

PROGRAMME: B.Sc. BIOTECHNOLOGY**CURRICULUM**

SEMESTER 1										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1.	Theory	STA 1101	Tamil - I	3	0	0	3	50	50	1
		SFR 1101	French – I					50	50	3
		SHN 1101	Hindi –I					50	50	4
2.	Theory	SHS 1109	General English-I	3	0	0	3	50	50	5
3.	Theory	SBB 1101	Cell Biology	4	0	0	4	50	50	7
4.	Theory	SBB 1102	Fundamentals of microbiology	4	0	0	4	50	50	8
5.	Theory	SBT 1001	Environmental Science	3	0	0	3	50	50	9
6.	Practical	SBB4101	Cell biology Lab	0	0		2	50	50	11
7.	Practical	SBB4102	Fundamentals of Microbiology Lab	0	0	4	2	50	50	11
Total Credits for Semester 1 – 21										
Total Marks for Semester 1 – 700										

SEMESTER 2										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1.	Theory	STA 1102	Tamil - II	3	0	0	3	50	50	12
		SFR 1102	French – II					50	50	14
		SHN 1102	Hindi –II					50	50	15
2.	Theory	SHS 1110	General English-II	3	0	0	3	50	50	16
3.	Theory	SMB 1102	Basic Biochemistry	4	0	0	4	50	50	18
4.	Theory	SBB 1201	Immunology	4	0	0	4	50	50	19
5.	Theory	SBB 1202	Intermediary Metabolism	3	0	0	3	50	50	20
6.	Practical	SMB4102	Basic Biochemistry Lab	0	0	4	2	50	50	21
7.	Practical	SBB4201	Immunology Lab	0	0	4	2	50	50	21
Total Credits for Semester 2– 21										
Total Marks for Semester 2 – 700										

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS
 CAE – CONTINUOUS ASSESSMENT EXAMINATION,
 ESE – END SEMESTER EXAMINATION

SEMESTER 3										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1.	Theory	SBB2101	Introduction to Molecular Biology & Genetics	4	0	0	4	50	50	22
2.	Theory	SBB2102	Genetic Engineering	4	0	0	4	50	50	23
3.	Theory	SBB2103	Concepts in Biotechnology	3	0	0	3	50	50	24
4.	Theory	SBB2104	Analytical techniques	3	0	0	3	50	50	25
5.	Theory		Elective	3	0	0	3	50	50	
6.	Practical	SBB4301	Molecular biology Lab	0	0	4	2	50	50	26
7.	Practical	SBB4302	Bioinstrumentation Lab	0	0	4	2	50	50	26
Total Credits for Semester 3– 21										
Total Marks for Semester 3 – 700										

SEMESTER 4										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1.	Theory	SBB2201	Environmental and Agricultural biotechnology	3	0	0	3	50	50	27
2.	Theory	SBB2202	Basic Industrial Biotechnology	3	0	0	3	50	50	28
3.	Theory	SBB2203	Food biotechnology	4	0	0	4	50	50	29
4.	Theory	SBB2204	Enzyme technology	4	0	0	4	50	50	30
5.	Theory		Elective	3	0	0	3	50	50	
6.	Practical	SBB4401	Soil & Agricultural biotechnology Lab	0	0	4	2	50	50	31
7.	Practical	SBB4402	Food Biotechnology Lab	0	0	4	2	50	50	31
Total Credits for Semester 4– 21										
Total Marks for Semester 4 – 700										

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS
 CAE – CONTINUOUS ASSESSMENT EXAMINATION,
 ESE – END SEMESTER EXAMINATION

SEMESTER 5										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1.	Theory	SBB3101	Medical Biotechnology	4	0	0	4	50	50	32
2.	Theory	SBB3102	Advanced Genetic Engineering	4	0	0	4	50	50	33
3.	Theory	SBB3103	Plant Biotechnology	3	0	0	3	50	50	34
4.	Theory	SBB3104	Animal Biotechnology	3	0	0	3	50	50	35
5.	Theory		Elective	3	0	0	3	50	50	
6.	Practical	SBB4501	Genetic Engineering Lab	0	0	4	2	50	50	36
7.	Practical	SBB4502	Plant and Animal Biotechnology Lab	0	0	4	2	50	50	36
Total Credits for Semester 5 – 21										
Total Marks for Semester 5 – 700										

SEMESTER VI										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1.	Theory	SBT1002	Research Methodology	3	0	0	3	50	50	37
2.	Theory	SMB3201	Clinical Microbiology	3	0	0	3	50	50	38
3.	Project	S30PROJ	Project	0	0	30	15	50	50	
Total Credits for Semester 6 – 21										
Total Marks for Semester 6 – 300										

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS
 CAE – CONTINUOUS ASSESSMENT EXAMINATION,
 ESE – END SEMESTER EXAMINATION

LIST OF ELECTIVES

ELECTIVE COURSES									
Sl. No.	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1	SBB1601	Advanced instrumentation Techniques	3	0	0	3	50	50	39
2	SBB1602	Biopharmaceutical Technology	3	0	0	3	50	50	40
3	SMB1603	Food Fermentation Techniques	3	0	0	3	50	50	41
4	SBB1604	Protein engineering	3	0	0	3	50	50	42
5	SBB1605	Cancer biology	3	0	0	3	50	50	43
6	SBB1606	Computer Application in Biology	3	0	0	3	50	50	44
7	SBB1607	Genomics and Proteomics	3	0	0	3	50	50	45
8	SBB1608	Metabolic Engineering	3	0	0	3	50	50	46
9	SBB1609	Introduction to Bioinformatics	3	0	0	3	50	50	47
10	SBB1610	Entrepreneurial biotechnology	3	0	0	3	50	50	48
11	SBB1611	Biostatistics	3	0	0	3	50	50	49
12	SBB1612	Molecular Modeling & Drug Design	3	0	0	3	50	50	50
13	SBB1613	Marine biotechnology	3	0	0	3	50	50	51
14	SMB1602	Biofertilizers and Biopesticides	3	0	0	3	50	50	52
15	SBB1615	Bioethics, Biosafety and IPR	3	0	0	3	50	50	53
16	SBB1616	Nanobiotechnology	3	0	0	3	50	50	54

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CAE – CONTINUOUS ASSESSMENT EXAMINATION,

ESE – END SEMESTER EXAMINATION

Semester	Theory courses (including elective courses)			Practical Courses (including Project)		
	Total No.	Total Credits	Total Marks	Total No.	Total Credits	Total Marks
1	5	17	500	2	4	200
2	5	17	500	2	4	200
3	5	17	500	2	4	200
4	5	17	500	2	4	200
5	5	17	500	2	4	200
6	2	6	500	1	15	100
Overall Total	27	91	3000	11	35	1100

Overall total credits for B.Sc.(Biotechnology) Programme	126
Overall total marks for B.Sc.(Biotechnology) Programme	4100

STA 1101	தமிழ் - முதல் தாள்	வி		செ	வரவு	மொத்த மதிப்பெண்கள்
		3	0	0	3	100

நோக்கம்:

- மாணவர்களுக்குத் தமிழ் இலக்கியப் பரப்பை எடுத்துரைத்து சிற்றிலக்கியம், உரைநடை, புதினம், சிறுகதை, புதுக்கவிதை ஆகிய இலக்கிய வகைமைகளை அறிமுகப்படுத்துதல்.

அலகு - ஒன்று: தமிழ் இலக்கிய வரலாறு

1. சிற்றிலக்கியம் - தோற்றமும் வளர்ச்சியும்
2. உரைநடை - தோற்றமும் வளர்ச்சியும்
3. புதினம் - தோற்றமும் வளர்ச்சியும்
4. சிறுகதை - தோற்றமும் வளர்ச்சியும்
5. புதுக்கவிதை - தோற்றமும் வளர்ச்சியும்

அலகு - இரண்டு: சிற்றிலக்கியம்

1. கலிங்கத்துப்பரணி - போர்பாடியது : 404 --- 408 பாடல்கள்
2. குற்றாலக்குறவஞ்சி - மலைவளம்
 - i. வானரங்கள் கனிகொடுத்து ... எனத் தொடங்கும் பாடல்
 - ii. முழங்கு திரைப்புனலருவி கழங்கென முத்தாடும் ... எனத் தொடங்கும் பாடல்

அலகு - மூன்று : புதுக்கவிதைகள்

1. பாரதியார் - நெஞ்சு பொறுக்கு திலையே ... என்று தொடங்கும் கவிதை.
2. பாரதிதாசன் - உலக ஒற்றுமை - தன்பெண்டு தன்பிள்ளை ... என்று தொடங்கும் கவிதை.
3. நா.காமராசன் - கருப்புமலர்கள் - காகிதப்பூக்கள் - கால மழைத் தூறலிலே... என்று தொடங்கும் கவிதை
4. இன்குலாப் - மரங்களின் சுற்றம்
5. பாரதிபுத்திரன் - மாரிக்கால இரவுகள் - சிவகாசிச்சிசுக்கள் - மகனே அன்றொரு நாள்.... என்று தொடங்கும் கவிதை

அலகு - நான்கு : சிறுகதை மற்றும் புதினம்

1. புதுமைப்பித்தன் சிறுகதைகள்
 - சாபவிமோசனம்
 - கடவுளும் கந்தசாமிப்பிள்ளையும்
 - அன்று இரவு
 - வாடாமல்லி
 - ஒருநாள் கழிந்தது
2. புதினம்
 - வாடிவாசல் - சி.சு. செல்லப்பா

அலகு - ஐந்து : உரைநடைப்பகுதி

பண்டைத் தமிழர் வாழ்வும் வழிபாடும் - கலாநிதி க. கைலாசபதி

பயன்

- நெடிய தமிழ் இலக்கிய வரலாற்றில் சிற்றிலக்கியம், உரைநடை, புதினம், சிறுகதை, புதுக்கவிதை ஆகிய இலக்கிய வகைமைகளை அறிதல்.

- பல்வேறு இலக்கிய ஆளுமைகளையும் அவர்தம் படைப்பு, மொழிநடை, மொழிப்பற்று ஆகியவற்றை உணர்ந்துகொள்ளுதல்.
- நவீன சிந்தனைகளோடு மாணவர்தம் கருத்தாக்கங்கள் உருப்பெறல்.
- படைப்பாக்க உத்திகளையும் திறன்களையும் அறிதல்.
- மாணவர்கள் இலக்கிய படைப்புகளை உருவாக்க அறிந்து கொள்ளுதல்.

பார்வை நூல்கள்

1. புதுக்கவிதை தோற்றமும் வளர்ச்சியும் – வல்லிக்கண்ணன்
2. தமிழில் சிறுகதை வரலாறும் வளர்ச்சியும் – சிட்டி, சிவபாதசுந்தரம்
3. தமிழ் நாவல் (புதினம்) தோற்றமும் வளர்ச்சியும் – சிட்டி, சிவபாதசுந்தரம்,
4. தமிழ் உரைநடை வரலாறு - வி.செல்வநாயகம்
5. நூற்றாண்டு தமிழ் உரைநடை – சு.சக்திவேல்
6. கலிங்கத்துப்பரணி – புலியூர்க் கேசிகன் உரை
7. குற்றாலக்குறவஞ்சி – புலியூர்க் கேசிகன் உரை
8. பாரதியார் கவிதைகள்
9. பாரதிதாசன் கவிதைகள்
10. மரங்களின் சுற்றம் - இன்குலாப்
11. கருப்புமலர்கள் – நா.காமராசன்
12. மாரிக்கால இரவுகள் - பாரதிபுத்திரன்
13. புதுமைப்பித்தன் சிறுகதைகள்
14. வாடிவாசல் – சி.சு. செல்லப்பா
15. பண்டைத்தமிழர் வாழ்வும் வழிபாடும் – கலாநிதி க. கைலாசபதி

பருவத்தேர்வு வினாத்தாள் அமைப்பு

மொத்த மதிப்பெண்கள்: 100

காலம் : 3 மணிநேரம்.

பகுதி அ: 10 வினாக்களுக்குத் தலா 2 மதிப்பெண்கள்

- 20 மதிப்பெண்கள்

பகுதி ஆ: 7 வினாக்களில் 5 வினாக்களுக்குத் தலா 7 மதிப்பெண்கள்

- 35 மதிப்பெண்கள்

பகுதி இ: 3 வினாக்களுக்குத் தலா 15 மதிப்பெண்கள்

- 45 மதிப்பெண்கள்

SFR1101	FRENCH- I	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To teach basic skills in written and spoken French.
- To encourage students' oral and written mastery of the language.

UNIT 1**9Hrs**

Se présenter à des publics différents et saluer - Saluer et Prendre congé - La presentation. Pronoms, objets et sujets. Articles définis /indéfinis. Des cartes d'identité. Présenter quelqu'un. Les chiffres 1 à 50. Épreuves.

UNIT 2**12Hrs**

Exprimer ses goûts, ses preferences. La negation. Les mois et les jours / le calendrier - Les verbes - L'interrogation avec intonation - Décrire un lieu, les noms des différentes salles - Les adjectifs - Les articles. Épreuves.

UNIT 3**12Hrs**

Donner des directions / localiser un lieu/ trouver un lieu-Les verbes aller et mettre.-L'article contracté et les prépositions de lieu - L'impératif- Les mots de caractérisation d'un lieu et les lieux urbains - Les transports. Épreuves.

UNIT 4**12Hrs**

Discuter et acheter des produits - Les expressions de quantité-Les fruits, les légumes, les produits alimentaires-les produits propres aux pays différents.-La negation-le COD-Le conditionnel et les verbes-irréguliers - Épreuves.

UNIT 5**15Hrs**

Fixer un rendez-vous avec le médecin-L'heure et Les nombres de 51 à 100-L'interrogation avec est-ce que- Les parties du corps, avoir + les expressions et les-maladies communes-Les adjectifs possessifs – Le COI - L'entraînement DELF et épreuves.

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Panorama De La Langue Francaise: Level 1 by Jacky Girardet, Jean-Marie Cridlig, CLE International, 2004.
2. Krishnan, C & Albert Adeline, Le Tramway Volant - I, Saraswathi House Pvt Ltd, India, 2011.
3. CAPELLE Guy; MENAND, Robert Taxi-1, Hachette, Paris, 2008.
4. MERIEUX , Régine; LOISEAU, Yves, Connexions-1, Didier, Paris , 2004.
5. MIQUEL, Claire,Vite et Bien-1, CLE International, Paris, 2009.
6. POISSON QUINTON, Sylvie, SIREJOLS, Evelyne, Amical -1, CLE International, Paris, 20011

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 6 Questions to be answered out of 8 questions and each question carries 5 Marks**30 Marks****PART B:** 4 questions to be answered out of 8 questions and each question carries 10 Marks**40 Marks****PART C:** 2 questions/Problems to be answered out of 4 questions each carries 15 marks**30 Marks**

SHN1101	HINIDI – I	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I ALPHABETS, VOWELS**10 hrs.**

स्वर अ से अः तक - व्यंजन क से झ तक,
बारह खड़ी अनुस्वार - अनुनासिक व विसर्ग ,संयुक्ताक्षर

UNIT II WHO, WHERE, HERE, THERE**10 hrs.**

क्या ,कौन ,कहाँ ,वहाँ ,यहाँ । मैं हूँ । तुम हो । पढ़ते हो ।

UNIT III ITS, HER, HIS, MINE**10 hrs.**

का, के, की, बड़ा, बड़े, बड़ी ,मेरा, तुम्हारा, हमारा ,आउँगा ,आएगा, आओगे आँँगे ,किससे , किसपर ,किसको ,
था ,थे ,थी ,थीँ ,आया ,आये, आयी, आयीं , खाया , खायी , खयीं आया है ,आया था ,रहा ,रहे ,रही

UNIT IV**10 hrs.**

प्रार्थना 2 पर्यटन 3 पालतु पशु 4 महाकवी तिरुवल्लुवर

UNIT V**10 hrs.**

Grammar प्रयोग काल Tense कारक विभक्तियों Case Endings का के की -
Possessive Case गिनती - Numbers(1-50)

TEXT BOOK:

1. Hindi Parichaya Publisher: Dakshin Bharat Hindi Prachar Sabha
2. Central Hindi directorate – Certificate course material, MHRD.

EVALUATION PATTERN**1. Exercises for written test**

Fill In The Blanks With Suitable Word
Write The Number Names
Write The Hindi Meanings
Write The English Meanings
Write The Opposites
Write The Correct Word

SHS1109	GENERAL ENGLISH – I	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To develop, in learners, the four basic skills of listening, reading, speaking, and writing, through an integrated approach. To improve the comprehension and expression of oral and written ideas in English.

Unit 1 DRESS IN COMMUNICATION**12 Hrs.**

Speaking - Rhetorical analysis and Group Discussion. Reading for details and Global Comprehension - Dress in communication, I have a Dream Speech by Martin Luther King and The Justice Peace by Hilaire Belloc. Critical Thinking: Asking Questions, Analyzing Assumptions and Biases. Vocabulary: Expressions and markers. Collocations – Identifying collocations by reading prose passages mentioned in the unit one. Language Focus: Determiners, Parts of Speech Writing: Paragraph writing based on hints given on topics like 'My dream for my family/ country', 'importance of clothing for communication, 'social inequality in society', 'Judge the Book by its Cover- Can we judge people by their appearance?

Unit 2 AN INCONVENIENT TRUTH**12 Hrs.**

Speaking: Debate on the topics related to Environmental issues and Discrimination in Society . Reading for details and Global Comprehension on An Inconvenient Truth, A Different History by Kamala Das and Sujata Bhatt. Critical Thinking: Identifying Facts and Opinions, Distinguish a main idea in text from a subordinate idea. Examine views on a controversial issue and consider one's own biases and personal interest. 'Vocabulary: Collocations, Useful words to express point of view. Language focus- Tenses, Conjunctions and discourse markers Writing- Responding to Slogans, Campaign Leaflet and Writing Film Review , Letter writing

UNIT 3 A SPEECH BY N R NARAYANA MURTHY**12 Hrs.**

Speaking: Giving Impromptu speeches- Welcome address and Vote of Thanks. Reading for details and Global Comprehension- A Speech by NR Narayana Murthy and Digging by Seamus Heaney Critical Thinking: Asking ' wh ' questions Questions, Making informed decisions based on evidence, Examining Evidence by citing evidence from the textbook or lecture to support a position. Vocabulary - Word association, onomatopoeic words. Language focus: Sentence Function and Sentence Kinds Writing: Writing email , Writing Diary Entry

Unit 4 AFTER TWENTY YEARS**12 Hrs.**

Listening: For details and Overall Idea, Speaking: Informal Speech, Reading for details and Global Comprehension- After Twenty Years by Jamila and After Twenty Years by O Henry Writing: Problem solving paragraph writing. Letter to the editor with solutions to current problems related to areas covered in the course Critical Thinking: Problem Solving selecting effective solutions for overcoming obstacles or constraints by explaining why it is the most effective of the possible solutions. Vocabulary : Phrasal Verbs Language Focus Types of sentences -simple, compound and complex. Language Focus: Subject verb Agreement

Unit 5 I LOVE YOU MOM**12 Hrs.**

Listening for details Speaking- Greeting , thanking , apologising, offering condolences by doing Role plays Reading for details and Global Comprehension- I Love you Mom by Joanna Fuchs and Prose passage on ' I Love You Mom'. Writing: Writing restaurant review, argumentative writing. Vocabulary: Phrasal Verbs , Synonyms and Antonyms Critical Thinking : Argumentation provides a well-articulated and detailed argument

Max Hours.60**TEXT BOOKS:**

1. P Bhaskaran Nair, C Radha Krishna Pillai, Geetha Rajeevan, CLN Prakash, Nadhini Nayar Reflections - An Anthology of Prose, Poetry and Fiction (2015) Foundation Books, Chennai . Foundation Books. ISBN 978-93-85386-008

2. References:
3. Sen S, Mahendra et al. (2015) Communication and Language Skills . Foundation books. Chennai

REFERENCE Links for teachers on Critical Thinking:

<https://designteachengage.wisc.edu/course-activities-learner-interaction/sdc-activity-types-active-learning/>

<https://www.uen.org/rubric/previewRubric.html?id=1219>

<https://www.diigo.com/profile/Teachonlineuw?query=%22Critical+Thinking%22+rubric>

SBB1101	CELL BIOLOGY	L	T	P	Credits	Total Marks
		4	0	0	4	100

COURSE OBJECTIVES:

- Cell biology is the study of the structure and function of prokaryotic and eukaryotic cells. In this course the students will learn different areas of cellular biology including the structure and functions of cell, its organelles, synthesis and function of macromolecules such as carbohydrate, protein, lipid, DNA & RNA; membrane structure and function; bioenergetics; cellular communication; and microscopic techniques to understand the cell structure.

UNIT 1 FUNDAMENTALS OF CELL STRUCTURE**12 Hrs.**

Discovery of cells; Basic properties of cells; Different classes of cells – Prokaryotic and eukaryotic cells. Cell division: Cell cycle; mitosis; meiosis, binary fission.

UNIT 2 CELLULAR MEMBRANES AND MATRICES**12 Hrs.**

Chemical composition and fluidity of membranes; dynamic nature of membranes; transportation across cell membrane; membrane potentials; extracellular matrices – structure and function; cytoskeleton – structure and function.

UNIT 3 CELLULAR ORGANELLES IN ENERGY METABOLISM**12 Hrs.**

Mitochondria – structure and function; Chloroplast – structure and function. Structure of nucleus – nuclear membrane, nucleolus, chromatin, structure of nucleic acids

UNIT 4 CELLULAR ORGANELLES IN METABOLISM**12 Hrs.**

Endoplasmic reticulum – smooth & rough; function of endoplasmic reticulum; Golgi complex – structure and function; Ribosomes – Types, structure and function; Morphology and functions of peroxisomes and glyoxisomes; Plant cell vacuoles.

UNIT 5 TRANSPORT ACROSS CELL MEMBRANE**12 Hrs.**

Passive and active transports, Permeases, Sodium -potassium pumps, Ca²⁺ ATPase pump, ATP dependant proton pumps, co-transport, symport, antiport, Endocytosis and Exocytosis. Introduction to intra and extra cellular products of medicinal use.

Max Hours.60**TEXT/REFERENCE BOOKS:**

1. Freifelder D. 1985. Molecular Biology, Narosa Publishing House. New Delhi.
2. Lewin B. 2007. Genes IX. Oxford University Press, London.
3. Ajoy Paul. 2011. Textbook of Cell and Molecular Biology. Books and Allied Ltd.
4. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. 2008. Molecular Biology of Cell. 6th Edition. Garland Science, Taylor & Francis group Publishers.
5. Harvey Lodish, Arnold Berk, S Lawrence Zipursky, Paul Matsudaira, David Baltimore, and James Darnell. 1995. Molecular Cell Biology. 3rd Edition. W.H. Freeman Publishers.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SBB1102	FUNDAMENTALS OF MICROBIOLOGY	L	T	P	Credits	Total Marks
		4	0	0	4	100

COURSE OBJECTIVES

- This course is aimed give an understanding about the basics of microbiology dealing types of microbes, classification & characterization

UNIT 1 HISTORY OF MICROBIOLOGY**12 Hrs.**

History and scope of Microbiology, Spontaneous generation - Biogenesis theory - Contribution of Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Paul Ehrlich and Flemming.

UNIT 2 MICROSCOPY**12 Hrs.**

Microscope- Principles, working mechanism and application - Simple and compound microscope - Dark field -Phase contrast, Fluorescence, SEM and TEM.

UNIT 3 STAINING METHODS**12 Hrs.**

Structure and organization of bacterial cell, Gram positive and Gram-negative bacterial cell wall. Types of Staining - Simple, Differential (Gram's, AFB), Special - Capsular staining (negative), Spore. LPCB, KOH mount.

UNIT 4 STERILIZATION METHODS**12 Hrs.**

Sterilization and Disinfection- principles -methods of sterilization- physical methods - Dry heat- Moist heat- Radiation. Filtration (Membrane and HEPA). Chemical sterilization- Chemical agents- mode of action- phenol coefficient test- sterility testing.

UNIT 5 MICROBIAL MEDIA**12 Hrs.**

Culture and media preparation - solid and liquid. Types of media- Semi synthetic, Synthetic, Enriched, Enrichment, Selective and Differential media. Pure culture techniques – Tube dilution, Pour, Spread, Streak plate. Anaerobic culture technique Wright's Tube, Roll tube method, Anaerobic Jar.

Max Hours.60**TEXT/REFERENCE BOOKS:**

1. Prescott, Harley, Klein. 2003. Microbiology. 5th Edition. McGraw Hill Publ.
2. Bernard R. Glick & Jack J. Pasternak. 2002. Molecular Biotechnology. Indian edition. Panima Publishing Corporation.
3. Pelzer, Chan and Kreig. 1986. Microbiology. 5th Edition. McGraw-Hill.
4. Tortora, G.J., Funke, B.R. and Case, C.L. 2012. Microbiology - An Introduction. 11th Edition. Pearson Education.
5. Stainer, Ingharam, Wheelis and Painter. 1987. General Microbiology. 5th Edition. Macmillan Education, London.
6. A.J. Salle. 1974. Fundamental Principles of Bacteriology. Tata McGraw – Hill Edition.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SBT1001	ENVIRONMENTAL SCIENCE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To impart knowledge on the issues related to environment and to emphasize the importance of a clean environment

UNIT 1 MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 12 Hrs.

Definition, scope and importance- Need for public awareness. Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT 2 ECOSYSTEMS, BIODIVERSITY AND ITS CONSERVATION**12 Hrs.**

Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Biodiversity: Definition-genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega- diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT 3 ENVIRONMENTAL POLLUTION**12 Hrs.**

Definition -Cause, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management floods, earthquake, cyclone and landslides.

UNIT 4 SOCIAL ISSUES AND THE ENVIRONMENT**12 Hrs.**

Idea of Sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case Studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.

UNIT 5 HUMAN POPULATION AND THE ENVIRONMENT**12 Hrs.**

Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health. Case Studies.

Visit to a local area to document environmental assets-river/forest/grassland/hill/mountain

- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

Max Hours.60**Text/Reference Books:**

1. Erach Bharucha, Text Book of Environmental Studies, 2nd Edition, University Press, Chennai, 2006
2. Meenakshi. P, Elements of Environmental Science and Engineering, 1st Edition, Prentice Hall of India, New Delhi, 2009.
3. Ravikrishnan. A, Environmental Science & Engineering, 3rd Edition, Sri Krishna Publications, Chennai, 2008.
4. Wrigh. R. T & Nebel B.J, Environmental science-towards a sustainable future by Richard 8th edition, Prentice Hall of India, NewDelhi,2006

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SBB4101	CELL BIOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Light Microscopy
2. Simple staining
3. Studying algal cell
4. Studying fungal cell
5. Studying plant cell (Onion cells)
6. Studying animal cell (Human cheek cells)
7. Studying mitotic cell division in root tips of *Allium cepa*
8. Identifying meiotic cell division

SBB4102	FUNDAMENTAL OF MICROBIOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Handling of Instruments and Laboratory safety measures.
2. Handling and Maintenance of compound microscope.
3. Cleaning of Glassware and preparation of cleaning solutions.
4. Staining Procedures
 - a. Smear preparation
 - b. Simple staining
 - c. Grams staining
 - d. Capsule staining
5. Sterilization procedures and preparation of solid and liquid media
6. Streak plate method
7. Decimal dilution method
8. Spread plate method
9. Pour plate method
10. Antibiotic Sensitivity test

STA 1102	தமிழ் - இரண்டாம் தாள்	L	T	P	Credits	Total Marks
		3	0	0	3	100

நோக்கம்

- மாணவர்களுக்குத் தமிழின் செவ்விலக்கியங்கள் மற்றும் காப்பியங்களை அறிமுகப்படுத்துதல்.

அலகு - ஒன்று : தமிழ் இலக்கிய வரலாறு

1. சங்க இலக்கியங்கள்
2. அற இலக்கியங்கள்
3. பக்தி இலக்கியம்
4. காப்பியங்கள்

அலகு - இரண்டு : சங்க இலக்கியம்

1. 'முளி தயிர் பிசைந்த' என்று தொடங்கும் குறுந்தொகைப் பாடல் (167)
2. 'நின்ற சொல்லர்' என்று தொடங்கும் நற்றிணைப்பாடல் (1)
3. 'மனை நடு வயலை வேழம் சுற்றும்' என்று தொடங்கும் ஐங்குறுநூற்று பாடல் (11)
4. 'எம்வெங்காமம் இயைவது ஆயின்' என்று தொடங்கும் அகநானூற்றுப்பாடல் (15)
5. 'சுடர் தொடிகு கேளாய்' என்று தொடங்கும் கலித்தொகைப்பாடல் (51)
6. 'மண்டு அமர் அட்ட' என்று தொடங்கும் புறநானூற்றுப்பாடல் (213)
7. 'நறவுவாய் உறைக்கும் நாகுமுதிர்' என்று தொடங்கும் சிறுபாணாற்றுப்படை பாடல் (51 - 67)

அலகு - மூன்று : அற இலக்கியங்கள்

1. திருக்குறள் - நட்பாராய்தல், புலவிநுணுக்கம் (2 அதிகாரம்).
2. நாலடியார் - பொருட்பால் - மேன்மக்கள் - (5) பாடல்கள்

அலகு - நான்கு : பக்தி இலக்கியங்கள்**சைவம் - பன்னிருதிருமுறைகள்**

1. திருஞானசம்பந்தர் தேவாரம் - முதலாம் திருமுறை
'காதல் ஆகி, கசிந்து' என்று தொடங்கும் பாடல்.
2. திருநாவுக்கரசர் தேவாரம் - ஐந்தாம் திருமுறை
'மாசில் வீணையும் மாலை' என்று தொடங்கும் பாடல்.
3. சுந்தரர் தேவாரம் - ஏழாம் திருமுறை
'பொன்னார் மேனியனே' என்று தொடங்கும் பாடல்.

வைணவம் - நாலாயிரத்திவ்யப்பிரபந்தம்

1. பூதத்தாழ்வார்
'பெருகு மத வேழம் மாப்பிடிக்கு' என்று தொடங்கும் பாடல்.
2. குலசேகராழ்வார்
'ஆனாதசெல்வத்து அரம்பையர்கள் தற்கூழ்' என்று தொடங்கும் பாடல்.

அலகு - ஐந்து : காப்பிய இலக்கியங்கள்

1. சிலப்பதிகாரம்
மங்கல வாழ்த்துப் பாடல் முழுவதும்
2. சீவகசிந்தாமணி
கோவிந்தையார் இலம்பகம் முழுவதும்
3. கம்பராமாயணம்
திருவிடித் தொழுத படலம் (பாடல் எண் : 25 - 48)

பயன்

- ஈராயிரம் ஆண்டுகளுக்கு முந்தைய தமிழின் செவ்விலக்கியங்களின் சிறப்பினை உணர்தல்.
- பண்டைய காலத் தமிழ் மக்களின் அக மற்றும் புற வாழ்வியலையும் பண்பாட்டையும் அறிதல்.
- தமிழர்தம் அறச்சிந்தனைகளையும் அற வாழ்வியலை அவர்கள் பேணிய முறையினையும் உணர்தல்.
- தமிழர்களுடைய மெய்யியல் தத்துவங்களையும் கடவுள் பற்றிய கோட்பாடுகளையும் உணர்தல்.
- நெடுங்கதைகளாகத் திகழும் காப்பியங்களின் வழி பல பண்பாட்டுச் செய்திகளை அறிதல்.

பார்வை நூல்கள்

1. தமிழ் இலக்கிய வரலாறு – மு.வ.
2. தமிழ் இலக்கியவரலாறு – மது. ச. விமலானந்தம்
3. சங்க இலக்கியம் – ஓளவை ச. துரைசாமிப் பிள்ளை
4. சங்க இலக்கியம் – புலியூர் கேசிகன்
5. திருக்குறள் – பரிமேலழகர் உரை
6. திருக்குறள் – மு.வ. உரை
7. நாலடியார் – கு. மதுரை முதலியார்
8. சைவத்திருமுறைகள் – வர்த்தமான் பதிப்பகம்
9. நாலாயிர திவ்வியப்பிரபந்தம் – வர்த்தமான் பதிப்பகம்
10. சிலக்கதிகாரம் – ஞா.மாணிக்கவாசகன்
11. சீவகசிந்தாமணி – துரை ராசாராம்
12. கம்பராமாயணம் – கழக வெளியீடு.

பருவத்தேர்வு வினாத்தாள் அமைப்பு

மொத்த மதிப்பெண்கள்: 100

பகுதி அ: 10 வினாக்களுக்குத் தலா 2 மதிப்பெண்கள்

பகுதி ஆ: 7 வினாக்களில் 5 வினாக்களுக்குத் தலா 7 மதிப்பெண்கள்

பகுதி இ: 3 வினாக்களுக்குத் தலா 15 மதிப்பெண்கள்

காலம்: 3 மணிநேரம்.

- 20 மதிப்பெண்கள்

- 35 மதிப்பெண்கள்

- 45 மதிப்பெண்கள்

SFR1102	FRENCH -II	L	T	P	Credits	Total Marks
		4	*	0	4	100

COURSE OBJECTIVES:

- To teach basic skills in written and spoken French.
- To encourage students' oral and written mastery of the language.

UNIT 1**12 Hrs.**

Acheter un billet - Les nombres au-delà de 100 - Les différents types de places (fumeur, non fumeur, aller-retour) - Les adjectifs démonstratifs - L'interrogation avec inversion - Les vêtements - L'entraînement DELF - Compréhension/Production écrite - Épreuves

UNIT 2**12 Hrs.**

Discuter les plats au restaurant - Les recettes, des plats et boissons différents, - les formules de cuisine, des recettes simples - des différents pays - Le passé récent - Les pronoms toniques - Il faut + infinitif, Le pronom - Faire des projets pour les vacances, décrire le temps - les lieux touristiques et le climat des différents pays - Le futur proche et les adverbes, le il - m personnel, le pronom y - Épreuves et entraînement DELF

UNIT 3**12 Hrs.**

Le passé composé - Les pronoms relatifs (qui, que) - Québec et son histoire - Parler du passé et de soi - Compréhension/production écrite - Entraînement DELF - Épreuves

UNIT 4**12 Hrs.**

Les verbes réfléchis - Les pronoms relatifs (dont, où) - L'impératif négatif - Compréhension/production écrite - Entraînement DELF - Épreuves

UNIT 5**12 Hrs.**

L'imparfait - La place des pronoms doubles - Décrire les mœurs et les pays - La Réunion - Compréhension/production écrite - Entraînement DELF - Épreuves

Max Hours.60**TEXT / REFERENCE BOOKS:**

1. Panorama De La Langue Française: Level 1 by Jacky Girardet, Jean-Marie Cridlig, CLE International, 2004.
2. Krishnan, C & Albert Adeline, Le Tramway Volant - I, Saraswathi House Pvt Ltd, India, 2011.
3. CAPELLE Guy; MENAND, Robert Taxi-1, Hachette, Paris, 2008.
4. MERIEUX, Régine; LOISEAU, Yves, Connexions-1, Didier, Paris, 2004.
5. MIQUEL, Claire, Vite et Bien-1, CLE International, Paris, 2009.
6. POISSON QUINTON, Sylvie, SIREJOLS, Evelyne, Amical -1, CLE International, Paris, 2001

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

Sathyabama Institute of Science and Technology**B.Sc. BIOTECHNOLOGY****SHN 1102 - Hindi- II**

Teaching Scheme: TH: 03 Hours/Week	Credit 03	Examination Scheme: In-Sem (Paper): 50 Marks End-Sem (Paper): 50 Marks
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Unit- I

- (i) पद्य – Poetry
- (ii) गद्य – Prose
- (iii) एकांकी एवं नाटक – One Act Play and Drama
- (iv) कहानी एवं उपन्यास – Story and Novel

Unit -II

- (v) हिन्दी व्याकरण (Hindi Grammer)
1.संज्ञा, 2. सर्वनाम, 3.विशेषण, 4.क्रिया-विशेषण, 5.काल, 6.लिंग, 7.वचन, 8.वाक्य-विचार, 9. शुद्ध लेखन.

Unit -III

- (vi) परिभाषिक शब्द – 250 आंग्रेजी पारिभाषिक शब्दों को हिन्दी परिभाषिक शब्द
Translate from English to Hindi – 250 Official words.
- (vii) अनुवाद अभ्यास (Translation):

Unit -IV

- (viii) निबंध लेखन(Essay):
गाँधी, नेहरू, अंबेडकर, बगत सिंह, अब्दुल कलाम
- (ix) पत्र लेखन(Letter Writing):
आवेदन पत्र, रासकीय पत्र, अर्धशासकीय पत्र, प्रत्यावेदन पत्र, प्रतिवेदन पत्र
Application letter, Official letter, Semi-Official letter, Government letter.

Unit -V

- (x) संक्षेपण और विस्तारण (Comprehensions)
- (xi) लोकोक्तियाँ एवं मुहावरे (Proverbs)

SHS1110	GENERAL ENGLISH – II	L	T	P	Credits	Total Marks
		4	0	0	4	100

OBJECTIVES OF THE COURSE:

- The paper provides opportunities for students to read and respond to representations of current issues through texts that present themes and topics that are familiar, insightful and informative. The thrust is on preparing students to effectively communicate by applying reflective thinking practices. Students will have an opportunity to improve their vocabulary related to immediate environment, practice speaking skills by discussing about issues based on reading texts, read texts that include everyday problems that provide opportunities to develop problem solving skills in cooperative learning situations, develop writing skills by summarising substance of a poems, letters and composition of dialogues and paragraphs.

UNIT 1 UNITY OF MINDS - A P J ABDUL KALAM**12 Hrs.**

Listening for details, Speaking - making a presentation , Reading for details and Global Comprehension Unity of Minds by APJ Abdul Kalam -Vocabulary Binomials Writing: Writing compare contrast paragraphs by representing data given in pie chart, Tables; Writing Speeches. Vocabulary : Binomials , Affixes Language Focus : Active and Passive Voice , Punctuation. Critical Thinking : Comparing & Contrasting presenting information by including important characteristics on which the items should be compared or contrasted

UNIT 2 LEAVE THIS CHANTING AND SINGING AND TELLING OF BEADS BY RABINDRANATH TAGORE AND ENGINE TROUBLE BY R K NARAYANAN**12 Hrs.**

Listening for details Speaking: Giving impromptu speech based on topics given in the class for clarifying one's point of view. Reading for Comprehension and for overall idea -Leave this Chanting and Singing and Telling of Beads by Rabindranath Tagore and Engine Trouble by R K Narayanan , Vocabulary : Archaic words , phrases Writing: Language Focus Imperatives. Writing: Writing Instructions and recommendations based on quotations given as prompts, writing an advertisement Critical Thinking: Expressing point of view

UNIT 3 THE HAPPY PRINCE BY OSCAR WILDE**12 Hrs.**

Speaking Telephonic conversation, Drama In the class based on the story prescribed Reading for details and Global Comprehension The Happy Prince by Oscar Wilde Language Focus: Adjective- degrees of Comparison ,Functional and personal Nouns Vocabulary : positive and negative connotations. Writing: Letter writing- personal letters Critical Thinking Self-regulation: Continuing improvement in thinking, involving monitoring one's cognitive process and correcting errors and biases as needed.

UNIT 4 TWO GENTLEMEN OF VERONA BY A J CRONIN**12 Hrs.**

Listening for Overall information of 'Anthem for Doomed Youth' by Wilfred Owen Speaking: Making requests and suggestions. Reading for details Two Gentlemen of Verona by A J Cronin, Vocabulary: Simile, metaphor , adjectives to describe people and their personalities. Idioms. Writing: Writing recommendations; Narratives based on prompts on plot and characters. Critical Thinking: identifying the subject of the investigation and presenting a well-articulated solution to the confusions or contradictions associated with the situation based on listening speaking tasks in the class. Creative writing - stories and poems Language Focus: Reported Speech

UNIT 5 THE AVENGER BY ANTON CHEKHOV**12 Hrs.**

Listening for specific details Speaking using imagination . Reading to identify factual and inferential information Writing: Imaginative writing by predicting. Vocabulary : Countable forms and meaning, foreign nouns and framing of plurals.

Language focus: Modal verbs, use of would. Critical Thinking: Deductive reasoning- generating a valid prediction or conclusion by articulating the relationship between the prediction or conclusion

Max Hours.60

TEXT / REFERENCE BOOKS:

1. P Bhaskaran Nair, C Radha Krishna Pillai, Geetha Rajeevan, CLN Prakash, Nadhini Nayar Reflections - An Anthology of Prose, Poetry and Fiction (2015) Foundation Books, Chennai . Foundation Books. ISBN 978-93-85386-008
2. Sen S , Mahendra etal. (2015) Communication and Language Skills . Foundation books. Chennai
3. <https://designteachengage.wisc.edu/course-activities-learner-interaction/sdc-activity-types-active-learning/>
4. <https://www.uen.org/rubric/previewRubric.html?id=1219>
5. <https://www.diigo.com/profile/Teachonlineuw?query=%22Critical+Thinking%22+rubric>

SMB1102	BASIC BIOCHEMISTRY	L	T	P	Credits	Total Marks
		4	0	0	4	100

COURSE OBJECTIVES

- This course is aimed give an understanding about the basics of biochemistry dealing carbohydrates, Amino acids, Lipids, nucleic acid and vitamins

UNIT 1 CARBOHYDRATES**12 Hrs.**

Carbohydrate – Definition, Classification, biological significance, structure of glucose, digestion and absorption of carbohydrates.

UNIT 2 PROTEINS**12 Hrs.**

Amino acids – structure, classification (Essential and non-essential, protein and non-protein amino acids). Proteins – definition, classification and structure (primary, secondary, tertiary and quaternary).

UNIT 3 LIPIDS**12 Hrs.**

Lipids – definition, classification and biological significance. Structure, properties and functions of fatty acids.

UNIT 4 NUCLEIC ACIDS**12 Hrs.**

Nucleic acids – Structure of DNA and its functions. Different forms of DNA. Different types of RNA and its functions.

UNIT 5 VITAMINS**12 Hrs.**

Vitamins – Source, biological function, daily requirement and deficiency symptoms of fat soluble vitamins (A, D, E and K) and water soluble vitamins (Ascorbic acid, thiamine, riboflavin, pyridoxine, niacin, pantothenic acid, lipoic acid, biotin, folic acid and vitamin B12).

Max Hours.60**TEXT / REFERENCE BOOKS:**

1. Lehninger Principles of Biochemistry-David L. Nelson, Michael M. Cox, Macmillan Worth Publishers.
2. Harper—s Biochemistry-Rober K. Murray, Daryl K. Grammer, McGraw Hill, Lange Medical Books. 25th edition.
3. Fundamentals of Biochemistry-J.L. Jain, Sunjay Jain, Nitin Jain, S. Chand & Company.
4. Biochemistry-Dr. Amit Krishna De, S. Chand & Co., Ltd.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SBB1201	IMMUNOLOGY	L	T	P	Credits	Total Marks
		4	0	0	4	100

COURSE OBJECTIVES

- To know the fundamentals of innate and acquired immunity. To understand how immune system fights and combats the infection and diseases. To get an insight about the principle mechanism of immunity

UNIT 1 IMMUNOLOGY AND IMMUNITY**12 Hrs.**

History of Immunology – Host-parasite relationship – Immunity – Innate and acquired immunity – Humoral and Cell-mediated immunity.

UNIT 2 IMMUNE CELLS**12 Hrs.**

Structure, Functions and Properties of: Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; and Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT

UNIT 3 ANTIGENS**12 Hrs.**

Antigens – Types, properties – Immunoglobulins – Structure, types and properties – Complement – Classical and alternative pathways.

UNIT 4 ANTIBODIES**12 Hrs.**

Structure, Types, Functions and Properties of antibodies; Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic); VDJ rearrangements; **Monoclonal and Chimeric antibodies. Antibody reactions – Agglutination – Precipitation – Complement fixation – Immunofluorescence – ELISA-RIA.**

UNIT 5 IMMUNOLOGICAL REACTIONS**12 Hrs.**

Hypersensitivity reactions – Antibody mediated – Type I, Type II and Type III – cell mediated – Type IV – Immunohaematology. Tumor immunology

Max Hours.60**TEXT / REFERENCE BOOKS:**

1. Zeev Pancer and Max D. Cooper, (2006), The Evolution of Adaptive Immunity, Ann. Rev. Immunol., 24: 497–518
2. Roitt Evan, Brostoff J. Male D. (1993) Immunology 6th Ed., Mosby & Co. London.
3. Roitt I. M. (1988) Essentials of Immunology, ELBS, London.
4. Roitt M. (1984) Essentials of Immunology, P. G. Publishers Pvt. Ltd., New Delhi.
5. Stites D. P., Stobo J. D., Fudenberg H. H. and Wells J. V., (1982), Basic and Clinical Immunology, 4th Ed., Lange Medical Publications, Maruzen Asia Pvt. Ltd., Singapore
6. Janeway Charles A., Paul Travers, Mark Walport, Mark Shlomchik. Immunobiology interactive. 2005. Garland Science Publishing. USA.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SBB1202	INTERMEDIARY METABOLISM	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- This course aims at understanding the essential metabolic functions of the organism as well as consumption and storage of energy intermediary metabolism of main biomolecules and its regulatory mechanisms

UNIT 1 GENERAL METABOLISM**12 Hrs.**

Anabolism – catabolism, Enthalpy entropy free energy, forward and reverse reaction equilibrium state

UNIT 2 METABOLIC PATHWAYS**12 Hrs.**

Glycolysis, TCA cycle and its energy production. Glycogen metabolism: Glycogenesis and Glycogenolysis, Alternative pathways: HMP pathway, gluconeogenesis

UNIT 3 FATTY ACID METABOLISM**12 Hrs.**

Fatty acid oxidation – α , β , ω oxidation. Biosynthesis of saturated and unsaturated fatty acids. Metabolism of cholesterol, triglycerides.

UNIT 4 METABOLIC CYCLES**12 Hrs.**

Ketogenic and Glucogenic amino acids metabolism. Deamination, Transamination and Decarboxylation, Urea cycle.

UNIT 5 BIOSYNTHESIS OF NUCLEIC ACIDS**12 Hrs.**

Biosynthesis and degradation of purine and pyrimidine nucleotides. Mitochondrial Electron Transport Chain: Oxidative phosphorylation

Max Hours.60**TEXT / REFERENCE BOOKS:**

1. Fundamentals of Biochemistry, J.L. Jain, S.Chand publications, 2004.
2. Lehninger's Principles of Biochemistry (2000) by Nelson, David I. and Cox, M.M. Macmillan /Worth, NY.
3. Harper's Biochemistry Robert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell, 24th edition, Prentice Hall International. Inc.
4. Principles of Biochemistry, Geoffrey L. Zubay, 3rd edition William W. Parson, Dennis E. Vance, W.C. Brown Publishers, 1995.
5. Principles of Biochemistry, David L. Nelson, Michael M.Cox, Lehninger, 4th edition, W.H. Freeman and company.
6. Biochemistry, Lubert Stryer, 4th edition, W.H. Freeman & Co, 1995.
7. Fundamentals of Biochemistry (1999) by Donald Voet, Judith G.Voet and Charlotte W Pratt, John Wiley & Sons, NY.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SMB4102	BASIC BIOCHEMISTRY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

1. Properties of water, Concept of pH and buffers, preparation of buffers and Numerical problems to explain the concepts
2. Estimation of Ascorbic acid.
3. Carbohydrates: Glucose, fructose, maltose and lactose.
4. Amino acids: Arginine, cysteine, tryptophan and tyrosine.
5. Colorimetric analysis (only for demonstration)
6. Estimation of protein by Lowry's method.
7. Estimation of DNA using diphenyl amine.
8. Estimation of glucose by O -Toluidine.

SBB4201	IMMUNOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

1. Identification of human blood groups.
2. To perform Total Leukocyte Count of the given blood sample.
3. To perform Differential Leukocyte Count of the given blood sample.
4. Agglutination reaction
 - i) Widal test
 - ii) ASO test
 - iii) RA test
 - iv) CRP test
 - v) Pregnancy test (Direct/Indirect)
5. To perform immunodiffusion by
 - i. Single Radial Immunodiffusion
 - ii. Ouchterlony double diffusion.
6. To perform DOT ELISA.
7. To perform immunoelectrophoresis.

SBB2101	INTRODUCTION TO MOLECULAR BIOLOGY & GENETICS	L	T	P	Credits	Total Marks
		4	0	0	4	100

COURSE OBJECTIVES

- This course provides you with further knowledge associated with molecular biology and inheritance at the molecular, cellular and phenotypic levels

UNIT 1 DNA AND RNA**12 Hrs.**

Introduction and History of Microbial Genetics. DNA as a Genetic material. Physical structure and Chemical composition of DNA – RNA and its types RNA as a Genetic material. DNA Replication – Types and Experimental proof of replication – Enzymes involved in DNA replication

UNIT 2 GENETIC CODE AND GENE EXPRESSION**12 Hrs.**

Prokaryotic Transcription, Translation. Genetic code – Regulation of gene expression in prokaryotes – lac Operon. Gene transfer mechanisms – Transformation, conjugation and Transduction. Plasmid – Characteristics and types.

UNIT 3 MOLECULAR BASIS OF GENETIC INFORMATION**12 Hrs.**

Mendel's work on transmission of traits, Genetic Variation, Molecular basis of Genetic Information. Interrelation between the cell structure and the genetics function, Mitosis, Meiosis (explaining Mendel's ratios).

UNIT 4 CHROMOSOME THEORY OF INHERITANCE AND GENE MAPPING**12 Hrs.**

Principles of Inheritance, Chromosome theory of inheritance, Laws of Probability, Pedigree analysis, Incomplete dominance and codominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Environmental effects on phenotypic expression, sex linked inheritance. Linkage and crossing over, Cytological basis of crossing over, Molecular mechanism of crossing over, Recombination frequency as a measure of linkage intensity, two factor and three factor crosses, Interference and coincidence, Somatic cell genetics – an alternative approach to gene mapping.

UNIT 5 DNA MUTATION AND REPAIR MECHANISMS**12 Hrs.**

Mutation – types of mutation – Molecular basis of mutation – Mutagenesis, Detection of mutants – Ames test, DNA repair mechanisms. Molecular basis of Mutations in relation to UV light and chemical mutagens, Detection of mutations: CLB method, Attached X method, DNA repair mechanisms.

Max Hours.60**TEXT / REFERENCE BOOKS:**

1. David Freifelder (1995). Molecular Biology. Narosa Publishing House, New Delhi.
2. Peter Snustad D and Michael J Simmons (2003). Principles of Genetics. 3rd Edition, John Wiley & Sons, Inc., Publication, New Delhi.
3. Peter J Russel (2002). Genetics. Benjamin Cummings.
4. Robert H Tamarin (2002). Principles of Genetics. 7th Edition, Tata Mc Graw Hill Publication, New Delhi.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SBB2102	GENETIC ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVES

- The course aims to give an understanding on the fundamentals of r-DNA technology and thereby a deep understanding about deliberate manipulation of genetic material for the benefit of mankind.
- It also aims to understand the possible dangers in doing the same without much of forethoughts.

UNIT 1 rDNA TECHNOLOGY AND TOOLS INVOLVED IN GENETIC MANIPULATIONS**12 Hrs.**

Introduction to rDNA technology- pros and cons of genetic engineering. Restriction modification system, Restriction enzymes – function, classification (Based on recognition and restriction sequence:-type I, II and III; based on buffer salt concentration: - low, medium and high; based on pattern of restriction:-sticky (5' and 3') and blunt end cutters). Other DNA modifying enzymes and its functions/uses in r-DNA technology (DNA Polymerases, Klenow fragment, Ligase, S1 Nuclease, Mung Bean nuclease, Alkaline Phosphatase, Terminal Transferase, Polynucleotide kinases, alkaline Phosphatases (CIP, SAP and TAP), RNase A, RNase H, DNase 1, Exonucleases, Reverse Transcriptase)

UNIT 2 BIOLOGY OF CLONING VECTORS**12 Hrs.**

Ideal features of vectors; Plasmids (Types, copy number, properties, origin of replication and incompatibility group, plasmid amplification), bacteriophages eg λ (Life cycle, genome organization, feasibility as a cloning vehicle), Types of Cloning Vectors (structure and general features of General Purpose cloning vectors, shuttle vectors), Examples of cloning vectors (pBR322, pUC series of vectors, λ insertional and replacement vectors), derivatives of phages and plasmids (cosmids, phagemids, phasmids) cloning vectors for large DNA fragments using YACs, PACs and BACs

Unit-3 INTRODUCTION TO R-DNA TECHNOLOGY**12 Hrs.**

General strategies for isolation of genomic and plasmid DNA; Strategies for isolation of gene of interest (restriction digestion, PCR), Creation of r-DNA (Restriction Digestion, modification of vector and insert, linker, adaptors, homopolymer tailing, ligation.), PCR Cloning, Selectable and screenable markers, reporter genes.

UNIT 4 GENE TRANSFER TECHNIQUES**12 HRS.**

Selection of host and vector, Host Organisms and its genotypes- Prokaryotic and eukaryotic systems, Methods of gene transfer- Physical (micro injection, gene gun/biolistic, electroporation), Chemical (Calcium chloride, Calcium phosphate precipitation method, liposome mediated) and Biological methods (*Agrobacterium* and viral).

UNIT 5 IDENTIFICATION OF GENETIC TRANSFORMANTS AND THEIR APPLICATIONS**12 Hrs.**

Methods for clone identification-direct screening (insertional inactivation of marker gene, visual screening methods), indirect screening (PCR and hybridization based techniques-colony PCR/ hybridization and dot blot hybridization), hybridization techniques - Southern blotting, Northern blotting, Western blotting. Examples of Transgenic plants and animals, current status of commercial rDNA products, Bio-safety measures and regulations for rDNA work

TEXT / REFERENCE BOOKS

1. Primrose, S.B. and Twyman, R.M., Principles of Gene Manipulation and Genomics, Blackwell Publishing (2006) 7th ed. ISBN 1-4051-3544-1
2. Sambrook, Joseph and David W. Russell "The Condensed Protocols: From Molecular Cloning: A Laboratory Manual" Cold Spring Harbor, 2006.
3. Brown T.A., Genomes, 3 by Third Edition (Garland Science Publishing), 2007.
4. Glick, B.R. and J.J. Pasternak. "Molecular Biotechnology: Principles and Applications of Recombinant DNA" 4th Edition. ASM, 2010.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SBB2103	CONCEPTS IN BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 BIOTECHNOLOGY: AN OVERVIEW**12 Hrs.**

What is Biotechnology? – an interdisciplinary pursuit, old Vs new biotechnology, scope and importance, commercial potential, public perception of Biotechnology, Biotechnology in India and Global. Branches of biotechnology.

UNIT 2 ANIMAL & PLANT BIOTECHNOLOGY**12 Hrs.**

Biotechnology methods of crop improvement- plant tissue culture. Transgenic plants, applications of transgenic plants, transgenesis, transgenic animals,

UNIT 3 INDUSTRIAL BIOTECHNOLOGY**12 Hrs.**

Isolation and screening of micro-organisms, Bioreactors, food and beverage fermentation, production of antibiotics (β -lactum antibiotic), vitamin B12, Enzyme- amylase, protease, Biotransformation, SCP and its economical implications.

UNIT 4 MEDICAL BIOTECHNOLOGY**12 Hrs.**

Conventional vaccines, recombinant vaccines, DNA vaccines, monoclonal antibodies and their applications, interferons, drug designing, genetherapy, forensic medicine applications in human genetic research.

UNIT 5 ENVIRONMENTAL BIOTECHNOLOGY AND BIOETHICS**12 Hrs.**

Novel and better bioinsecticides. Biofertilizers, Biodegradation of Xenobiotic compounds. Legal aspects genetically manipulated organisms and environment, biosafety, Social, moral and Ethical Considerations, IPR.

Max Hours.60**TEXT / REFERENCE BOOKS:**

1. Satyanarayana. U. Biotechnology Books And Allied (p) Limited, 2013.
2. H.D. Kumar, Modern Concepts of Biotechnology, Vikas Publishing House Pvt Ltd, 1998.
3. P.K. Gupta, Elements of Biotechnology, Rastog Publications, 2003.
4. A.H. Patel, Industrial Microbiology, Macmillan Publishers, 1984

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SBB2104	ANALYTICAL TECHNIQUES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To understand the design, working principle and application of analytical instruments used in the field of biotechnology.

UNIT 1 BASIC INSTRUMENTS**12 Hrs.**

Microscopy- (Compound, Phase contrast, Electron- TEM & SEM), Fluorescence microscopy, pH meter.
Centrifugation: Zonal, Density gradient, Differential centrifugation

UNIT 2 BASIC SPECTROSCOPY**12 Hrs.**

Beer Lambert's law - Colorimeter and its applications. Spectrophotometer- Principle and its applications- Types of Spectrophotometer- UV, visible, Infrared Spectrophotometer, NMR and ESR, mass spectrophotometer.

UNIT 3 SEPERATION TECHNIQUE**12 Hrs.**

Chromatography: Paper chromatography, Thin layer chromatography, Column chromatography, HPLC, GC-MS

UNIT 4 MOLECULAR TECHNIQUES**12 Hrs.**

Electrophoresis - Principle and its applications - Types of electrophoresis- Agarose Gel, SDS-PAGE and 2 D Gel, Blotting –Southern, Northern, Western & Immuno blotting.

UNIT 5 LABORATORY INSTRUMENTS**12 Hrs.**

Maintenance of laboratory instruments-Autoclave, Hot air oven, Laminar air flow, Incubator. Biosensors- Principle and its applications.

Max Hours.60**TEXT / REFERENCE BOOKS:**

1. H.V. Volkones., General Biophysics, Vol I&II
2. Upadhyay., Biophysical Chemistry-, Himalaya Publication, Edition III
3. S.Mahesh., 2003 Biophysics New Age International Private Ltd.
4. Ghatak, K.L., 2003. Techniques and Methods In Biology. PHI Learning Private Ltd. New Delhi
5. Zubay.G.L., 1993. Biochemistry, 4th Edi. WmC. Brown Publishers.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 questions of 2 marks each - No choice****20 Marks****PART B : 2 questions from each unit of internal choice; each carrying 16 marks****80 Marks**

SBB4301	MOLECULAR BIOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES:

- The experiments provide hands-on experience in performing basic molecular biology techniques thereby developing skill in performing molecular biology experiments.
- This will facilitate the students to take up specialized projects in Molecular biology and will be a pre-requisite for research work.

LIST OF EXPERIMENTS:

I. Isolation of nucleic acids

1. Isolation of Plasmid DNA
2. Isolation of Plant Genomic DNA/ bacterial genomic DNA

II. Analysis, separation and staining of Nucleic acids

1. Estimation of DNA/RNA content in the given sample by spectrophotometer
2. Determination of T_m of DNA.
3. Agarose gel electrophoresis
4. Poly acrylamide gel electrophoresis
5. Staining of DNA with ethidium bromide
6. Staining of proteins with coomassie brilliant blue/ silver

REFERENCE BOOK:

1. Sambrook, Joseph and David W. Russell "The Condensed Protocols: From Molecular Cloning: A Laboratory Manual" Cold Spring Harbor, 2006.

SBB4302	BIOINSTRUMENTATION LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

1. Sterilization: principles & operations – Autoclave, Hot Air Oven, Filtration, Laminar Air Flow
2. Principles & operations of Incubators & Shakers
3. Principle & operation of Centrifuge
4. Principle & operation of pH meter
5. Principle & operation of Colorimeter
6. Principle & operation of Spectrophotometer
7. Electrophoresis techniques

SBB2201	ENVIRONMENTAL AND AGRICULTURAL BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COUSE OBJECTIVE

- The primary objective is to exploit biotechnology principles for the sustained environment and agriculture

UNIT 1 ENVIRONMENT AND WASTE TREATMENT PROCESS**12 Hrs.**

Basic concepts of Environment and ecosystem- Effluents and sewages- Sewage treatment processes- Physical, chemical and biological. Biological processes for domestic and industrial waste water treatments: Aerobic system – activated sludge processes-Trickling filters – biological filters- fluidized bed reactors (FBR)

UNIT 2 WASTE MANAGEMENT**12 Hrs.**

Anaerobic biological treatment – contact digestion – packed column reactors - Methanogenesis. Methanogenic, acetogenic, and fermentative bacteria – technical process conditions, Solid waste management-Landfills, composting, earthworm treatment, recycling and processing of organic residues. Hazardous wastes: source management and safety.

UNIT 3 BIODEGRADATION OF PESTICIDES**12 Hrs.**

Biodegradation of xenobiotic compounds, organisms involved in degradation of chlorinated hydrocarbons, substituted simple aromatic compounds, polyaromatic hydro carbons, pesticides, surfactants and microbial treatment of oil pollution.

UNIT 4 MICROBIAL LEACHING AND BIOREMEDIATION**12 Hrs.**

Microbial leaching and mining: Extraction of metals from ores; recovery of metals from solutions. Microbial petroleum extraction; Microbial desulfurization of coal wasteland; Uses and management; bioremediation and bioremediation of contaminated lands.-Phyto remediation – bioventing – and biosparging- liquid phase

UNIT 5 BIOFERTILIZERS AND SUSTAINABLE ORGANIC AGRICULTURE**12 Hrs.**

Bioinoculant Technology - Bioinoculants- various types- biofertilizer, biomanures and biopesticides-their importance in sustainable agriculture - organic farming and environmental health Historical development of Bioinoculants technology- Biofertilizers- Bacteria, fungi and algal biofertilizers.

Max Hours.60**TEXT / REFERENCE BOOKS:**

1. Environmental biotechnology and cleaner bioprocesses – Eugenia J.Olguin, Gloria Sanchez, Elizabeth Hernandez, Taylor and Francis, London 2000.
2. Introduction to soil Microbiology – Alexander. M. 2ndedn. John Wiley and Sons, 2003.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SBB2202	BASIC INDUSTRIAL BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

The importance of microorganism in industries and product its application

UNIT 1 INTRODUCTION TO INDUSTRIAL BIOPROCESS**12 Hrs.**

Fermentation- Bacterial, Fungal and Yeast, Biochemistry of fermentation. Traditional and Modern Biotechnology- A brief survey of organisms, processes, products. Basic concepts of Upstream and Downstream processing in Bioprocess, **Process flow sheeting – block diagrams, pictorial representation.**

UNIT 2 PRODUCTION OF METABOLITES**12 Hrs.**

Primary Metabolites- Production of commercially important primary metabolites like organic acids, amino acids and alcohols. **Secondary Metabolites-** Production processes for various classes of secondary metabolites: Antibiotics, Vitamins and Steroids.

UNIT 3 DEGRADATION OF POLLUTANTS**12 Hrs.**

Microbes role in degradation of pollutants, genetically modified microorganism-super bugs, advantage of biodegradation than the conventional method.

UNIT 4 PRODUCTION OF ENZYMES AND OTHER BIOPRODUCTS**12 Hrs.**

Production of Industrial Enzymes, Biopesticides, Biofertilizers, Biopreservatives, Biopolymers Biodiesel. Cheese, Beer, SCP & Mushroom culture.

UNIT 5 PRODUCTION MODERN BIOTECHNOLOGY PRODUCTS**12 Hrs.**

Production of recombinant proteins having therapeutic and diagnostic applications, vaccines. Bioprocess strategies in Plant Cell and Animal Cell culture.

Max Hours.60**TEXT / REFERENCE BOOKS:**

1. Dubey, R.C. "A Textbook of Biotechnology" S.Chand & Co. Ltd., 2006.
2. Satyanarayana, U. "Biotechnology" Books & Allied (P) Ltd., 2005.
3. Kumar, H.D. "A Textbook on Biotechnology" 2 nd Edition. Affiliated East West Press Pvt. Ltd., 1998.
4. Balasubramanian, D. etal., "Concepts in Biotechnology" Universities Press Pvt.Ltd., 2004.
5. Ratledge, Colin and Bjorn Kristiansen "Basic Biotechnology" 2 nd Edition Cambridge University Press, 2001.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SBB2203	FOOD BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	4	100

COURSE OBJECTIVE**UNIT 1 MICROORGANISMS IN FOOD****12 Hrs.**

Bacteria, fungi & yeast, role and significance. Enzymes in food preparation. Food carcinogens & mutagen (N – nitrosamines, Acrylamide & their mode of action).

UNIT 2 NUTRITIONAL BOOSTS AND FLAVOR ENHANCERS**12 Hrs.**

Antioxidants. Food colors (natural & artificial food colourants). Food flavoring agents. Properties & function of Emulsifiers & Stabilizers in food. Food Sweeteners – Saccharine, Acesulfane, Aspartame & Sucrolose).

UNIT 3 FOOD BORNE DISEASES AND CONROL**12 Hrs.**

Food borne diseases. Food Allergens. Microbiological Examination of surfaces, Air Sampling, Metabolically Injured Organisms, Enumeration and Detection of Food-borne Organisms. Bioassay and related Methods.

UNIT 4 FERMENTATION**12 Hrs.**

Fermented food: pickles, yogurt, cheese, Beverages: Beer, wine and distilled spirits.

UNIT 5 FOOD PRESERVATION**12 Hrs.**

Food Preservation. Principles Underlying the Destruction of Microorganisms by Irradiation, Radiation, Radappertization, Radicidation, and Radurization of Foods. Stability Food Preservation with Low Temperatures, Food Preservation with High Temperatures, Preservation of Foods by Drying.

Max Hours.60**TEXT / REFERENCE BOOKS:**

1. B.Siva 2011.Food Processing & Preservation –PHI Learning Pvt Ltd.
2. D.G. Rao, 2010. Fundamentals of Food Engineering –PHI Learning Pvt Ltd.
3. Michael P. Doyle, Larry. R. Food Microbiology – Fundamentals & Frontiers
5. Frazier, Food Microbiology

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SBB2204	ENZYME TECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	4	100

UNIT 1 INTRODUCTION TO ENZYMES**12 Hrs.**

Nature and function of enzymes, Enzyme nomenclature, classification of enzymes, mechanisms of catalysis - Acid base catalysis, electrostatic catalysis, covalent catalysis and enzyme catalysis., Role of co-enzymes and co-factors.

UNIT 2 ENZYME KINETICS**12 Hrs..**

Michaelis - Menton kinetics, determination of K_m , Lineweaver Burke plot, Eadie - Hofstee plot, Hanes-Woolf plot. Turnover number, Enzyme inhibition -Types of enzyme inhibition, competitive inhibition, uncompetitive inhibition, non-competitive inhibition, Irreversible inhibition and inactivation kinetics. Multi substrate enzyme catalysed reaction.

UNIT 3 ENZYME IMMOBILIZATION**12 Hrs.**

Classification of enzyme immobilization, physical and chemical techniques for enzyme immobilization -adsorption, matrix entrapment, encapsulation, cross-linking, covalent bonding, advantages and disadvantages, Application of immobilized enzymes, mass transfer effect on immobilization, properties of immobilized enzymes.

UNIT 4 ENZYME SPECIFICITY AND EXTRACTION**12 Hrs.**

Types of specificity, Active site- Fischer hypothesis and Koshland hypothesis, Extraction of soluble enzymes, membrane bound enzymes, purification procedures, criteria of purity.

UNIT 5 CLINICAL AND INDUSTRIAL APPLICATIONS OF ENZYMES**12 Hrs.**

Application of enzymes in medicine and industry – Assay of plasma enzyme, enzyme biosensors, design of enzyme electrodes, Synzymes, Abzymes, Enzymes in genetic engineering.

Max Hours.60**TEXT / REFERENCE BOOKS:**

1. Enzyme by Palmer (2001); Horwood publishing series.
2. Fundamental of Enzymology by Price and Stevens (2002): Oxford University Press.
3. Enzyme Technology: Pacemaker of Biotechnology Paperback – 2011: Prasad N K
4. Principles of Enzyme Technology – 2015: M. Y. Khan and Farha Khan
5. Enzyme technology by Helmut uhling (1998): John Wiley

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SBB4401	SOIL & AGRICULTURAL BIOTECHNOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Isolation of Microorganisms from soil and water adopting culture dependent methods technique.
2. Isolation of microorganisms from air using open plate method.
3. Analysis of microbial quality of water by MPN technique
4. Isolation and enumeration of microorganisms from water using membrane filtration method.
5. Isolation of plant pathogens from infected plant parts.
6. Isolation of Rhizobium from root nodules.
7. Estimation of BOD of an effluent.
8. Estimation of COD of an effluent.
9. Isolation of nitrate reducing bacteria from soil.
10. Isolation of phosphate solubilizing bacteria from soil.

SBB4402	FOOD BIOTECHNOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. To check the quality of milk by MBRT test
2. Preparation of yoghurt and curd.
3. Preparation of cheese, pickles and sauerkraut
4. To prepare the spawn for white button mushroom
5. Estimation of different enzymes (protease, catalase, lactase)

SBB3101	MEDICAL BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		4	0	0	4	100

COURSE OBJECTIVES

- To study about the medicinal approach of Biotechnology and recent advancements in diagnosis.

UNIT 1 ANIMAL CELL CULTURE**12 Hrs.**

Animal cell culture-media, maintenance and culture of primary, secondary and continuous cell lines- organ culture-applications- cancer cell lines- apoptosis. Tissue Engineering – Skin, Liver, Pancreas. Assisted reproductive technology- Pregnancy diagnosis.

UNIT 2 CHROMOSOMAL ABNORMALITIES**12 Hrs.**

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 3 DIAGNOSTIC TECHNIQUES**12 Hrs.**

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 4 PREVENTION AND TREATMENT**12 Hrs.**

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

UNIT 5 MODERN MEDICINE**12 Hrs.**

Hybridoma technique for mAb production and applications- Gene therapy: Ex vivo, In vivo, In situ- Cell and tissue engineering- Stem cell therapy- Nanomedicines- Gene products in medicine – Humulin, Erythropoietin, Growth Hormone/Somatostatin, tPA, Interferon.

Max Hours.60**TEXT / REFERENCE BOOKS:**

1. Ramasamy, P. "Trends in Biotechnology", University of Madras, Pearl press, 2002.
2. Trevan. "Biotechnology". Tata McGraw-Hill, 2005.
2. Betty Forbes, Daniel SAHM Alica Weinfield, Bailey 2007. Scott's diagnostic microbiology, 12th edition Mosby.
3. 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.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SBB3102	ADVANCED GENETIC ENGINEERING	L	T	P	Credits	Total Marks
		4	0	0	4	100

COURSE OBJECTIVES

- The course aims to give an understanding on the modern techniques applied in genetic engineering. It also aims to understand the application of GMOs and evaluate the current status of genetic Engineering.

UNIT 1 ADVANCED MOLECULAR TECHNIQUES**12 Hrs.**

Genome mapping-genetic and physical mapping, Chromosome Walking, Chromosome Jumping, DNA foot printing, DNA library construction-Genomic and c-DNA library construction. PCR: basic concept on normal PCR and real time PCR (cyber green and taqman chemistry). DNA fingerprinting: basic genetic principle, Single locus and multi locus DNA fingerprinting. DNA sequencing: Maxam and Gilbert chemical method, Sanger and Coulson enzymatic chain termination method, Automated DNA sequencing, Pyrosequencing, Introduction to NGS.

UNIT 2 RECOMBINANT PROTEIN PRODUCTION**12 Hrs.**

Strategies for gene isolation and full-length cDNA: 5' and 3' RACE basic technique and comparison with RLM RACE. Modern molecular tools in genetic engineering: Gene expression systems - Studying the transcript of a cloned gene. expression vectors, binary vectors and Cointegrating vectors, transposons; Expression and Purification of Recombinant Proteins.

UNIT 3 GENE MANIPULATION TECHNIQUES**12 Hrs.**

Gene Silencing Techniques; Antisense RNA technology, Micro RNA- ShRNA, siRNA, technology; Construction of siRNA vectors. Site directed mutagenesis. Gene knock in and knock out technologies. Targeted gene replacement, Chromosome engineering. Gene Therapy: Strategies of gene therapy, gene replacement/augmentation, gene correction, gene editing, gene regulation and silencing.

UNIT 4 GENETICALLY MODIFIED ORGANISMS**12 Hrs.**

Application of genetic engineering in food & agriculture (golden rice and other improved nutritional qualities, herbicide and pesticide resistant plants), health & medicine (Gene editing, xenotransplantation and gene therapy), industry and environment (production of vaccines, antibodies, bioplastics and bioremediation).

UNIT 5 HAZARDS AND IMPACT OF GMOS**12 Hrs.**

Negative impacts of genetic engineering and Present controversies on genetically modified organisms (GMOs). Biosafety Considerations: Biological risks, ethical issues, economic issues, legal issues. Biosafety regulations/ norms for the release of genetically engineered organisms.

Max Hours.60**TEXT/ REFERENCE BOOKS:**

1. Sambrook, Joseph and David W. Russell "The Condensed Protocols: From Molecular Cloning: A Laboratory Manual" Cold Spring Harbor, 2006.
2. Lewin, B., Genes XI, International Edition, Jocelyn Krebs, Stephen Kilpatrick, and Elliott Goldstein. Jones & Bartlett Learning (2017), ISBN 978-1-4496-5985-1
3. Glick, B.R. and J.J. Pasternak. "Molecular Biotechnology: Principles and Applications of Recombinant DNA" 4th Edition. ASM, 2010.
4. Primrose, S.B. and Twyman, R.M., Principles of Gene Manipulation and Genomics, Blackwell Publishing (2006) 7th ed. ISBN 1-4051-3544-1
5. Brown T.A., Genomes, 3 by Third Edition (Garland Science Publishing), 2007.
US- FDA guidelines on the genetically modified organisms

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SBB3103	PLANT BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- The course aims to give an overview on application of biotechnology in agriculture. It also aims to understand the basic concepts in plant tissue culture and transgenic plants

UNIT 1 INTRODUCTION TO PLANT CELL AND TISSUE CULTURE**12 Hrs.**

History, Definition and Principle of plant tissue culture, Laboratory organization, Culture environment, Methods of sterilization, Nutritional components of tissue culture media, Plant growth regulators, Types of culture: Shoot, root, Callus and cell cultures, *In vitro* regeneration of plants- Organogenesis, Somatic embryogenesis, Different areas and applications of plant tissue culture, Factors affecting *in vitro* culture.

UNIT 2 APPLICATION OF PLANT TISSUE CULTURE**12 Hrs.**

Embryo culture and embryo rescue methods, Production of haploid plant through Androgenesis and Gynogenesis, Isolation and culture of protoplasts, Protoplast fusion and somatic hybridization, Somaclonal variations, Production of secondary metabolites by plant cell cultures, Germplasm conservation and cryopreservation.

UNIT 3 GENETIC ORGANIZATION AND GENETIC TRANSFORMATION OF PLANTS**12 Hrs.**

Structure and organization of plant genome, Chloroplast and Mitochondrial genome, Genetic Transformation methods for production of transgenic plants (Direct, Indirect) with a detailed methodology on chloroplast transformation, protoplast transformation and normal methods using particle bombardment.

UNIT 4 TRANSGENIC PLANTS**12 Hrs.**

Examples of transgenic plants and the methodologies adopted in the following areas-Production of transgenic plants for quality traits like increased biomass production (nif gene transfer) nutritional enhancements (Vitamins, proteins), increased shelf life of fruits (Flavr savr tomatos), Production of genetically modified plants for herbicide resistance (round up crops), pest resistance (Bt and other resistance gene candidates), stress tolerance (salt and draught), and horticultural quality (Designer flowers) Molecular farming for therapeutic protein (Plantibodies, Plantigens, Edible Vaccines), Protection of intellectual property (Seed terminator technology)

UNIT 5 APPLICATION AND SAFETY REGULATIONS**12 Hrs.**

Positive and negative impacts of genetic engineering in plants and Current issues and controversies related to transgenic plants, Guidelines on genetic engineering, safety regulations and patenting of transgenic plants, national and international regulations.

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Adrian Slater, Nigel Scott, and Mark Fowler, Plant Biotechnology, Oxford University Press, NewYork, 2008.
2. Satyanarayana, U. Biotechnology, Allied Pvt. Ltd. Kolkata, 2007.
3. Purohit S.S., Agricultural Biotechnology, Agrobios Indi., Jodhpur, 2002.
4. Chawla H.S., Introduction to Plant Biotechnology, 2nd Edition, Oxford and IBH Press, 2003.
5. Lewin, B., Genes XI, International Edition, Jocelyn Krebs, Stephen Kilpatrick, and Elliott Goldstein. Jones & Bartlett Learning (2017), ISBN 978-1-4496-5985-1
6. Primrose, S.B. and Twyman, R.M., Principles of Gene Manipulation and Genomics, Blackwell Publishing (2006) 7th ed. ISBN 1-4051-3544
7. US- FDA guidelines on the genetically modified organisms

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SBB3104	ANIMAL BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION TO ANIMAL TISSUE CULTURE**12 Hrs.**

History and Scope of Animal tissue culture. Design & layout of ATC laboratory. Requirements for Animal cell culture. Types of media, ingredients of media. Foetal Bovine Serum.

UNIT 2 CELL LINES AND CELL CULTURE**12 Hrs.**

Basic Techniques of mammalian cell culture; Disaggregation of animal tissue. Primary culture & secondary culture. Evolution of cell line & continuous cell line, characterization of cell lines. Monolayer, suspension culture. Organ culture, Embryo culture. Maintenance of cell culture. Common cell culture contaminants.

UNIT 3 GENETIC ENGINEERING**12 Hrs.**

Genetic engineering in animals: methods of DNA transfer into animal cells- calcium phosphate co precipitation, micro-injection, electroporation, Liposome encapsulation, Biological vectors. Hybridoma technology, Vaccine production.

UNIT 4 APPLICATIONS OF GENETIC ENGINEERING**12 Hrs.**

Gene therapy, mapping of human genome. RFLP and applications. DNA finger printing and Forensic Science. Molecular diagnosis of Genetic disorders.

UNIT 5 ANIMAL CELL AND TISSUE BASED PRODUCTS AND THEIR APPLICATIONS**12 Hrs.**

Applications of animal tissue culture for *in vitro* testing of drugs. Production of transgenic animals & molecular pharming, animal cloning techniques. Cell culture based vaccines. Ethical values in animal biotechnology.

Max Hours.60**TEXT / REFERENCE BOOKS:**

1. Freshney, E. D. 2000. Animal Cell Culture: A practical approach. John Wiley Pub. New York.
2. Mather, J.P. and Barnes, D. (Eds.). 1998. Animal Cell Culture Methods (Methods in Cell Biology. VOL. 57). Academic Press, London.
3. Butler, M. (Ed.). 1990. Mammalian Cell Biotechnology- A Practical Approach. Oxford Univ. Press, Oxford.
4. R.C. Dubey., A Text Book of Biotechnology. S. Chand & Co Ltd, New Delhi.
5. Sudha Gangal, Animal Tissue culture. Second edition. University Press (India) Pvt Ltd. Hyderabad.
6. Sverdrup H.V., Oceans & their Physics, Chemistry & Biology –Johns & R.H. Fleming, Prentice Hall Inc.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SBB4501	GENETIC ENGINEERING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Isolation of genomic DNA from leaf samples - CTAB Precipitation method
2. Restriction digestion of DNA
3. Construction of restriction map - plasmids
4. DNA ligation
5. Polymerase Chain Reaction - Amplification of DNA of interest/ RAPD
6. Purification of PCR products
7. Southern blotting / Western blotting / northern blotting
8. Cloning of PCR products (competent cell preparation, CaCl₂ transformation, blue - white screening of transformants).

SBB4502	PLANT AND ANIMAL BIOTECHNOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

PLANT BIOTECHNOLOGY LAB**LIST OF EXPERIMENTS**

1. Plant tissue culture media preparation
2. Micropropagation
3. Anther culture
4. Embryo culture
5. Callus and Cell suspension culture
6. Preparation of synthetic seeds
7. Isolation of protoplast

ANIMAL BIOTECHNOLOGY LAB**LIST OF EXPERIMENTS**

1. Media preparation for animal tissue culture
2. Primary cell culture-Chick Embryo Fibroblast
3. Sub culturing of normal cell/Cancer cell
4. Cryopreservation and Retrieval
5. Viability checking (Trypan Blue) and cell counting by Hemocytometer
6. Cytotoxicity assay
 - a). Direct Microscopic Observation
 - b). MTT assay
 - c). Staining and observation of cells

SBT1002	RESEARCH METHODOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- This course aims at understanding the research terminology.
- Be aware of the ethical principles of research, ethical challenges and approval processes. Describe quantitative, qualitative and mixed methods approaches to research.
- Identify the components of a literature review process. Critically analyze published research.

UNIT 1 STATISTICAL METHODS**12 Hrs.**

Research methodology-basic concepts-types- definition of research problems- statistical methods- Correlation and Regression, Binomial, Poisson and Normal Distributions (mean and variance applications only) - Sampling Distributions: Tests based on t, F, Z and Chi square distributions- Analysis of Variance.

UNIT 2 DESIGN OF EXPERIMENT, SAMPLING AND DATA COLLECTION**12 Hrs.**

Research design-Nature and Classification of research designs, data classification, primary and secondary data, primary and secondary data- sources-advantages- Sampling- sampling concepts and methods

UNIT 3 ANALYTICAL METHODS AND SPECTROSCOPY**12 Hrs.**

Principles of biophysical methods used for analysis. X-ray diffraction, Fluorescence, UV-VIS, ORD/CD, NMR and ESR spectroscopy, Hydrodynamic methods, Atomic absorption, Plasma emission spectroscopy.

UNIT 4 MOLECULAR TECHNIQUES FOR BIOTECHNOLOGY**12 Hrs.**

Principles and techniques of nucleic acid hybridization and cot curves, sequencing of proteins and nucleic acids, southern, northern and south-western blotting techniques, PCR, methods for measuring nucleic acids and protein interactions.

UNIT 5 RADIO LABELLING AND ANALYSIS**12 Hrs.**

Principles and applications of tracer techniques in biology, radiation dosimetry, radio-active isotopes and half-life of isotopes, effect of radiation on biological systems, autoradiography, Cerenkov radiation and liquid scintillation spectrometry.

Max Hours.60**TEXT / REFERENCE BOOKS:**

1. Principles of biochemistry and molecular biology – Keith Wilson & John Walker
2. Biostatistics – Khan & Khanum

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SBB3201	BIOINFORMATICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION TO BIOINFORMATICS**12 Hrs.**

Introduction to bioinformatics: Definition, History, Objectives, Fields related to bioinformatics. Applications of Bioinformatics in the modern era

UNIT 2 DATABASES**12 Hrs.**

Biological databases: Definition, Classification. Primary and secondary databases. Nucleotide databases, Protein sequence and structure databases, Structural Classification databases – SCOP and CATH

UNIT 3 SEQUENCE ANALYSIS**12 Hrs.**

Introduction to sequence analysis and alignment - Global and Local Alignments, algorithm - Pairwise and Multiple sequence alignment. Tools for sequence alignments - BLAST, FASTA, Clustal W. Phylogenetic analysis

UNIT 4 PROTEIN ANALYSIS**12 Hrs.**

Introduction to protein structure - primary, secondary and tertiary structures, domains, motifs and their uses. Secondary structure prediction - tools used. 3D structure prediction

UNIT 5 CONCEPT OF GENE PREDICTION**12 Hrs.**

Exploring biological information: World Wide Web, Internet and its Uses in Bioinformatics

Max Hours.60**END SEMESTER EXAMINATION QUESTION PAPER PATTERN****Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 questions of 2 marks each - No choice**20 Marks****PART B:** 2 questions from each unit of internal choice; each carrying 16 marks**80 Marks**