognosy: Drug adulteration - types, methods of drug evaluation - Biological testing of herbal drugs - Phytochemical screening tests for secondary emtabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds, fatty acids, tannins, glycosides and volatile oils).

UNIT-V: [12 Hours]

Medicinal Plant Biotechnology: Genetics as applied to medicinal herbs - mutation - polyploidy. Plant tissue culture as source of biomedicinals - Historical developments - types of cultures - phytopharmaceuticals in tissue cultures.

REFERENCES:

1. Glossary of Indian medicinal plants, R.N.Chopra, S.L.Nayar and I.C.Chopra, 1956. C.S.I.R, New Delhi.
2. The indigenous drugs of India, Kanny, Lall, Dey and Raj Bahadur, 1984. International Book Distributors.
3. Herbal plants and Drugs Agnes Arber, 1999. Mangal Deep Publications.
4. Ayurvedic drugs and their plant source. V.V. Sivarajan and Balachandran Indra 1994. Oxford IBH publishing Co.
5. Ayurveda and Aromatherapy. Miller, Light and Miller, Bryan, 1998. Banarsidass, Delhi.

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2	2	3	2	2		1			2	3	1	
CO3	1	3	1	2	1				3		1	2
CO4	2	2	3	3	2	1			2	3	1	
CO5	1	2		1				3	2	1		3

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
21BBTE11	Lifestyle Diseases	**4**	**5**	**0**	**0**	**Theory**

Course Focus on: Skill Development

Course Outcome

CO 1: able to aware of Life style diseases

CO 2: able to know the various types of disease.

CO 3: able to understand the biological mechanism of lifestyle diseases.

CO 4: able to know the human habitation involved in growth of disease

CO5: able to understand the practice to avoid those kind of disease

UNIT I [12 Hours]

INTRODUCTION - Lifestyle diseases – Definition ; Risk factors – Eating, smoking, drinking, stress, physical activity, illicit drug use ; Obesity, diabetes, cardiovascular diseases, respiratory diseases, cancer; Prevention – Diet and exercise.

UNIT II [12 Hours]

CANCER - Types - Lung cancer, Mouth cancer, Skin cancer, Cervical cancer, Carcinoma oesophagus; Causes Tobacco usage, Diagnosis – Biomarkers, Treatment

UNIT III [12 Hours]

CARDIOVASCULAR DISEASES - Coronoary atherosclerosis – Coronary artery disease; Causes -Fat and lipids, Alcohol abuse -– Diagnosis - Electrocardiograph, echocardiograph, Treatment, Exercise and Cardiac rehabilitation

UNIT IV [12 Hours]

DIABETES AND OBESITY - Types of Diabetes mellitus; Blood glucose regulation; Complications of diabetes – Paediatric and adolescent obesity – Weight control and BMI

UNIT V [12 Hours]

RESPIRATORY DISEASES - Chronic lung disease, Asthma, COPD; Causes - Breathing pattern (Nasal vs mouth), Smoking – Diagnosis - Pulmonary function testing

TEXT BOOKS:

1. R.Kumar&Meenal Kumar, "Guide to Prevention of Lifestyle Diseases", Deep & Deep Publications, 2003

2. Gary Eggar et al, "Lifestyle Medicine", 3rd Edition, Academic Press, 2017

REFERENCES:

1. James M.R, "Lifestyle Medicine", 2nd Edition, CRC Press, 2013

2. Akira Miyazaki et al, "New Frontiers in Lifestyle-Related Disease", Springer, 2008

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2	2	3	2	2		1			2	3	1	
CO3	1	3	1	2	1				3		1	2
CO4	2	2	3	3	2	1			2	3	1	
CO5	1	3		2				1	2	1		3

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
21BBTE12	**BIOFUEL**	**4**	**5**	**0**	**0**	**Theory**

Course Focus on: Skill Development

Course Outcome

CO1: able to know the environment sustainability of biofuel
CO2: able to learn the microbial resource used to production of oil.
CO3: able to understand the downstream processing of bioethanol
CO4: able to know the economic importance of biofuels
CO5: able to find the other important potential use of biofuel base allied product.

UNIT I

OVERVIEW OF BIOFUELS : Generation of biofuels − Development of biological conversion technologies − Integration of biofuels into biorefineries − Energy security and supply − Environmental sustainability of biofuels − Economic sustainability of biofuels.

UNIT II

BIODIESEL : Biodiesel − Microorganisms and raw materials used for microbial Oil production − Treatment of the feedstocks prior to production of the Biodiesel − Current technologies of biodiesel production −Purification of biodiesel; Industrial production of biodiesel − Biodiesel production from single cell oil.

UNIT III

BIOETHANOL : Bioethanol – Properties – Feedstocks − Process technology − Pilot plant for ethanol production from lignocellulosic feedstock − Environmental aspects of ethanol as a biofuel.

UNIT IV

BIOMETHANE AND BIOHYDROGEN: Biomethanol − Principles, materials and feedstocks − Process technologies and techniques − Advantages and limitations − Biological hydrogen production methods − Fermentative hydrogen production − Hydrogen economy − Advantages and limitations.

UNIT V

OTHER BIOFUELS : Biobutanol production − Principles, materials and feedstocks − Process technologies –Biopropanol – Bioglycerol − Production of bio-oils via catalytic pyrolysis − Life-Cycle environmental impacts of biofuels and Co-products.

TEXT BOOKS:

1. Luque, R., Campelo, J.and Clark, J. Handbook of biofuels production, Woodhead Publishing Limited 2011

2. Gupta, V, K. and Tuohy, M, G. Biofuel Technologies, Springer, 2013

3. Moheimani, N. R., Boer, M, P, M, K, Parisa A. and Bahri, Biofuel and Biorefinery Technologies, Volume 2, Springer, 2015

REFERENCES:

1. Eckert, C, A. and Trinh, C, T. Biotechnology for Biofuel Production and Optimization, Elsevier, 2016

2. Bernardes, M, A, D, S. Biofuel production – recent developments and prospects, InTech, 2011

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2	2	3	2	2		1			2	3	1	
CO3	1	3	1	2	1				3		1	2
CO4	2	2	3	3	2	1			2	3	1	
CO5	1	3		2				2	2	1		3

Semester VI

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
21BBTS04	**Nanoscience & Nanotechnology**	**4**	**4**	**0**	**0**	**Theory**

Introduction: This course presents the Basics of Nanotechnology, Nanoparticle preparations and Characterizations.

Course Focus on: Skill Development

Course Outcome
CO1: To understand the History of Nanotechnology concept and applications.
CO2: To learn the biology of Nanoparticles synthesis and applications.
CO3: To know the techniques of Nanoparticle structure and preparations.
CO4: To become familiar with characterization of Nanoparticles.
CO5: To become know the applications of Nanobiotechnology.

Unit I: [12 Hours]
History of Nanotechnology: Early use of nanomaterials, concept and application. Introduction to nanomaterials, properties of materials and nanomaterials, role of size in nanomaterials, nanoparticles. Nanoparticles – Size, Shape, Properties.

Unit II: [12 Hours]
Biological Nano objects – DNA, Protein and Lipids. Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thin films-multi-layered materials. Hot Nanoparticles – Quantum dot, synthesis, applications. Carbon quantum dots, synthesis and applications.

Unit III: [12 Hours]
Nanoparticles structure and Preparation – Solvent Evaporation, Nanoprecipitation, Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Emulsification Diffusion, Supercritical fluid Technology, Polymerization in Emulsion, Interfacial Polymerization, Liposomes, Cubosomes, Hexosomes. Sputtering, Molecular Beam Epitaxy, Atomic Layer Epitaxy.

Unit IV: [12 Hours]
Nanoparticles Characterization Techniques – X-ray diffraction (XRD), Scanning Electron Microscope (SEM), Energy Dispersive X-ray Spectroscopy (EDX), Transmission Electron Microscope (TEM), Scanning probe microscopes (SPM), Atomic force microscopy (AFM), and X-ray photoelectron spectroscopy (XPS), Fourier transform infrared spectroscopy (FTIR), Ultraviolet visible spectroscopy (UV-Vis). Nuclear magnetic resonance (NMR), Secondary Ion Mass Spectrometer (SIMS).

Unit V: [12 Hours]
Applications of Nanobiotechnology in Medicine, Drug Designing, and Cancer treatment. Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS) - Nano sensors. 3D bio-printing techniques. Nanobiotechnology in Medical, Social and Ethical Consideration.

Text Book

1. Text book of Nanotechnology by Dr.G.Dhamodharan, first edition, Umadevi Publication, India.
2. Nanotechnology Assessment and perspective by Professor H. Brune et al., Springer 2015.
3. The Handbook of Nanotechnology- Business, Policy and Intellectual Property law by John C. Miller et al., 2004.

Mapping of Course Outcomes with Programme Outcomes

Course outcomes	**Programme outcomes**								**Programme Specific Outcomes**			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	1		1		3	2		1
CO2	2	3	2			1			2	3	1	
CO3	1	3	1	2	1				3		1	2
CO4	2	2		3	2	1			2	3	1	
CO5	1	3		2				2	2	1		3

Semester VI

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
21BBT6CP	Lab in Environmental Biotechnology	2	0	0	5	Practical

Course Focus on: Employability & Research

1. Estimation of Dissolved Oxygen
2. Estimation of Total hardness
3. Estimation BOD
4. Estimation of COD
5. Isolation of Bacteria and fungi from industrial effluent

Subject Code	Subject title	Credit	Lecture	Tutorial	Practical	Type
21BBT6CP	Lab in Industrial Biotechnology	2	0	0	5	Practical

Course Focus on: Employability & Research

1. Ethanol production from fruit waste
2. Wine production
3. Citric acid production from waste product
4. Industrial enzyme production Protease/Amylase
5. Production of antibiotics by using the isolated microbes from effluent.

References

1. Laboratory Manual for Biotechnology Verma, Ashish S./ Das Surajit & Singh Anchal
S. Chand Publishing, 2014

2.Biotechnology Procedures And Experiments Handbook, S. Harisha, Ph.D. Infinity Science Press Llc, Hingham, Massachusetts, New Delhi, India