VIVEKANANDHA

COLLEGE OF ENGINEERING FOR WOMEN

(An Autonomous Institution Affiliated to Anna University-Chennai

Approved by AICTE – Accredited by NBA New Delhi and ISO 9001:2015 Certified)

Elayampalayam, Tiruchengode – 637 205, Namakkal District, Tamilnadu.

DEPARTMENT OF BIOTECHNOLOGY

CURRICULUM & SYLLABI

FOR

UG – B.TECH. BIOTECHNOLOGY

REGULATION 2023
(CBCS)
(After 16th BoS)

Department of Biotechnology

Department Vision

To nourish the world of Technology & research with highly skilled women Biotechnologiststo invent, innovate and disseminate the knowledge for the benefit of society & environment.

Department Mission

✓ To create excellent prospects for multifaceted bioengineering exercise and research in   biotechnology.

✓ To produce tailored human resource to drive innovative biotechnological processes.

✓ To disseminate the knowledge in upcoming opportunities evolving sustainable entrepreneurship and research in the field of biotechnology for present and future.

Program Outcomes

PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** : Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

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PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Educational Objectives

PEO1	The ability to provide the students with a solid foundation and the ability to apply mathematics, science in Biotechnology and to analyze data and technical concepts for application in **Quality assurance** and enabling **placements/higher education**.
PEO2	An ability to inculcate the professional and ethical attitudes, effective communication skills, team work skills, multidisciplinary approach among the students and an ability to relate environmental issues in broader **social context.**
PEO3	To provide with an excellent training to enhance the core profession career in the field of agriculture, pharmaceutics, biochemical, food tech and other allied biosciences.

Program Specific Outcomes

PSO1	Demonstrate expertise in basic sciences and foundation courses.
PSO2	Demonstrate a working knowledge of advanced biological sciences
PSO3	Demonstrate competence in application of engineering principles to biological systems.

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MAPPING OF PROGRAMME EDUCTIONAL OBJECTIVES (PEO) WITH PROGRAMME OUTCOMES (PO)

PEO	PROGRAMME OUTCOMES											
	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	Po10	Po11	Po12
1	√	√	√	√	√					√		√
2	√				√	√	√	√	√	√	√	√
3	√				√	√	√	√		√		√

Credit Distribution

S.No.	Course Components	Credits per semester								Total number of credits for each component
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities and Social Sciences Courses (HSMC)	4	4	-	-	-	-	-	-	8
2	Basic Science Courses (BSC)	8	8	4	4	-	-	-	-	24
3	Engineering Science Courses (ESC)	7	8	-	-	-	-	-	-	15
4	Programme Core Courses (PCC)	-	-	14	14	14	14	10	-	66
5	Programme Elective Courses (PEC)	-	-	-	-	3	3	6	6	18
6	Open Elective Courses (OEC)	-	-	-	-	3	3	3	-	9
7	Employability Enhancing Courses (EEC)	1	-	2	3	2	2	5	8	23
8	Mandatory Course	-	-	-	-	-	-	-	-	-
								Total Credits		163

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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN

(Autonomous Institution, Affiliated to Anna University, Chennai)Elayampalayam, Tiruchengode – 637 205

Programme	B.Tech.	Programme Code	105	Regulation	2023
Department	BIOTECHNOLOGY			Semester	I

CURRICULUM

(Applicable to the students admitted from the academic year 2023 - 2024 onwards)

Course Code	Course Name	Category	L	T	P	C	CA	ESE	Total
			Periods / Week			Credit	Maximum Marks		
THEORY									
U23MA101	Matrices and Calculus*	BSC	3	1	0	4	40	60	100
U23EN101	English For Communication*	HSMC	3	0	0	3	40	60	100
U23PH101	Engineering Physics$	BSC	3	0	0	3	40	60	100
U23CS101	Programming for Problem Solving*	ESC	3	0	0	3	40	60	100
U23TA101	Heritage of Tamils*	HSMC	1	0	0	1	40	60	100
THEORY INTEGRATED WITH PRACTICAL									
U23GE101	Engineering Graphics*	ESC	2	0	3	3	50	50	100
PRACTICAL INTEGRATED WITH THEORY									
U23GE102	Design Thinking*	EEC	1	0	2	1	50	50	100
PRACTICAL									
U23PH102	Physics Laboratory$	BSC	0	0	3	1	60	40	100
U23CS102	Programming for Problem Solving Laboratory*	ESC	0	0	3	1	60	40	100
MANDATORY COURSES									
-	Induction Programme*	3 Weeks				0	-	-	-
U23MCFY1	Environmental Science and Engineering$	MC	2	0	0	0	100	-	100
					Total	20	520	480	1000

BSC - Basic Science Courses, ESC- Engineering Science Courses, MC- Mandatory courses, HSMC- Humanities and Social Sciences including management courses, EEC- Employability Enhancement Courses, CA- Continuous Assessment, ESE - End Semester Examination.
*Common for all branches $Common for AI & DS, CSE, CST, IT&BT

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Programme	B.Tech.	Programme Code	105	Regulation	2023
Department	BIOTECHNOLOGY			Semester	II

CURRICULUM

(Applicable to the students admitted from the academic year 2023 - 2024 onwards)

Course Code	Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
THEORY									
U23MA202	Complex Analysis and Ordinary Differential Equations*	BSC	3	1	0	4	40	60	100
U23CH201	Engineering Chemistry$	BSC	3	0	0	3	40	60	100
U23EE201	Basic Electrical and Electronics Engineering#	ESC	3	0	0	3	40	60	100
U23TA202	தமிழரும்தொழில்நுட்பமும் / Tamils and Technology*	HSMC	1	0	0	1	40	60	100
THEORY INTEGRATED WITH PRACTICAL									
U23CS203	Python Programming@	ESC	3	0	2	4	50	50	100
U23EN202	Professional Communication*	HSMC	2	0	3	3	50	50	100
PRACTICAL									
U23CH202	Chemistry Laboratory$	BSC	0	0	3	1	60	40	100
U23GE204	Engineering Practices Laboratory*	ESC	0	0	3	1	60	40	100
MANDATORY COURSES									
U23MCFY2	Indian Constitution$	MC	2	0	0	0	100	-	100
					Total	20	480	420	900

BSC - Basic Science Courses, ESC- Engineering Science Courses, MC- Mandatory courses, HSMC- Humanities and Social Sciences including management courses, EEC- Employability Enhancement Courses, CA- Continuous Assessment, ESE - End Semester Examination.

*Common for all branches
#Common for BT, CSE, CST, IT, AI & DS
@Common for ECE, EEE, BME, BT, CIVIL & AGRI
$Common for AI & DS, CSE, CST, IT&BT

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Programme	B.Tech.	Programme Code	105				Regulation		2023	
Department	BIOTECHNOLOGY						Semester		III	

CURRICULUM

(Applicable to the students admitted from the academic year 2023 - 2024 onwards)

Course Code	Course Name		Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
THEORY									
U23MA303	Transforms and Partial Differential Equations	BSC	3	1	0	4	40	60	100
U23BT302	Microbiology	PCC	4	0	0	3	40	60	100
U23BT303	Cell Biology	PCC	4	0	0	3	40	60	100
U23BT304	Thermodynamics for Biotechnologist	PCC	4	0	0	3	40	60	100
U23BT305	Biochemistry and Bioenergetics	PCC	4	0	0	3	40	60	100
U23CTCP1	Verbal, Quantitative Aptitude and Reasoning - I	EEC	2	0	0	1	40	60	100
PRACTICAL									
U23BT306	Cell & Microbiology Laboratory	PCC	0	0	3	1	60	40	100
U23BT307	Biochemistry Laboratory	PCC	0	0	3	1	60	40	100
U23CTCP2	Personality Development	EEC	1	0	2	1	60	40	100
				Total Credits		20	420	400	900

ESC- Engineering Science Courses, MC- Mandatory courses, EEC- Employability Enhancement Courses, PCC- Professional core courses, PEC- Professional Elective courses, OEC- Open Elective courses, CA- Continuous Assessment, ESE - End Semester Examination

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Programme	**B.Tech.**	Programme Code	105	Regulation	2023
Department	**BIOTECHNOLOGY**			Semester	**IV**

CURRICULUM
(Applicable to the students admitted from the academic year 2023 - 2024 onwards)

Course Code	Course Name		Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
THEORY									
U23MA408	Biostatistics	BSC	3	1	0	4	40	60	100
U23BT408	Plant and Animal Biotechnology	PCC	4	0	0	3	40	60	100
U23BT409	Molecular Biology	PCC	4	0	0	3	40	60	100
U23BT410	Instrumentation Methods of Analysis	PCC	4	0	0	3	40	60	100
U23ADL01	Additional Language	EEC	3	0	0	2	40	60	100
THEORY INTEGRATED WITH PRACTICAL									
U23BT411	Unit Operations	PCC	3	0	3	4	50	50	100
PRACTICAL									
U23BT412	Plant and Animal Biotechnology Laboratory	PCC	0	0	3	1	60	40	100
CAREER TRACK COURSES									
	Career Track Course – I	EEC	2/0	0	0/2	1	40/60	60/40	100
				Total Credits		21	350/ 370	450/ 430	800

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Programme	B.Tech	Programme Code	105		Regulation		2023
Department	BIOTECHNOLOGY				Semester		V

CURRICULUM

(Applicable to the students admitted from the academic year 2023 - 2024 onwards)

Course Code	Course Name		Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
THEORY									
U23BT514	Enzyme Engineering	PCC	4	0	0	3	40	60	100
U23BT515	Genetic Engineering	PCC	4	0	0	3	40	60	100
U23BT516	Heat and Mass Transfer Operations	PCC	4	0	0	3	40	60	100
	Professional Elective - I	PEC	4	0	0	3	40	60	100
	Open Elective - I	OEC	4	0	0	3	40	60	100
THEORY INTEGRATED WITH PRACTICAL									
U23BT517	Computational Biology	PCC	3	0	3	4	50	50	100
PRACTICAL									
U23BT518	Molecular Biology & Genetic Engineering Laboratory	PCC	0	0	3	1	60	40	100
U23BT519	Mini project –I	EEC	0	0	3	1	60	40	100
CAREER TRACK COURSES									
	Career Track Course – II	EEC	2/0	0	0/2	1	40/60	60/40	100
	Total Credits					22	410/470	490/470	900

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Programme	B.Tech	Programme Code	105		Regulation		2023
Department	BIOTECHNOLOGY				Semester		VI

CURRICULUM
(Applicable to the students admitted from the academic year 2023 - 2024 onwards)

Course Code	Course Name		Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
THEORY									
U23BT620	Biopharmaceutical Technology	PCC	4	0	0	3	40	60	100
U23BT621	Bioprocess Engineering and Technology	PCC	4	0	0	3	40	60	100
U23BT622	Chemical Reaction Engineering	PCC	4	0	0	3	40	60	100
	Professional Elective – II	PEC	4	0	0	3	40	60	100
	Open Elective – II	OEC	4	0	0	3	40	60	100
THEORY INTEGRATED WITH PRACTICAL									
U23BT623	Immunology	PCC	3	0	3	4	50	50	100
PRACTICAL									
U23BT624	Bioprocess Laboratory	PCC	0	0	3	1	60	40	100
U23BT625	Mini project –II	EEC	0	0	3	1	60	40	100
CAREER TRACK COURSES									
	Career Track Course – III	EEC	2/0	0	0/2	1	40/60	60/40	100
	Total Credits					22	410/ 470	490/4 70	900

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Programme	B.Tech	Programme Code	105	Regulation	2023
Department	BIOTECHNOLOGY			Semester	VII

CURRICULUM
(Applicable to the students admitted from the academic year 2023 – 2024 onwards)

Course Code	Course Name		Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
THEORY									
U23BT726	Downstream Processing	PCC	4	0	0	3	40	60	100
U23BT727	Proteomics & Genomics	PCC	4	0	0	3	40	60	100
U23BT728	Principles of Food Processing	PCC	4	0	0	3	40	60	100
	Professional Elective – III	PEC	4	0	0	3	40	60	100
	Professional Elective – IV	PEC	4	0	0	3	40	60	100
	Open Elective – III	OEC	4	0	0	3	40	60	100
PRACTICAL									
U23BT729	Downstream Processing Laboratory	PCC	0	0	3	1	60	40	100
U23BT730	Project Phase - I	EEC	0	0	3	2	60	40	100
U23BT731	Internship Training and Summer Project	EEC	0	0	3	2	60	40	100
CAREER TRACK COURSE									
	Career Track Course – IV	EEC	2/0	0	0/2	1	40/60	60/40	100
	Total Credits					24	460/480	540/520	1000

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Programme	B.Tech	Programme Code	105		Regulation		2023
Department	BIOTECHNOLOGY				Semester		VIII

CURRICULUM

(Applicable to the students admitted from the academic year 2023 - 2024 onwards)

Course Code	Course Name		Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
THEORY									
	Professional Elective – V	PEC	4	0	0	3	40	60	100
	Professional Elective – VI	PEC	4	0	0	3	40	60	100
PRACTICAL									
U23BT832	Project Phase - II	EEC	0	0	3	8	60	40	100
				Total Credits		14	140	160	300

Cumulative Course Credit: 163

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Career Track Courses										
Sem	Course Code	Course Name	Category	Periods/Week			Credit	Maximum Marks		
				L	T	P	C	CA	ESE	Total
Track 1 - Entrepreneurship										
IV	U23CTCE1	Entrepreneurial Mindset and Business Model Canvas	EEC	-	-	2	1	60	40	100
V	U23CTCE2	Product Innovation, Commercialization and Finance	EEC	2	-	-	1	40	60	100
VI	U23CTCE3	Intellectual Property Rights	EEC	2	-	-	1	40	60	100
Track 2 - Competitive Examination										
IV	U23CTCP3	Verbal , Quantitative Aptitude and Reasoning -II	EEC	2	-	-	1	40	60	100
V	U23CTCG1	History & Culture of India and Indian Geography	EEC	2	-	-	1	40	60	100
VI	U23CTCG2	Indian economy and Freedom struggle in India & Tamil Nadu	EEC	2	-	-	1	40	60	100
Track 3 - Higher Studies										
IV	U23CTCP3	Verbal, Quantitative Aptitude and Reasoning -II	EEC	2	-	-	1	40	60	100
V	U23CTCH1	Higher Studies in Abroad & India	EEC	2	-	-	1	40	60	100
VI	U23CTCH2	Social Networking for Higher Studies	EEC	2	-	-	1	40	60	100
Track 4 - Placement										
IV	U23CTCP3	Verbal , Quantitative Aptitude and Reasoning -II	EEC	2	-	-	1	40	60	100
V	U23CTCP4	Leveraging Arithmetic and Codes Snippet	EEC	2	-	-	1	40	60	100
VI	U23CTCP5	Integrated Reasoning and Pseudo Code	EEC	2	-	-	1	40	60	100

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SEMESTER I

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN									
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Programme	B.TECH			Programme Code	105	Regulation		2023	
Department	Biotechnology					Semester		I	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23MA101	**Matrices and Calculus**	3	1	0	4	40	60	100

Course Objective	The Main Objective of the course is • To develop the use of matrix algebra techniques that is needed by engineers for practical applications. • To familiarize the students with differential calculus. • To familiarize the student with functions of several variables. This is needed in many branches of engineering. • To make the students understand various techniques of integration. • To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

Course Outcome	At the end of the course the students will be able to	Knowledge level
	CO1: Use the matrix algebra methods for solving practical problems.	K3
	CO2: Apply differential calculus tools in solving various application problems.	K4
	CO3: Able to use differential calculus ideas on several variable functions.	K5
	CO4: Apply different methods of integration in solving practical problems.	K5
	CO5: Apply multiple integral ideas in solving areas, volumes and other practical problems.	K3

Pre-requisites	-

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

COs	Programme Outcomes (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2		1	1								2		
CO 2	3	3	2		1								2		
CO 3	3		2	1									2		
CO 4	3	2	2	1	1								2		
CO 5	3		1	1	1								2		

Course Assessment Methods

Direct

1. Continuous Assessment Test I, II & III
2. Assignment.

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3.	End-Semester examinations

Indirect

1.	Course - end survey

Content of the syllabus

Unit – I	MATRICES	Periods	9+3

Characteristic equation – Eigen values and Eigenvectors of a real matrix– Properties of Eigen values and Eigenvectors – Cayley-Hamilton theorem(excluding proof) – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms. Simple application in encoding message using 2×2 matrix.

Unit - II	DIFFERENTIAL CALCULUS	Periods	9+3

Limit, Continuity, Differentiability, Rules of differentiation, Differentiation of various functions, Rolle's theorem(excluding proof), Mean value theorem(excluding proof), Taylor's theorem(excluding proof), Maxima and Minima. Applications: Newton's law of cooling – Heat flow problems.

Unit – III	FUNCTIONS OF SEVERAL VARIABLES	Periods	9+3

Partial differentiation – Homogeneous functions and Euler's theorem(excluding proof) – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables(excluding proof) – Maxima and minima of functions of two variables. Applications: Lagrange's method of undetermined multipliers.

Unit - IV	INTEGRAL CALCULUS	Periods	9+3

Definite and Indefinite Integrals- Methods of integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions -Reduction formula on $\int_{0}^{\frac{\pi}{2}} \cos^n x\,dx$, $\int_{0}^{\frac{\pi}{2}} \sin^n x\,dx$.

Unit - V	MUTIPLE INTEGRALS	Periods	9+3

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

		Total Periods	45+15=60

Text Books

1.	Stewart, J. Calculus: Early Transcendentals (8th Edition), Cengage Learning, 2015.
2.	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 45th Edition, 2024.

References

1.	Kreyszig E, Advanced Engineering Mathematics (10th Edition), John Wiley (2015).
2.	Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3.	Thomas. G. B., Hass. J, and Weir. M.D, "Thomas Calculus ", 14th Edition, Pearson India, 2018.
4.	Anton H, Calculus: Early Transcendentals, 10th Edition, Wiley (2016).
5.	B V Ramana, Higher Engineering Mathematics, Tata McGraw Hill Education Pvt Ltd., New Delhi (2016)

E-Resources

1.	https://freevideolectures.com › All Courses › Calculus › UCLA
2.	www.learnerstv.com/Free-engineering-Video-lectures
3.	www.nptel.ac.in

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Programme	B.Tech.		Programme Code	105	Regulation		2023
Department	Biotechnology				Semester		I

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23EN101	English for Communication	3	0	0	3	40	60	100

Course Objective	The main objective of this course is to: - Improve the communicative ability of learners. - Make learners read widely in order to practice writing - Make learners develop vocabulary and strengthen grammatical understanding - Assist students in the development of intellectual flexibility, creativity, and cultural literacy so that they may engage in life-long learning. - Identify and begin to apply the language features of academic and professional writing and speaking

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Use appropriate vocabulary in a professional context	K1
	CO2: Write appropriately based on the knowledge gained through reading of a variety of materials	K1
	CO3: Use language through their grammatical acquisition	K2
	CO4: Read and infer meanings of technical texts	K2
	CO5: Comprehend and retain the contextual and syntax understanding from reading.	K3

Pre-requisites	Nil

	CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak												CO/PSO Mapping		
Cos	Programme Outcomes (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1						2			3	3		3		2	
CO 2						2			3	3		3		2	
CO 3						2			3	3		3		2	
CO 4						2			3	3		3		2	
CO 5						2			3	3		3		2	

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Course Assessment Methods			
Direct			
1. Continuous Assessment Test I, II & III			
2. Assignment			
3. End-Semester examinations			
Indirect			
1. Course - end survey			

Content of the syllabus

Unit – I		Periods	9

Listening-Introduction to Different Types of Listening, Listening to Casual Conversations, **Speaking-** Introduction to develop the Art of Speaking, Giving Self Introduction, **Reading**–Understanding the Basics of Reading Skills, Reading Instructions and Technical Manuals, **Writing**- Introduction to writing strategies, Writing Definitions, **Focus on Language** - -Technical terms (Jargon), Word Formation with Prefixes and Suffixes, Using Active Voice and Passive Voice, Basic sentence patterns, Tenses (past, present, perfect and continuous tenses).

Unit – II		Periods	9

Listening- Listening to lectures, listening to description of equipment, **Speaking**- Strategies for Developing Conversational Skills, Short Conversations through Role Play Activities, **Reading**– Reading Comprehension, Reading e-mails, Reading Headlines, Predicting the Content, **Writing**- Note making, Writing Descriptions, **Focus on Language**–Collocations, One word substitution, Subject - verb agreement

Unit – III		Periods	9

Listening- Listening to different kinds of interviews (Face - to - face, radio, TV and telephone interviews), **Speaking**-Describing an Object, Asking Questions, Participating in Discussions **Reading**– Intensive reading, Reading passages for gist. **Writing**- Writing short& lengthy e-mails with emphasis on Brevity, Clarity, Coherence and Cohesion), **Focus on Language**–Sequential Connectives, Impersonal Passive

Unit – IV		Periods	9

Listening-Note Taking, **Speaking**- Improving Fluency through Narration. **Reading**–Reading passages for specific information- Phone messages, Reading and Transferring Information. **Writing**- Effective writing strategies, Informal writing, Writing a Memo, **Focus on Language**– Cause and Effect, Conditional Statements (if - clauses and types), Usage of Modal Verbs.

Unit – V		Periods	9

Listening- Listening to understand Modulation, Listening to Welcome Speeches, **Speaking**- Delivering Welcome Address, Understanding Segmental and Supra-segmental Features-Practicing Stress, Pause and Intonation, **Reading**– Reading for a purpose, Reading Business Documents, Interpreting Charts and Graphs. **Writing**- Describing a Process. **Focus on Language** -Synonyms and Antonyms, Common Errors in English.

		Total Periods	45

Text Books		
1.	Dr. S. R. Kannan & Faculty from the Department of English -English for Communication, Karun Printers Pvt. Ltd, 2023.	
2.	Sokkaalingam, S.RM., The Art Of Speaking, English Versatile Publishing House, 2019.	
References		
1.	Dr. Padma Ravindran, Poorvadevi, M. Y. Abdur Razack- English for life, English for work, students Book, Ebek language laboratory pvt ltd, 2011.	
2.	Dutt Rajeevan, Prakash. A Course in Communication Skill (Anna University, Coimbatore edition): Cambridge University Press India Pvt.Ltd, 2007.	
3.	S.P. Dhanavel, English and Communication Skills for Students of Science and Engineering, Orient Blackswan Pvt, Ltd, 2009.	
4.	Technical English – I & II, Sonaversity, Sona College of Technology, Salem, First Edition, 2012.	
5.	Meenakshmi Raman and Sangeeta Sharma- 'Technical communication English Skills for	

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	Engineers; oxford University Press, 2008.
E-Resources	
1.	http://www.sparknotes.com/lit/the-alchemist/summary.html
2.	https://www.stephencovey.com/7habits/7habits.php
3.	http://en.wikipedia.org/wiki/The_Seven_Habits_of_Highly_Effective_People

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Programme	B.Tech.		Programme Code		105	Regulation		2023
Department	Biotechnology					Semester		I

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23PH101	Engineering Physics	3	0	0	3	40	60	100

Course Objective	The student should be made to, • understand the basic concepts of properties of matter • gain knowledge about the conduction properties of metals • identify the different types of crystal structures and crystal growth techniques. Study the production and applications of ultrasonics. • correlate better understanding the carrier concentration and its variations with temperature in a semiconductor. Study the properties of modern engineering materials and its uses • categorize the types of laser and fiber optics

Course Outcome	At the end of the course, the student will be able to	KL
	CO1: Understand the elastic properties of the materials	K2
	CO2: Gain knowledge about the conduction properties of metals	K3
	CO3: Determine packing factor for various unit cells and understand different types of crystal imperfections and learn the engineering, medical applications.	K1
	CO4: Discuss the basic idea of semiconducting materials and realize the function of modern engineering materials	K1
	CO5: Learn the optical properties of materials and its uses	K3

Pre-requisites	---

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak													CO/PSO Mapping		
COs	Programme Outcomes (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	3	1	2									2	
CO 2	3	2	3	3	1										
CO 3	3	3		3	1									2	
CO 4	3		2	1	1								3	2	
CO 5	3			1	2	2								2	

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III 2. Assignments and Mind map 3. End-Semester examinations

Indirect
Course - end survey

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Content of the syllabus				
Unit – I	**PROPERTIES OF MATTER**		Periods	**9**
Elasticity: Types of moduli of elasticity - Poisson's ratio - Stress - Strain Diagram – uses - Hooke's law. Young's modulus: Uniform bending (qualitative) Experimental determination by non-uniform bending - Twisting couple on a wire – Application: I shape girders, Torsional pendulum.   **Viscosity:** Co-efficient of viscosity - Poiseuilles' formula - Experimental determination – uses.
Unit - II	**ELECTRICAL PROPERTIES OF METALS**		Periods	**9**
Classical theory: Classical free electron theory of metals- Expressions for electrical conductivity and Thermal Conductivity of metals – Wiedemann-Franz law (Qualitative) - Success and failures.   **Quantum theory:** de Broglie's hypothesis - Schrodinger's time independent and time dependent wave equations - Fermi – Dirac Statistics - Density of energy states (Qualitative).
Unit – III	**CRYSTAL PHYSICS AND ULTRASONICS**		Periods	**9**
Crystallography: Unit cell - Crystal systems - Bravais lattices- Lattice planes - Miller indices - Inter-planar spacing in cubic lattice- Calculation of number of atoms per unit cell- Atomic radius – Coordination number- Packing Factor for HCP structures - Crystal defects – point and line defects (qualitative). **Ultrasonics:** Introduction - Properties and Generation of Ultrasonics – Magnetostriction and Piezoelectric Oscillator methods – Applications: Sound Navigation and Ranging (SONAR), Non – Destructive Testing (NDT) and Sonogram.
Unit - IV	**SEMICONDUCTING & MODERN ENGINEERING MATERIALS**		Periods	**9**
Semiconductors: Elemental and Compound semiconductors - Intrinsic semiconductor: (Qualitative only) – Carrier concentration – Fermi level – Electrical conductivity - Band gap determination. Extrinsic semiconductors: Carrier concentration in n – type and p – type semiconductor (Qualitative) – Variation of Fermi level with temperature. Application; Construction and working of LED.   **Metallic glasses:** preparation, properties and applications - Shape memory alloys (SMA): Characteristics and applications of NiTi alloy.
Unit – V	**LASER AND FIBER OPTICS**		Periods	**9**
Laser: Interactions of Radiations with matters - Characteristics of laser – Derivation of Einstein's A and B coefficients. Types: CO2 laser - Semiconductor laser: Homo junction - Applications.   **Optical fiber:** Principle of propagation of light through optical fiber - Numerical aperture and acceptance angle (Qualitative) -Types of optical fibers -Fiber optical communication system (block diagram) - Application: Temperature sensor.
			Total Periods	**45**

Text Books

1.	R.K. Gaur and Gupta. S.L, Engineering Physics, Dhanpat Rai Publishers, 2017.
2.	S.O Pillai., Solid state physics, New Age International Private Limited.
3.	Dr.A.Panneerselvam and Dr.P.Mani, "Engineering Physics", Dhanam publisher, Chennai – 600 042. (2024)

References

1.	B.K. Pandey, S. Chaturvedi. "Engineering Physics", 1st Edition, Cengage Learning India Pvt Ltd, (2012).
2.	David Halliday, Robert Resnick Jearl Walker, Fundamentals Of Physics Extended 8/Ed 8th Edition, , Wiley India Pvt Ltd, 2008.
3.	Lawrence H.Vanvlack, "Elements of materials Science Engineering, 6th Edition, Pearson

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	Publication.
4.	S.O.Pillai, "Solid State Physics", New Age International Publishers
5.	Dr.V.Rajendran, "Engineering Physics", Tata McGraw Hill Education Private Limited, New Delhi.
E-Resources	
1.	www.e-booksdirectory.com
2.	Home.iitk.ac.in
3.	physics.cu.ac.bd

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Programme	B.E./B.Tech.		Programme Code		Regulation	2023
Department	CSE, EEE, ECE, IT, BT, CST & BME				Semester	I

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23CS101	Programming for Problem Solving	3	0	0	3	40	60	100

Course Objective	The main objective of this course is to: • Learn the fundamentals of computers, languages, number systems and acquire problem solving skills in C Programming

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Examine number systems and to apply problem solving techniques	K3
	CO2: Learn the basics of C programming with branching and looping statements	K2
	CO3: Experiment the C programs using Arrays and Pointers for simple applications	K3
	CO4: Solve C programs with the Functions and Strings	K3
	CO5: Apply Structures, Union and File concepts to solve simple real world problems	K3

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak													CO/PSO Mapping	
COs	Programme Outcomes (POs)												PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO 1	3	2	1	1	2							2	3	3
CO 2	2	1	1		2							2	2	2
CO 3	3	2	1	1	2							2	3	3
CO 4	3	2	1	1	2							2	3	3
CO 5	3	2	1	1	2							2	3	3

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III
2. Assignment / Quiz / Seminar
3. End-Semester examination

Indirect
1. Course - end survey

Content of the syllabus

Unit – I	INTRODUCTION TO PROBLEM SOLVING	Periods	9

Basic organization of Computer - Programming languages - Compilers – Interpreter - Flowchart – Pseudocode – Algorithm.
Number Systems – Decimal, Binary, Octal and Hexadecimal conversions

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Unit - II	BASICS OF C PROGRAMMING	Periods	9
Introduction to C – Features - Data Types – Constants – Variables - I/O Statement - Operators –Expressions - Decision Making and Branching – Looping Statements - Break, Go to, Continue.			
Unit – III	ARRAYS AND POINTERS	Periods	9
Arrays: Concepts – Need – one dimensional array – array declaration – features – array initialization - Two-Dimensional Arrays- Multidimensional Arrays. **Pointers**: Introduction, pointer declaration-accessing variable through pointer- Pointers and Arrays, Pointers and strings – Pointers structures - Pointer Arithmetic - Array of Pointers – dynamic memory allocation - malloc, realloc, free.			
Unit - IV	FUNCTIONS AND STRINGS	Periods	9
Functions: Introduction, function declaration, defining and accessing functions, User-defined Functions-storage classes-function prototypes-parameter passing methods-recursion. **Strings**: Concepts – Strings manipulation - String Input / Output Functions- Strings standard functions - Arrays of Strings.			
Unit – V	STRUCTURES, UNIONS AND FILE SYSTEMS	Periods	9
Structures: Introduction- nested structures- Arrays of Structures - Structures and Functions - Pointers to Structures – Unions. **File**: opening, defining, closing, File Modes, File Types , Writing contents into a file, Reading file contents, Appending an existing file, File permissions and rights, Changing permissions and rights.			
		Total Periods	**45**

Text Books	
1.	S.Kuppuswami, S.Malliga, C. S. Kanimozhi and K.Kousalya, "Problem Solving and Programming", McGraw Hill, 2019.
2.	E. Balagurusamy, "Programming in ANSI C", 8th Edition, Mc Graw Hill, 2019.

References	
1.	Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition, 2017
2.	Kernighan BW and Ritchie DM, "The C Programming Language", 2nd Edition, Prentice Hall of India, 2017.
3.	Dr.V.Rameshbabu, Dr.R.Samyutha, M.Muni Rathnan, "Computer Programming", VRB Publishers Pvt.Ltd, 2016.

Tools Required	
	Codetandra/HackerRank/ HackerEarth / Any online Problem Solving Platforms

E-Resources	
1.	https://www.geeksforgeeks.org/c-language-set-1-introduction/
2.	https://www.programiz.com/c-programming
3.	https://www.cprogramming.com/

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Programme	B.TECH	Programme code		105	Regulation		2023
Department	Biotechnology			Semester			I

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23TA101	Heritage of Tamils / தமிழர் மரபு	1	0	0	1	40	60	100

Content of the syllabus

அலகு 1	மொழி மற்றும் இலக்கியம்		Periods	3

இந்திய மொழிக்குடும்பங்கள் – திராவிடமொழிகள் – தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் – சங்க இலக்கியத்தின் சமயச் சார்பற்றதன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் திருக்குறளில் மேலாண்மைக்கருத்துக்கள் – தமிழ்க்காப்பியங்கள் – தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம்,ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசனின் பங்களிப்பு.

அலகு 2	மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை –சிற்பக்கலை	Periods	3

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன்சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப்பொருட்கள்,பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறதெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக்கருவிகள் – மிருதங்கம், பறை,யாழ்,வீணை,நாதஸ்வரம் – தமிழர்களின் பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு 3	நாட்டுப்புறக்கலைகள் மற்றும் வீரவிளையாட்டுக்கள்	Periods	3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான்கூத்து, ஒயிலாட்டம் ,தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம் , தமிழர்களின் விளையாட்டுக்கள்.

அலகு 4	தமிழர்களின் திணைக்கோட்பாடுகள்	Periods	3

தமிழகத்தின் தாவரங்களும் விலங்குகளும்– தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடுகள் – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவு, கல்வியறிவு – சங்ககால நகரங்களும் துறைமுகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு 5	இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்கு	Periods	3

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இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப்பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித்தமருத்துவத்தின் பங்கு – கல்வெட்டுகள் கையெழுத்துப்படிகள் – தமிழ்ப்புத்தகங்களின் அச்சுவரலாறு.

	Total Periods	15

VIVEKANANDHACOLLEGE OF ENGINEERING FOR WOMEN
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Programme	B.TECH	Programme code	105	Regulation		2023
Department	Biotechnology			Semester		I

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23TA101	Heritage of Tamils / தமிழர் மரபு	1	0	0	1	40	60	100
	Content of the syllabus							

UNIT I	LANGUAGE AND LITERATURE	Periods	3

Language Families in India – Dravidian Languages-Tamil as a Classical Language-Classical Literature in Tamil-Secular Nature of Sangam Literature - Distributive Justice in Sangam Literature-Management Principles in Thirukural- Tamil Epics and Impact of Buddhism & Jainism in Tamil and -Bakthi Literature Azhwars and Nayanmars – Forms of minor Poetry– Development of Modem literature in Tamil-Contribution of Bharathiyar and Bharathidhasan.

UNIT II	HERITAGE-ROCK ART PAINTINGS TO MODERN ART– SCULPTURE	Periods	3

Herostone to modern sculpture - Bronzeicons- Tribes and their handicrafts- Art of temple car making—Massive Terracotta sculptures Villagedeities , Thiruvalluvar Statue at Kanyakumari, Making of musical instruments-Mridhangam,Parai Veenai,Yazhand Nadhaswaram – Role of Temples in Social and Economic Life of Tamils.

UNIT III	FOLK AND MARTIAL ARTS	Periods	3

Therukoothu, Karagattam, VilluPattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance-Sports and Games of Tamils.

UNIT IV	THINAI CONCEPT OF TAMILS	Periods	3

Flora and Fauna of Tamils & Ahamand Puram Concept from Tholkappiyam and Sangam Literature- Aram Concept of Tamils- Education and Literacy during Sangam Age- Ancient Cities and Portso Sangam Age-Export and Import during Sangam Age- Overseas Conques to Cholas.

UNIT V	CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE	Periods	3

Contribution of tamils to Indian Freedom Struggle-The Cultural Influence of Tamils over the other parts of India.-Self-Respect Movement- Role of Siddha Medicine in Indigenous Systems of Medicine-Inscriptions & Manuscripts– Print History of Tamil Books.

	Total Periods	15

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TEXT-CUM-REFERENCE BOOKS

1	தமிழகவரலாறும் – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித்தமிழ் – முனைவர்இல. சுந்தரம். (விகடன் பிரசுரம்).
3	கீழடி – வைகை நதிக்கரையில் சங்க நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4	பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் வெளியீடு)
5	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies
7	Historical Heritage of the Tamils (Dr.S.V.Subaramanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

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Programme	B.Tech.		Programme Code		105	Regulation		2023		
Department	Biotechnology					Semester		I		
Course Code	Course Name		Periods Per Week			Credit	Maximum Marks			
			L	T	P	C	CA	ESE	Total	
U23GE101	Engineering Graphics		2	0	3	3	50	50	100	

Course Objective	The main objective of this course is to:
	• Develop skills to enhance their ability to know the concept of engineering graphics and to draw the points kept in various positions, lines and planes.
	• Project the drawing of various solids.
	• Sketch sectioned views of solids.
	• Draw the development of surfaces.
	• Draw the isometric and orthographic projections for any given object to the required standard.

Course Outcomes	At the end of the course, the student should be able to	Knowledge Level
	CO1: Construct plane curves and develop projection of points , lines and plane surfaces	K2
	CO2: Construct projection of solids with various conditions.	K4
	CO3: Design the section of solids and analyze the true shape of the section	K3
	CO4: Design and develop the different solid surfaces.	K2
	CO5: Construct isometric and orthographic projection of different solids.	K2

Pre - requisites	Nil

	CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak												CO/PSO Mapping		
COs	Programme Outcomes (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	3	-	-	-	-	-	-	-	2	-	-
CO 2	3	3	2	2	2	-	-	-	-	-	-	-	2	-	-
CO 3	3	2	2	2	3	-	-	-	-	-	-	-	2	2	-
CO 4	3	2	3	3	2	-	-	-	-	-	-	-	2	-	-
CO 5	3	3	2	3	3	-	-	-	-	-	-	-	2	2	-

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III
2. Assignment
3. End-Semester examination

Indirect
1. Course - end survey

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Content of the Syllabus			
Concepts & Conventions (Not for Examination)	Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.	Periods	1
Unit – I	PROJECTION OF POINTS, LINES AND PLANE SURFACES	Periods	3+8
Introduction to Plane curves, Orthographic projection – principles – projection of points, straight lines (only first angle projections) and plane surfaces (polygonal and circular).			
Unit - II	PROJECTION OF SOLIDS	Periods	3+8
Projections of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane.			
Unit - III	SECTION OF SOLIDS	Periods	3+8
Sectioning of solids - prisms, pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other - Obtaining true shape of section.			
Unit - IV	DEVELOPMENT OF SURFACES	Periods	3+8
Development of lateral surfaces of simple solids like prisms, pyramids, cylinders and cones – development of simple truncated solids involving prisms, pyramids, cylinders and cones.			
Unit - V	ISOMETRIC PROJECTIONS, ORTHOGRAPHIC VIEWS FROM PICTORIAL VIEWS	Periods	5+10
Isometric Projection and Introduction to AutoCAD / Solid Edge: Principles of isometric projection - Isometric scale -Isometric projections of simple solids like prisms, pyramids, cylinders and cones & orthographic views from pictorial views.			
Demonstration only: Computer Aided Drafting (Auto CAD / Solid Edge): Introduction to drafting packages and demonstration of their use.			
		Total Periods	60
Text Book:			
1.	Basant Agrawal and C.M Agrawal ,"Engineering Drawing ",Tata McGraw Hill ,2019		
2.	Jain and Gautam ,"Engineering Graphics & Design ",Khanna Publishing House, 2020		
Reference Book :			
1.	Dr.P.Kannan and Dr.J.Bensam Raj, "Engineering Graphics", JBR Tri Sea Publishers Pvt. Ltd,2024		
2.	K.V Natarajan, "Engineering Drawing and Graphics", M/s. N.Dhanalakshmi, Chennai,2020		
3.	K.Venugopal and V. Prabhu Raja, "Engineering Graphics"New Age International Publishers,2016		
4.	N.S Parthasarathy and Velamurali, " Engineering Graphics", Oxford University, New Delhi,2015		
5.	Bhatt N.D and Panchal V.M, "Engineering Drawing", Charotar Publishing House,2014		
e-RESOURCES:			
1.	http://nptel.ac.in/courses/105104148, "Engineering Graphics" - Dr. Nihar Ranjan Patra , IIT Kanpur		
2.	http://cfd.annauniv.edu/webcontent.htm, "Engineering Graphics" - Dr.Velamurali		
3.	http://link.springer.com/ "Engineering Graphics"-Springer Nature.		

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN						
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	Elayampalayam, Tiruchengode – 637 205						

Programme	B.Tech.		Programme code		105	Regulation		2023
Department	Biotechnology			Semester				I
Course Code	Course name		Periods per week		Credit	Maximum Marks		
U23GE102	**Design Thinking**		L	T	P	C	CA	ESE	Total
			1	0	2	1	50	50	100

Course Objective	The student should be made to, • Familiarize with design thinking concepts and principles • Practice the methods, processes and tools of design thinking. • Apply the design thinking approach and have ability to model real world situations.

	At the end of the course, the student should be able to,	KL
	CO1: Understand and apply the concept of team building activity	K2
Course Outcome	**CO2:** Understand Design Thinking and apply the design thinking approach to empathize situations in real world	K3
	CO3: Identify various methods of empathy and define the problem	K3
	CO4: Develop creative ideas through design thinking	K4
	CO5: Understand benefits of learning through observation, experience and application	K5

Pre-requisites	-

	CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 – Weak												CO/PSO Mapping	
	Programme Outcomes (POs)												PSOs	
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	3	3	3	3	2	2	3	3	3	2	2	3	3
CO 2	3	3	3	3	3	3	3	3	3	3	3	3	2	2
CO 3	3	3	1	2	2	2	2	1	2	1	-	-	2	2
CO 4	3	3	3	3	3	2	2	2	2	2	2	1	2	2
CO 5	3	3	3	3	1	2	2	2	1	2	2	1	2	2

Course Assessment Methods

Direct
1. Continuous Assessment Test through activities, assignment & Quiz 2. Models (Chart/paper/3D) 3. Prototype & Presentation
Indirect
1. Course - end survey

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Content of the Syllabus		
SESSION - I	Periods	6
Introduction – Team Building - Types – 4 C's of Team Building – Levels of Team Building – Benefits of Team Work – Team Building Activity.		
SESSION - II	Periods	9
Introduction to Design Thinking – Purpose of Design Thinking – Design Thinking Framework, Empathy and related case studies		
SESSION - III	Periods	6
Define: Examine and Reflect on the problem.		
SESSION - IV	Periods	12
Generating Ideas – Identifying ideas – Bundling the ideas and create concepts – Rapid Prototyping – Idea Refinement.		
SESSION - V	Periods	12
Importance & testing the design with people - Retest and redefine results		
	Total Periods	45

Textbooks	
1.	Solving Problems with Design Thinking - Ten Stories of What Works by Jeanne Liedtka 2013.
2.	Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.
3.	Yousef Haik and Tamer M.Shahin, "Engineering Design Process", Cengage Learning, 2nd edition, 2011
4.	Design of Business: Why Design Thinking is the Next Competitive Advant age by Roger L. Martin 2009.
5.	Change by Design: How Design thinking transforms organizations and empires Innovation, 2009, Harper Business, Brown, Tim and Berry.

References	
1.	Design thinking toolbox by Michael Lewick, Wily 2020
2.	Design thinking playbook by Michael Lewrick , Wily 2019
3.	Creative Confidence: Unleashing the Creative Potential Within Us All by by Tom 2014
4.	The Design of Everyday Things: by Don Norman 2013

E-Resources	
1.	https://www.collectivecampus.io/blog/6-resources-to-help-you-learn-design-thinking
2.	https://thisisdesignthinking.net/on-design-thinking/design-thinking-resources/
3.	http://hs.griet.ac.in/pdf/studymaterialsgr20/Design%20Thinking%20Lab%202020-21.pdf
4.	https://www.mindtools.com/brainstm.html
5.	https://www.quicksprout.com/. /how-to-reverse-engineer-your-competit
6.	https://www.youtube.com/watch?v=2mjSDIBaUlM
7.	thevirtualinstructor.com/foreshortening.html

Activity Based Learning/Practical Based Learning
http://dschool.stanford.edu/dgift/

Online Course	
1	https://onlinecourses.nptel.ac.in/noc19_mg60/preview
2	https://www.ibm.com/design/thinking/page/badges/core-skills

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Programme	B.Tech.		Programme Code	105	Regulation		2023
Department	Biotechnology				Semester		I

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23PH102	Physics Laboratory	0	0	3	1	60	40	100

Course Objective	➤ Understand elastic behavior of Materials ➤ Predict viscous force in liquids. ➤ Gain knowledge in measuring the lowest thickness materials ➤ To Identify wavelengths of prominent lines using polychromatic lamp ➤ Observe heat conduction in bad conductor ➤ Understand the principle of interferometer ➤ To learn about the characteristics of Lasers

Course Outcome	At the end of the course, the student will be able to	Knowledge Level
	CO1: Measure the young's modulus of the materials, Rigidity modulus – Torsion pendulum	K3
	CO2: Calculate Coefficient of viscosity of liquid and thickness of thin wire using Air wedge	K3
	CO3: Observe and measure the different wavelengths of mercury Spectrum and dispersive power of a prism	K3
	CO4: Illustrate the conductivity of bad conductors. To know how to determine the velocity of ultrasonic waves in liquid	K3
	CO5: To understand the importance of laser beam compared to ordinary light	K2

Pre-requisites	Nil	

CO / PO Mapping													CO/PSO Mapping	
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak														
COs	Programme Outcomes (POs)												PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO 1	3	1											2	
CO 2	3	3	1	2	2								2	
CO 3	3	2			2								3	
CO 4	3	3		1									1	
CO 5	3	1	1		1								2	

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Course Assessment Methods

Content of the syllabus

PHYSICS LABORATORY

S.No.	Experiments	CO
1.	Determination of Young's modulus of the material - Uniform bending method	CO1
2.	Determination of Young's modulus of the material - Non uniform bending method	CO1
3.	Determination of Rigidity modulus – Torsion pendulum	CO1
4.	Determination of Coefficient of viscosity of a liquid – Poiseuille's method	CO2
5.	Determination of thickness of a thin material – Air wedge method	CO2
6.	Determination of wavelength of mercury spectrum – spectrometer grating	CO3
7.	Determination of Dispersive power of a prism – Spectrometer	CO3
8.	Determination of thermal conductivity of metallic glass using Lee's Disc Method	CO4
9.	Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer	CO4
10.	Determination of Wavelength and particle size using Laser	CO5
	Total Periods	30

Lab Manual

1.	R. Jayaraman, Engineering Physics Laboratory Manual, Pearson Pub, Edition-2021.
2.	A.K. Katiyar & C.K. Pandey Engineering Physics: Theory and Practical, Wiley Pub,2nd Edition.
3.	Dr.P.Mani, "Physics laboratory manual ", Dhanam publisher, Chennai – 600 042. (2024)
4.	Dr.G.Senthil Kumar, "Physics laboratory manual", VRB Publishers Private Limited, Chennai. 2024.

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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205								
Programme	B.E. / B.Tech.,		Programme Code			Regulation		2023
Department	CSE, EEE, ECE, IT, BT, CST & BME					Semester		I

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23CS102	**Programming for Problem Solving Laboratory**	0	0	2	1	60	40	100

Course Objective	The main objective of the course is to • Develop simple C programs to illustrate the applications of User Defined and Derived Data Types such as Arrays, Pointers, Structures, and Functions.

	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Develop C programs for computer based solution of simple real world problems using Conditional and Looping statements	K3
Course Outcome	**CO2**: Implement simple C Programs using Strings and Arrays	K3
	CO3: Implement C program for simple applications using Pointers	K3
	CO4: Write C programs that perform operations on File	K4
	CO5: Demonstrate C Programs using Structures	K3

COs	CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak												CO/PSO Mapping	
	Programme Outcomes (POs)												PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO 1	3	2	1	1	2							2	3	3
CO 2	3	2	1	1	2							2	3	3
CO 3	3	2	1	1	2							2	3	3
CO 4	3	2	1	1	2							2	3	3
CO 5	3	2	1	1	2							2	3	3

Course Assessment Methods

Direct

1. Pre lab and post lab
2. End-Semester examination

Indirect

1. Course - end survey

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List of Experiments	CO's
1. Write a C program that accepts an employee's ID, total worked hours in a month and the amount he received per hour. Print the ID and salary (with two decimal places) of the employee for a particular month.	CO1
2. Write a program in C to calculate the sum of three numbers with input on one line separated by a comma.	CO1
3. Write a program in C to find the sum of the series $[x - x^3 + x^5 + ...]$.	CO1
4. Write a program in C to find the number and sum of all integers between 100 and 200 which are divisible by 9.	CO1
5. Write a program in C to count the total number of duplicate elements in an array.	CO2
6. You are given an input string 'S'. Your task is to find and return all possible permutations of the input string. **Note:** 1. The input string may contain the same characters, so there will also be the same permutations. 2. The order of permutation does not matter. **Sample Input** xyz sample Output xyz, xzy, yxz, yzx, zxy, zyx **Sample Output :** All the possible permutations for string "XYZ" will be "XYZ", "XZY", "YXZ", "YZX", "ZXY" and "ZYX".	CO2

7. Find the Smallest and Largest Element in an Array
 	
Method 1: Traverse the array iteratively and keep track of the smallest and largest element until the end of the array.
Method 2: Traverse the array recursively and keep track of the smallest and largest element until the end of the array.
Method 3: Sort the array using STL and return the first element as the smallest element and the last element as the largest element.
    For example, consider the array.
        arr = {1, 2, 3, 4, 5}
    Sample output:
    Smallest element: 1
    Largest element: 5
	CO2

8. Write a C program to find the sum of all the multiples of 3 and 5 below 100 using pointers. We have to find the number of numbers which are multiples of both 3 and 5 in the first 100 natural numbers. Multiples of both 3 and 5 in the first 100 natural numbers are the multiples of LCM of 3 and 5.
    LCM of 3 and 5 =3×5=15
    Sample output:
    Multiples of 15 below 100 are 15, 30, 45, 60, 75 and 90.
	CO3

9. Write a C program to count number of characters, words and lines in a text file. Logic to count characters, words and lines in a file in C program. How to count total characters, words and lines in a text file in C programming.	CO4

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Example Source file I love programming. Working with files in C programming is fun. I am learning C programming at VCEW. **Sample output** Total characters = 100 Total words = 18 Total lines = 3	

10. Write a C program to implement Student database using Structure
    Sample output:
    Enter details of student:
Name :abi
RollNo:101
Percentage :89.7
    Entered details:
Name: abi
RollNo: 101
Percentage: 89.70
	CO5

Total Periods	45

Tools Required
Codetandra / HackerRank / HackerEarth / Any online Problem Solving Platforms

E-Resources	
1.	https://www.programiz.com/c-programming
2.	https://www.cprogramming.com/
3.	https://beginnersbook.com/2015/02/simple-c-programs/

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Programme	B.TECH			Programme Code	105	Regulation		2023
Department	Biotechnology					Semester		I

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23MCFY1	Environmental Science and Engineering	2	0	0	0	100	0	100

Course Objective	The main objective of this course is to: • Familiarize basics of ecosystem and creating environmental awareness. • Congregate about environmental pollution. • Contrast on solid waste and social issues. • Acquire knowledge in environmental legislation and protection. Summarize population growth, human rights and Environment

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Acquire knowledge about Eco-system, Natural resources and Bio-diversity.	K1
	CO2: Be aware of Environmental Pollution and its control.	K3
	CO3: Infer and express Solid waste management and Social issues.	K3
	CO4: Acquire Knowledge about Environmental legislation and protection.	K3
	CO5: Awareness about population growth, human rights and Environment	K2

Pre-requisites	NIL

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong. 2 – Medium. 1 - Weak														CO/PSO Mapping			
COs	Programme Outcomes (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CO 1	1	2	2			2	3					2	2		
CO 2	3	2	2		1	2	3				1	3	3		2
CO 3	3	2	2		1	3	3				1	2	3		2
CO 4	1	1	1			2	3				1	2	2		1
CO 5	1	2	1			2	2				1	3	1		1

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III
2. Assignment

Indirect
1. Course - end survey

Content of the syllabus

Unit – I	INTRODUCTION TO ENVIRONMENTAL SCIENCE AND ENGINEERING	Periods	6

Nature and scope of environmental education- natural resources – (forest, water, food,& land resources)

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problems and remedial measures. Ecosystem-Structure, characteristics and functions of ecosystem. Biodiversity – definition – conservation of biodiversity (in-situ and Ex-situ)-environmental awareness and sustainable development.

Unit – II	ENVIRONMENTAL POLLUTION AND ITS CONTROL	Periods	6

Water pollution-causes, effects and control measures of water pollution- waste water treatment process (secondary-BOD,COD) . Air Pollution – types of air pollutants-CO_2, SO_2, NO_2, PAN-sources- control measures (electro static precipitator, bag house filter, wet scrubber and cyclone separator).

Unit – III	SOCIAL ISSUES AND SUSTAINABILITY	Periods	6

Solid waste Management-Types (E-Waste, Hazardous waste, Bio-waste)-Disposal method. Sustainability-Definition-Sustainable development Goals-Environmental issues-global warming and Ozone depletion, Climate change, Acid rain, Carbon foot print-Possible solutions to Environmental issues.

Unit – IV	SUSTAINABILITY PRACTICES AND ENVIRONMENTAL LEGISLATION	Periods	6

Zero waste and R-concept-circular economy, material life cycle assessment- energy efficiency and management-environmental legislation-air act, water act-wildlife protection act-environmental protection act.

Unit – V	HUMAN POPULATION AND THE ENVIRONMENT	Periods	6

Population growth, human rights, value education, environment and human health, family welfare program, women and child welfare, role of information technology in environment – satellite, data base, Geographical Information System (GIS), Environmental impact Analysis (EIA) and human health.

		Total Periods	30

Text Books	
1.	Dr.S. Vairam - "Environment Science and Engineering" Gems publication. Edition 2018
2.	Gilbert.M.Masters-"Environmental Science"-Pearson education. Edition-2-2013
3.	Dr.S.Mageswari, Dr.G.Vijayakumar, Ms. A. Preethi-"Environment Science and Engineering" RK Publication. Edition 2022.

References	
1.	Linda Williams- "Environmental Science"-Tata McGRAW – Hill Edition. Edition-I-2008
2.	T.G.Miller Jr-"Environmental Science"-Wadsworth publishing Co. Edition -10-2004
3.	William P. Cunningham, Barbara Woodworth Saigo- Tata McGraw Hill.Edition-4-2011
4.	NPTEL Course Notes
5.	Cunnighum and cooper-"Environmental Science"-Jaico Publ, House Edition-4-2007

E-Resources	
1.	https://libraries.ou.edu/
2.	https://libguides.reading.ac.uk/
3.	https://www.loc.gov/, https://rdl.lib.uconn.edu/

SEMESTER II

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN					
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Programme	B.TECH			Programme Code	105	Regulation	2023
Department	Biotechnology				Semester		II

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23MA202	Complex Analysis and Ordinary Differential Equations	3	1	0	4	40	60	100

Course Objective	The Main Objective of the course is to • Understand the Analytic functions and Bilinear transformations. • Proficiently understand the Complex Integration. • Demonstrate Vector Differentiation and Integration. • Know about the Ordinary Differential Equations. • Identify the Laplace Transform of Derivatives and Integrals.

Course Outcome	At the end of the course, the student should be able to,	Knowledge level
	CO1: Analyze the construction of analytic functions.	K4
	CO2: Understand the concepts of cauchy's integral theorem and residue theorem in evaluation of complex integrals.	K3
	CO3: Explore the concepts of Green's , Stoke's and Gauss Divergence theorems in real life problems.	K5
	CO4: Understand the concepts of solving second order differential equations.	K5
	CO5: Apply the concepts of Laplace transform in solving ODE.	K3

Pre-requisites	-

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

COs	Programme Outcomes (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	1	1								2		
CO 2	3	2	1	1									2		
CO 3	3	2		1									2		
CO 4	3	2		1	1								2		
CO 5	3	2	1	1									2		

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III 2. Assignment. 3. End-Semester examinations

Indirect
1. Course - end survey

Content of the syllabus

Unit – I	ANALYTIC FUNCTIONS	Periods	9+3

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
Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions c+z, cz,1/z and Bilinear transformation.

Unit - II	COMPLEX INTEGRATION	Periods	9+3

Problem solving using Cauchy's integral theorem and integral formula- Taylor's and Laurent's expansions- Residues- Cauchy's residue theorem- Application: Contour integration over unit circle.

Unit – III	VECTOR DIFFERETIATION & INTEGRATION	Periods	9+3

Vector Differentiation: Vector and Scalar Functions- Derivatives- Curves, Gradient of a Scalar Field- Directional Derivative -Divergence of a Vector Field - Curl of a Vector Field – Line, Surface and Volume integrals (concepts only), Green's theorem in a plane(excluding proof), Gauss Divergence theorem(excluding proof), Stoke's theorem (Excluding proof).

Unit - IV	ORDINARY DIFFERENTIAL EQUATIONS	Periods	9+3

Second order Linear ordinary differential equations with constant coefficients, Cauchy's - Euler equations (excluding proof)- Legendre's Linear differential equations(excluding proof) - Method of variation of parameters.

Unit – V	LAPLACE TRANSFORMS	Periods	9+3

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems(excluding proof) -Transforms of derivatives and integrals – Initial and final value theorems(excluding proof) – Inverse transforms – Convolution theorem(excluding proof) – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

	Total Periods	45+15=60

Text Books

1.	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 45th Edition, 2024.
2.	Ravish R Sing , Mukul Bhatt, "Engineering Mathematics", Mc Graw Hill Education Pvt. Ltd-2018
3.	Sivaramakrishna Das. P, Vijayakumari.C, " Engineering Mathematics – II", Pearson India Education Pvt. Ltd-2022.

References

1.	Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics" , Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.
2.	Kreyszig, E., Advanced Engineering Mathematics (10th Edition), John Wiley (2015).
3.	Alan Jefferis , Advanced Engineering Mathematics, Academic Press- New Delhi-2003
4.	Yunus A.Cengel, William J.Palm III," Differential equations for Engineers & Scientists", Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.
5.	John Bird, Higher Engineering Mathematics, Anuradha Agencies(2004)

E-Resources

| 1.	https://en.wikipedia.org › wiki › Ordinary_differential_equation
2.	www.learnerstv.com/Free-engineering-Video-lectures
3.	www.nptel.ac.in

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Elayampalayam, Tiruchengode - 637 205

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205		

Programme	B.TECH		Programme Code	105	Regulation	2023
Department	Biotechnology				Semester	II

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23CH201	Engineering Chemistry	3	0	0	3	40	60	100

Course Objective	The main objective of this course is to:
	• Recognize the basic technology requirements in water treatment
	• Gain knowledge in basics and preparations, properties and applications of Polymers.
	• Enrich the Knowledge of the students with the basics of Nano materials, their properties and applications.
	• Familiarize about the Non renewable, renewable energy and different types of storage devices in the engineering application.
	Gain knowledge in destruction and protection of metals for engineering applications.

Course Outcome	The students who complete this course successfully are expected to:	Knowledge Level
	CO1: Implement innovative solutions in wastewater treatment process.	K3
	CO2: Familiarize with the applications of polymers in the field of engineering.	K3
	CO3: Identify the synthesis methods of Nanoparticles and their industrial applications	K2
	CO4: Recognize the renewable, non renewable energy and storage devices for domestic and industrial applications.	K3
	CO5: Categorize the metal corrosion in different environment and find out appropriate control techniques to avoid corrosion	K3

Pre-requisites	Nil	

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak													CO/PSO Mapping		
COs	Programme Outcomes (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2	PSO 3
CO 1	3	3	3	2	1	2	2	2					1	1	2
CO 2	3	2	2	2		2	2	1					2	2	2
CO 3	3	2	2	3	2	1	2	1					2	1	1
CO 4	3	3	2	2	1	1	3	2					3	2	2
CO 5	3	3	3	2	1	2	2	1					2	1	2

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III
2. Assignment
3. End-Semester examinations

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Indirect	
1. Course - end survey	

Content of the syllabus

Unit - I	WATER TECHNOLOGY	Periods	9

Introduction-sources and impurities in water-soft and hard water- water quality parameters.Types of hardness. Determination of hardness by EDTA method. Domestic water treatment. Boiler feed water –requisites, scale and sludge formation in boilers-caustic embrittlement- boiler corrosion- treatment of boiler feed water. Internal conditioning (carbonate, phosphate, and calgon conditioning) ,external conditioning – ion exchange process, zeolite process, Electrodialysis. Brackish water –water purification by reverse osmosis.

Unit - II	POLYMER CHEMISTRY	Periods	9

Introduction - occurrence, definitions – functionality - degree of polymerization- classification of polymers – structure (linear, branched & network polymer structure) block, random & graft copolymers, tacticity, Tg (Factors influencing Tg), molecular weight - number and weight average method. Types of polymerizations - addition, condensation and copolymerization. Mechanism of polymerization (Free radical). Preparation, properties and applications of PE, nylon6, nylon 66, Poly Urethane, poly isoprene and Vulcanization of rubber, TEFLON ,PET, and Bakelite

Unit - III	NANO CHEMISTRY	Periods	9

Basics- distinction between molecules, nanoparticles and bulk materials; size dependent properties. Nanoparticles: nanocluster, nanorod, nanotube (CNT) and nanowires. Synthesis: Top down process- laser ablation,spray pyrolysis, chemical vapour deposition, electro deposition. Bottom up process- precipitation, sol-gel, thermolysis - hydrothermal, solvothermal -properties and applications of nano materials in medical and electronic devices.

Unit - IV	ENERGY RESOURCES AND STORAGE DEVICES	Periods	9

Non renewable energy - nuclear energy, nuclear reaction and its types; Nuclear power plant and its working (light water nuclear power plant & breeder reactor).Renewable energy and its sources - solar Energy - photo voltaic cells-working of photovoltaic cell, recent advances in solar cell materials; wind energy - types of wind power plants (WPPs), components and working of WPPs.
Batteries and fuel cells: types of batteries -alkaline battery, lead storage battery, Ni-Cd battery, lithium battery, fuel cell - H_2-O_2 fuel cell-applications.

Unit - V	CORROSION AND ITS CONTROL	Periods	9

Introduction, types of corrosion - chemical and electrochemical corrosion, mechanism, pilling -bedworth rule, types of electrochemical corrosion – galvanic corrosion, pitting corrosion, crevice corrosion, corrosion on wire fence and pipeline corrosion, factors influencing rate of corrosion. Corrosion control methods – sacrificial anode and impressed cathodic current. Protective coatings – paints: constituents and functions, metallic coatings - steps involved in cleaning the surface for electroplating, electroplating (Au), and electro less plating (Ni).

	Total Periods	45

Text Books

1.	Dr.S.Mageswari, Dr.K.Balachandran, M.S.Viswaksenan, Engineering Chemistry : First Edition, RK publication, Edition-2022.
2.	O.G.Palanna, "Engineering Chemistry "Tata Mc GrawHill PVT,Ltd. Second Edition -2017

References

1.	P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, DhanpatRai Publishing company (P) Ltd, New Delhi, 2018.
2.	Arun Bahl, B.S. Bahl, G.D. Tuli, "Essentials of Physical Chemistry" Published by S. Chand & Company Ltd, 2014
3.	Sashi Chawla, Dhanpat Rai & Co (pvt.)Ltd."Engineering Chemistry" Edition- 5- 2013.
4.	Dr.S.Vairam ,Dr.Suba Ramesh, "Engineering Chemistry" First Edition, Wiley publication,Reprint-2016

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Engineering for Women,
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E-Resources	
1.	https://www.who.int/water_sanitation_health/dwq/arsenicun6.pdf
2.	https://www.schandpublishing.com/books/tech-professional/applied-science/a-textbook-polymer-chemistry/9788121941129/#.XdZ214MzY2w
3.	https://www.elsevier.com/books/nanochemistry/klabunde/978-0-444-59397-9

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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
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Elayampalayam, Tiruchengode – 637 205

Programme	B.E./B.Tech		Programme Code		Regulation	2023
Department	Common to CSE,IT,BT,CST branches				Semester	II

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23EE201	Basic Electrical and Electronics Engineering	3	0	0	3	40	60	100

Course Objective	The students should made to • Introduce the basics of electric circuits and analysis • Impart knowledge in the basics of working principles and application of electrical machines • Learn the electrical wiring methods • Analyze the characteristics of Semiconductor devices • Educate on the fundamental concepts of digital electronics and introduce the functional elements and working of measuring instruments

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1:Understand the basics of electric circuits and type of the connection	K2
	CO2: Understand the basics of electromagnetic laws and basic working principle of DC and AC machines.	K2
	CO3: Understand the concepts of tariff, energy saving, illumination, electric lamps and safety measures.	K2
	CO4: Understand the basic operating characteristics of semiconductor devices.	K2
	CO5:Understand the fundamentals of digital logics and measuring instruments	K2

Pre-requisites	Basic concepts and understanding of magnetic fields

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong. 2 – Medium, 1 - Weak

COs	Programme Outcomes (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2	PSO3
CO 1	3	2	1					1				3	3		2
CO 2	3	2	1					1				3	3		2
CO 3	3	1	1					1				3	3		3
CO 4	3	2	1					1				3	3		2
CO 5	3	2	1					1				3	3		2

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III
2. Assignment
3. End-Semester examinations

Indirect
1. Course –end Survey

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Content of the syllabus

Unit – I	INTRODUCTION OF ELECTRICAL CIRCUITS	Periods	9

Definition of Voltage, Current, Power, Energy, Power factor, Circuit parameters, Ohm's law, Kirchhoff's law Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Real power, Reactive power and Apparent power, Power factor. Introduction to three phase systems - types of connections Concept of DC circuits.

Unit - II	ELECTRICAL MACHINES AND ITS APPLICATIONS	Periods	9

Faraday's laws of electromagnetic induction - Lens law - Fleming's left hand rule and Right hand rule. Working principle and construction of AC and DC machines - Construction, Working principle and Applications of single phase Transformer. Motor used for domestic applications.

Unit – III	WIRING AND ILLUMINATION	Periods	9

Types of wiring-staircase and corridor wiring - wiring accessories. Different types of safety measures - Earthing. Electrical tariff -Energy conservation. Simple layout of power system-various energy resources, The Laws of Illumination- Different types of electrical lamps.

Unit - IV	SEMICONDUCTOR DEVICES	Periods	9

PN junction diodes - Zener diodes - characteristics. Transistors: PNP and NPN transistors - Theory of operation - Transistor configurations -characteristics - comparison. Special semiconductor devices: FET - SCR - LED – V-I characteristics – Rectifier and Inverters -UPS – SMPS.

Unit – V	DIGITAL FUNDAMENTALS AND MEASUREMENTS	Periods	9

Number systems - Boolean Theorems – DeMorgan's Theorem - Logic gates -Implementation of Boolean Expression using Gates - SOP and POS forms- Functional elements of an instrument, Standards and calibration, Operating Principle of Ammeters and Voltmeters.

		Total Periods	45

Text Books

1.	S.K.Bhattacharya, "Basic Electrical and Electronics Engineering",Pearson,2017
2.	D.P. Kotharti and I.J Nagarath, "Basic Electrical and Electronics Engineering", Mc Graw Hill, Third Edition, 2020.

ferences

1.	S.B. Lal Seksena and Kaustuv Dasgupta, "Fundaments of Electrical Engineering", Cambridge, 2016
2.	Mittle,Mittal, Basic Electrical Engineering, 2nd Edition, Tata McGraw-Hill Edition, 2016.
3.	T.K. Nagsarkar and M.S. Sukhija, "Basic Electrical Engineering", Oxford, 2017.
4.	John Bird, "Electrical and Electronic Principles and Technology", Fourth Edition, Elsevier, 2010.
5.	K MurugeshKumar, "Elements of Electrical Engineering", Vikas Publishing House Pvt. Ltd.2011.

E-Resources

1.	https://nptel.ac.in/courses
2.	https://www.electrical4u.com/electrical-engineering-articles/illumination-engineering/
3.	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/lecture-notes
4.	https://www.google.co.in/books/edition/_/4nJROSC7iK8C?hl=en&gbpv=1

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Programme	B.TECH		Programme code		105	Regulation		2023
Department	**Biotechnology**				Semester			II

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23TA202	**தமிழரும் தொழில் நுட்பமும்/ TAMILS AND TECHNOLOGY**	1	0	0	1	40	60	100

	Content of the syllabus			
அலகு 1	**நெசவு மற்றும் பானைத்தொழில்நுட்பம்**		**Periods**	**3**

சங்ககாலத்தில் நெசவுத்தொழில்– பானைத்தொழில்நுட்பம் – கருப்புசிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு 2	**வடிவமைப்பு மற்றும் கட்டிடத்தொழில்நுட்பம்**		**Periods**	**3**

சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு – சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள்–மாமல்லபுரச்சிற்பங்களும் கோவில்களும் – சோழர்காலத்துப் பெருங்கோயில்கள் மற்றும் பிறவழிபாட்டுத்தலங்கள் – நாயக்கர்காலக்கோயில்கள்-மாதிரிகட்டமைப்புகள் பற்றி அறிதல் மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக்கட்டிடக்கலை.

அலகு 3	**உற்பத்தித் தொழில்நுட்பம்**		**Periods**	**3**

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத்தொழிற்சாலை – இரும்பை உருக்குதல் எஃகு – வரலாற்றுச்சான்றுகளாக - செம்பு மற்றும் தங்கநாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடிமணிகள் – சுடுமண்மணிகள் – சங்குமணிகள் – எலும்புத்துண்டுகள் – தொல்லியல்சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு 4	**வேளாண்மை மற்றும் நீர்ப்பாசனத்தொழில்நுட்பம்**		**Periods**	**3**

அணை, ஏரி, குளங்கள் ,மதகு – சோழர்காலக்குமுழித்தூம பின் முக்கியத்துவம் – கால்நடைபராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச்சார்ந்த செயல்பாடுகள் – கடல்சார்அறிவு – மீன்வளம் – முத்துமற்றும்முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு –அறிவுசார்சமூகம்.

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அலகு 5	அறிவியல் தமிழ் மற்றும் கணினித்தமிழ்	Periods	3
அறிவியல் தமிழின் வளர்ச்சி – கணினித்தமிழ் வளர்ச்சி – தமிழ்நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மின் பொருட்கள் உருவாக்கம் – தமிழ் இணையக்கல்விக்கழகம் – தமிழ் மின்னூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத்திட்டம்.			
		Total Periods	15

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<table>
<tr><td rowspan="3"></td><td colspan="7">VIVEKANANDHACOLLEGE OF ENGINEERING FOR WOMEN
(Autonomous Institution Affiliated to Anna University Chennai)
Elayampalayam, Tiruchengode – 637 205</td></tr>
</table>

Programme	B.TECH	Programme code		105	Regulation		2023	
Department	**Biotechnology**				Semester		II	

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23TA202	TAMILS AND TECHNOLOGY	1	0	0	1	40	60	100

	Content of the syllabus		
UNIT I	WEAVING AND CERAMIC TECHNOLOGY	Periods	3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) –Graffiti on Potteries

UNIT II	DESIGN AND CONSTRUCTION TECHNOLOGY	Periods	3

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)-Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III	MANUFACTURING TECHNOLOGY	Periods	3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel - Copper and gold- Coins as source of history - Minting of Coins – Beads making - industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV	AGRICULTURE AND IRRIGATION TECHNOLOGY	Periods	3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V	SCIENTIFIC TAMIL & TAMIL COMPUTING	Periods	3

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

		Total Periods	**15**

TEXT-CUM-REFERENCE BOOKS

1	தமிழகவரலாறும் – மக்களும்பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம).
2	கணினித்தமிழ் – முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3	கீழடி – வைகைநதிக்கரையில்சங்கநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4	பொருநை - ஆற்றங்கரைநாகரிகம். (தொல்லியல்வெளியீடு)
5	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

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6	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies
7	Historical Heritage of the Tamils (Dr.S.V.Subaramanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN				
	(Autonomous Institution, Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				

Programme	B.E. / B.Tech.		Programme Code		Regulation	2023
Department	EEE, ECE, BT, BME				Semester	II

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23CS203	Python Programming	3	0	2	4	50	50	100

Course Objective	The student should be made to, • Understand the fundamentals of Python programming • Handle list, tuples, sets and Dictionaries data types • Learn function prototypes and string functions. • Use files and modules for data processing • Understand packages in Python and data visualization

	At the end of the course, the student should be able to,	Knowledge Level
Course Outcome	**CO1:** Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.	K3
	CO2: Perform operations on list, tuples, sets and Dictionaries using python.	K3
	CO3: Implement function prototypes and string functions.	K3
	CO4: Apply files and modules and perform operations on CSV files.	K3
	CO5: Perform data visualization and apply Python packages for CSV files	K3

Pre-requisites	Nil

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 – Weak													CO/PSO Mapping	
Cos	Programme Outcomes (POs)												PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO 1	3	2	1	-	1	-	-	-	-	-	-	2	3	2
CO 2	3	3	1	1	2	-	-	-	-	-	-	2	3	2
CO 3	3	3	1	2	2	-	-	-	-	-	-	2	3	2
CO 4	3	3	1	2	2	-	-	-	-	-	-	2	3	2
CO 5	3	3	1	2	2	-	-	-	-	-	-	2	3	2

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III
2. Assignments / Quiz
3. End-Semester examinations

Indirect
1. Course - End survey

Content of the syllabus

Unit – I	**INTRODUCTION TO PYTHON**	Periods	9

Introduction to Python, features, installing Python, writing and executing Python program — native data types, comments, constants, variables, operators, expression, conditional statements, control statements,

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continue, pass, break.

Unit - II	LISTS, TUPLES, SETS AND DICTIONARIES	Periods	9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Sets: methods and operators, Dictionaries: operations and methods.

Unit – III	FUNCTIONS AND STRINGS	Periods	9

Functions definition, declaration, arguments, parameters – formal and local, parameter passing methods - function prototypes, recursion; Strings: string slices, immutability, string functions and methods, string module, regular expressions.

Unit - IV	FILES AND MODULES	Periods	9

Files and exception: Text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, accessing CSV file.

Unit – V	PACKAGES AND DATA VISUALIZATION	Periods	9

Text processing, Numerical processing: numpy package – mean, medium and mode, pandas package – vector, data frame, data visualization: matplotlib, Time operations.

		Total Periods	45

Suggested List of Experiments

	List of Experiments	CO's
1.	Write a program to demonstrate different number data types in Python.	CO1
2.	Write a program to perform different Arithmetic Operations on numbers in Python.	CO1
3.	Write a program to create, append and remove lists and demonstrate the tuples in python.	CO2
4.	Write a program to demonstrate working with dictionaries in python.	CO2
5.	Write a program to create, concatenate and print a string and accessing sub-string from a given string.	CO3
6.	Write a Python function to calculate the factorial of a number (a non-negative integer). The function accepts the number as an argument.	CO3
7.	Write a program to compute the number of characters, words and lines in a file.	CO4
8.	To write a Python program to find the most frequent words in a text read from a file.	CO4
9.	Find mean, median, mode for the given set of numbers in a list.	CO5
10.	Draw a horizontal bar chart with Matplotlib	CO5

Lecture 45: Practical 30; Total: 75

Text Books

1.	Anurag Gupta,G.P BISWAS ,” Python Programming – Problem solving, packages and Libraries, Edition 1, McGraw Hill, 2019	
2.	E Balagurusamy, "Problem Solving and Python Programming", Edition1, McGraw Hill, 2018	
3.	Reema Thareja, "Python Programming using Problem Solving Approach", OXFORD University Press, 2017.	

References

1.	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.
2.	John V Guttag, — Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press , 2021

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3.	Guido van Rossum (Author), The Python Development Team (Author), An Introduction to Python Tutorial and What's New ,2022,Shroff Publishers first edition
E-Resources	
1.	http://greenteapress.com/wp/think- python/)
2.	https://www.python.org/about/gettingstarted/
3.	https://beginnersbook.com/2018/03/python-tutorial-learn-programming/
4.	https://www.tutorialspoint.com/python/index.htm
5.	https://www.learnpython.org/
6.	https://www.udemy.com/topic/python/free

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Programme	B.Tech.		Programme Code	105	Regulation	2023
Department	Biotechnology				Semester	II

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23EN202	Professional Communication	2	0	3	3	50	50	100

Course Objective	The main objective of this course is to: • Provide suitable reading &writing tasks to develop communicative ability for academic and professional progress • Inculcate channelized reading to make learners proficient in the chosen professional writing contexts. • Improve learners' vocabulary and grammar to supplement their language use at professional contexts • Assist students in the development of intellectual flexibility, creativity, and cultural literacy so that they may engage in life-long learning. • Identify and begin to apply the language features of academic and professional writing and speaking

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Acquire sufficient command over language to speak at an academic or professional context	K1
	CO2: Write technically well at professional contexts through exposing them to similar readings.	K1
	CO3: Use language at length at technical and professional situations through enrichment of vocabulary and strengthening of grammatical knowledge.	K2
	CO4: Ethically gather, understand, evaluate and synthesize information from a variety of written and electronic sources.	K2
	CO5: Be proficient in oral communication and writing.	K3

Pre-requisites	Nil	

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

CO/PSO Mapping

Cos	Programme Outcomes (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1						2			3	3		3		2	
CO 2						2			3	3		3		2	
CO 3						2			3	3		3		2	
CO 4						2			3	3		3		2	
CO 5						2			3	3		3		2	

Course Assessment Methods

Direct
1. Continuous Assessment Test I & II

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| | 2. Continuous Assessment Test III in the Communication Skills Lab |
| 3. Assignments |
| 4. End-Semester examinations |

Indirect

| 1. Course - end survey |

Content of the syllabus

Unit – I		Periods	15

Listening- Listening for Cultural Awareness, Listening to Professional Conversations, Talks, Interviews and Lectures **Speaking-** Developing Confidence to get rid of Fear on the Dias, Discussion at a Corporate Context. **Reading–** Inferential Reading, Reading Short Messages and Technical Articles, **Writing-** Introduction to Letter Writing, Writing Formal and Informal Letters, Thanking Letters, Letters Calling for Quotations, Letters Placing an Order, Seeking clarification, Letters of Complaint. **Focus on Language–**Adjectives and Degrees of Comparisons

Unit – II		Periods	15

Listening- Listening to specific information relating to technical content, Listening for statistical information **Speaking-** Expressing opinions, Formal Discussions, Describing Role Play at Business Context and Consolidating Ideas. **Reading–**Reading Technical Articles in Journals and Comparing Articles. **Writing-** Letter seeking permission to undergo practical training and to undertake project work. **Focus on Language–** Simple, compound and complex sentences and Transformation of Sentences.

Unit – III		Periods	15

Listening- Listening to understand the overall meaning, Listening to Interviews and Presentations. **Speaking-** Giving Instructions and Showing Directions and Rephrasing Instructions. **Reading–** Skimming and Scanning, Reading Job Advertisements. **Writing-** Applying for a Job, Writing a CV. **Group Discussion:** Introduction – Topic Analysis – Thematic Expressions-Objective and content of discussion.

Unit – IV		Periods	15

Listening- Listening and retrieving Information. **Speaking-** Developing fluency and Coherence, Accent Neutralization, Voice Modulation, and Intonation, Improving Voice Quality. **Reading–**Reading and understanding Advertisements. **Writing-** Letters to the Editor, Letter of Complaint, Various kinds of Reports, Permission to go for Industrial visits. **Presentation skills:** Making Self Introduction Effectively-Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Accents analysis – Stylistics.

Unit – V		Periods	15

Listening- Listening to Fragmented Texts and Filling in the Blanks. **Speaking-**Mind Mapping, Developing Coherence and Self-Expression, Making presentations, Paralinguistic and Extra linguistic Features (body language), **Reading–** Predicting content, Interpreting Reports. **Writing-** Writing Proposals, Agenda, Minutes of the Meeting. **Soft Skills:** Introduction - Change in Today's Workplace: Soft Skills as a Competitive Weapon - Antiquity of Soft Skills - Classification of Soft skills - Ability to work as a team.

		Total Periods	75

Text Books

1.	Dr. S. R. Kannan, Sumant. S, Pereira Joyce, Professional Communication, Vijay Nicole Imprints Pvt. Ltd., 2023.
2.	Sokkaalingam, S.RM., The Art Of Speaking, English Versatile Publishing House, 2019.

References

1.	Norman Whitby - Business Benchmark Pre-Intermediate to Intermediate, Students Book, Cambridge University Press, 2008. , 1997.
2.	Dutt, Rajeevan, Prakash .A Course in Communication Skills (Anna University, Coimbatore edition) :. Cambridge University Press India Pvt.Ltd, 2007.
3.	Meenakshi Raman and Sangeeta Sharma-'Technical Communication English Skills for Engineers'; Oxford University Press, 2008.

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4.	S.P. Dhanavel, English and Communication Skills for Students of Science and Engineering, Orient Blackswan Pvt, Ltd, 2009.
5.	Technical English – I & II, Sonaversity, Sona College of Technology, Salem, First Edition, 2012.
E-Resources	
1.	http://www.kalevleetaru.com/Publish/Book_Review_Who_Moved_My_Cheese.pdf
2.	http://www.bookbrowse.com/reviews/index.cfm/book_number/304/who-moved-my-cheese
3.	http://www.imdb.com/title/tt0482629/plotsummary

Programme	B.Tech			Programme Code		105	Regulation		2023
Department	Biotechnology					Semester			II

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23CH202	Chemistry Laboratory	0	0	2	1	60	40	100

Course Objective	The main objective of this course is to: • Gather basic simple acid-base reactions and study the mechanism of acid mixture with base. • Learn pH and potential of hydrogen in a sample solution. • Study the redox reaction through potential difference. • Infer iron forms complex with thiocyanate. • Gather knowledge on hardness producing salts and removal of hardness through estimation. • Collect data required for dissolved oxygen present in water sample. • Understand alkalinity and available chlorine present in water sample.

Course Outcome	The students who complete this course successfully are expected to:	Knowledge Level
	CO1: Infer knowledge on neutralization reaction between acid, acid mixture with base and identify the concentrations.	K3
	CO2: Identify the concentration of sample using pH.	K3
	CO3: Spot the concentration of sample solution through redox reaction by potentiometric method	K4
	CO4: Estimate Iron by complexation reaction spectrometric ally.	K4
	CO5: Determine hardness and dissolved oxygen present in domestic water supply and Identify alkalinity and available chlorine present in the given sample.	K4

Pre-requisites	Nil

CO / PO Mapping														CO/PSO Mapping		
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak																
COs	Programme Outcomes (POs)													PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12		PSO1	PSO 2	PSO 3
CO 1	3	3		2	2	1	1							2	2	2
CO 2	3	3		2	2	2	2							2	1	2
CO 3	3	3		2	2	1								1	2	2
CO 4	3	3	1	2	2	1								2	2	
CO 5	2	3	1	2		2	3							2	2	

Course Assessment Methods

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Direct
1. Pre lab and Post lab
2. Execution of Experiment and Viva-voce
3. End semester examination

Indirect
Course - end survey

Content of the syllabus

S.No	Name of the Experiment	Course Outcome
1.	Estimation of HCl using NaOH by Conductometric titration	CO1
2.	Estimation of Mixture of acid [standard HCl+ unknown CH_3COOH] using NaOH by Conductometric titration.	CO1
3.	Estimation of Barium Chloride using sodium sulphate by Conductometric precipitation titration	CO1
4.	Determination of HCl using NaOH by pH metry	CO2
5.	Estimation of Ferrous iron by Potentiometric titration.	CO3
6.	Estimation of Ferric ion by Spectrophotometry	CO4
7.	Determination of Total, Temporary and Permanent hardness of water by EDTA method.	CO5
8.	Estimation of Dissolved Oxygen content in water by Winkler's method	CO5
9.	Estimation of Alkalinity in water sample.	CO5
10.	Estimation of available Chlorine in bleaching powder.	CO5
	Total Periods	30

Lab Manuals suggested:

1	Chemistry laboratory I & II by Dr.A.Ravikrishnan,Sri Krishna Pub,Revised Edition-2017
2	Chemistry laboratory Manual by Dr.Veeraiyan, Revised Edition-2017

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Programme	B.Tech.			Programme Code	105	Regulation		2023
Department	Biotechnology					Semester		II

Course Code	Course Name	Periods Per Week			Credit		Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23GE204	Engineering Practices Laboratory	0	0	3	1	60	40	100

Course Objective	The main objective of this course is to: The students should made to 1. Know the plumbing line assemblies. 2. Weld lap joint, butt joint and T-joint. 3. Learn the assembling and dismantling methodology of home appliances. 4. Learn the resistor value identification through colors coated on resistor. 5. Learn the basics of signal generation in CRO. 6. Learn the soldering techniques in PCB board for designing the projects.

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Perform basic machining operations and finish the job to the requirements and quantify the accuracy.	K2
	CO2: Make various joints such as cross lap joint and Tee lap joint in the carpentry.	K2
	CO3: Understand the basics of house wiring techniques and the measurements of basic electrical quantities.	K2
	CO4: Understand the resistor value identification through colors coated on resistor.	K2
	CO5: Understand the soldering techniques in PCB board for designing the projects.	K2

Pre -requisites	Nil

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak													CO/PSO Mapping		
	Programme Outcomes (POs)												PSOs		
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	3	2	2	-	-	-	2	-	-	-	2	2	-
CO 2	3	2	3	2	2	-	-	-	2	-	-	-	3	2	-
CO 3	3	2	2	3	2	2	-	-	2	-	-	-	2	-	-
CO 4	3	2	2	3	2	2	-	-	2	-	-	-	2	3	-
CO 5	3	2	3	3	2	2	-	-	2	-	-	-	3	-	-

Course Assessment Methods

Direct

1.Pre lab and Post lab

2.Record mark

3.End- Semester Examinations

Indirect

1.Course –End survey

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Content of the Syllabus	
GROUP A **(CIVIL & MECHANICAL ENGINEERING)**	
CIVIL ENGINEERING PRACTICE:	**COs**
1.Plumbing: a) Single Tap G.I / PVC pipe connection involving the fitting like valves, taps & bends. b) Two Tap G.I / PVC pipe connection involving the fitting like valves, taps & bends.	CO2
2.Carpentry: a) To make a Cross Lap Joint from the given work piece. b) Preparation of ' T' Lap Joint from the given work piece.	CO2
MECHANICAL ENGINEERING PRACTICE:	
3.Welding: a) To join the metal plates by a Butt Joint in arc welding machine. b) To join the metal plates by a Lap Joint in arc welding machine.	CO1
4.Basic Machining: a) To perform simple facing & turning operation. b) To perform of step turning operation.	CO1
5.Sheet Metal: a) To make a rectangular tray from the given sheet metal. b) To make a basket from the given sheet metal.	CO1
STUDY EXPERIMENT: 6. Study of 3D Printing machine and its applications. 7. Study of CO_2 Laser engraving & cutting machine and its applications. 8. Study of Wood routing machine and its applications.	CO1
GROUP B **(ELECTRICAL & ELECTRONICS ENGINEERING)**	
ELECTRICAL ENGINEERING PRACTICE	
1. Residential house wiring and stair case wiring using switches, fuse, indicator & lamp.	CO3
2. LED lamp assembly.	CO3
3. Measurement of voltage, current, power & power factor using R-Load.	CO3
4. Measurement of energy using single phase meter.	CO3
5. Measurement of resistance to earth of electrical equipment.	CO3
ELECTRONICS ENGINEERING PRACTICE	
1. Study of Electronic components and equipment's – Resistor color-coding, Inductor, Capacitor and CRO.	CO4
2. Logic gates AND, OR, NOR, NAND and NOT.	CO4
3. Generation of Clock Signal.	CO4
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.	CO5
Total Periods	**45**
Reference Book :	
1. Dr.P.Kannan, Mr.T.Satheeskumar & Mr.K.Rajasekar, "Engineering Practices Laboratory" Manual. First Edition, 2017.	
2. Mr.T.Jeyapoovan, Mr.M.Saravana Pandian, "Engineering Practices Lab" Manual, Vikas Publishing House Pvt Ltd, 2017.	

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Programme	B.Tech.			Programme Code	105	Regulation		2023
Department	Biotechnology					Semester		II

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23MCFY2	**Indian Constitution**	2	0	0	0	100	NA	100

Course Objective	The main objective of this course is to: i) To know about the basic structure of Indian constitution. ii) To know about our Central Government Executive system of India iii) To know about our State Government Executive system of India iv) To learn the Election system, Amendments and Emergency Provisions given by the constitution. v) To know about the Special Constitutional Provisions in India

Course Outcome	At the end of the course, the student should be able to,	Knowledge level
	• Understand the functions of the Indian government	K1
	• Know about our Central Government, political structure & codes, procedures	K1
	• Understand our State Executive & Elections system of India.	K1
	• Remember the Election system, Amendments and Emergency Provisions given by the constitution.	K2
	• Understand our Special Constitutional Provisions in India	K2

Pre-requisites	----

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak													CO/PSO Mapping		
COs	Programme Outcomes (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1						3		3	2						
CO 2						3		3	3						
CO 3						3		3	2						
CO 4						3		3	3						
CO 5						3		3	3						

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Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III   2. Assignment
Indirect
Course - end survey

Content of the syllabus

Unit – I	INTRODUCTION	Periods	6
Historical Background – Constituent Assembly of India – Fundamental Rights – Citizenship – Constitutional Remedies for citizens			
Unit - II	STRUCTURE AND FUNCTION OF CENTRAL	Periods	6
Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India			
Unit – III	STRUCTURE AND FUCTION OF STATE	Periods	6
State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts			
Unit - IV	ELECTION PROVISIONS, EMERGENCY PROVISIONS, AMENDMENT OF THE CONSTITUTION	Periods	6
Election Commission of India-composition, powers and functions and electoral process. Types of emergency-grounds, procedure, duration and effects. Amendment of the constitution- meaning, procedure and limitations.			
Unit – V	SPECIAL CONSTITUTIONAL PROVISIONS	Periods	6
Directive Principles of State Policy: Importance and its relevance. Special Constitutional Provisions for Schedule Castes, Schedule Tribes & Other Backward Classes, Women & Children.			
		Total Periods	30

Text Books

1.	Durga Das Basu, "Introduction to the Constitution of India ", Prentice Hall of India, New Delhi.
2.	The Constitution of India (Coat Pocket Edition) by Gopal Sankaranarayanan - 17th Edition. (2024)

References

1.	R.C.Agarwal, (1997) "Indian Political System", S.Chand and Company, New Delhi.
2.	M.Laksmikanth, Indian polity, Tata mchraw hill publications.

E-Resources

1.	https://mhrd.gov.in/
2.	https://niti.gov.in/content/niti-aayog-library
3.	www.drishtiias.com/

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SEMESTER III

Programme	B.TECH		Programme Code	105	Regulation	2023
Department	Bio Technology				Semester	III

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23MA303	**Transforms and Partial Differential Equations**	3	1	0	4	40	60	100

Course Objective	The Main Objective of the course is - To solve boundary value problems by using Fourier series. - To introduce the basic concepts of PDE for solving standard partial differential equations. - To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations. - To acquaint the student with Fourier transform techniques used in wide variety of situations. - To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

Course Outcome	At the end of the course, the student should be able to,	Knowledge level
	CO1: Understand the concepts of Fourier series which plays a vital role in engineering applications.	K4
	CO2: Understand how to solve the given standard partial differential equations.	K4
	CO3: Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.	K5
	CO4: Understand the mathematical principles on transforms which will provide them the ability to formulate and solve some of the physical problems of engineering.	K5
	CO5: Use Z transform techniques for analyzing discrete time systems.	K3

Pre-requisites	-

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak													**CO/PSO Mapping**		
COs	Programme Outcomes (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2		1	1								2		
CO 2	3	2	1	1									2		
CO 3	3	2	1		1								2		
CO 4	3	2	1	1									2		
CO 5	3	2	1	1	1								2		

Course Assessment Methods

Direct

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1. Continuous Assessment Test I, II & III
2. Assignment
3. End-Semester examinations

Indirect

1. Course - end survey

Content of the syllabus

Unit – I	FOURIER SERIES	Periods	9+3

Dirichlet's conditions – General Fourier series – Change of interval – Odd and even functions – Half range Sine series – Half range Cosine series – Harmonic analysis.

Unit - II	PARTIAL DIFFERENTIAL EQUATIONS	Periods	9+3

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of Standard types of first order partial differential equations -Lagrange's linear equation – Solution of homogeneous linear partial differential equations of higher order with constant coefficients.

Unit – III	APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	Periods	9+3

Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two dimensional heat equation (excluding insulated edges).

Unit - IV	FOURIER TRANSFORM	Periods	9+3

Fourier Integral theorem (without proof) – Fourier transform pair – Properties (without proof) – Transforms of simple functions – Fourier Sine and Cosine transforms – Properties (without proof) – Convolution theorem and Parseval's identity (Statement and applications only).

Unit – V	Z –TRANSFORM	Periods	9+3

Definition – Z-transform of some basic functions – Elementary properties – Inverse Z-transform: Partial fraction method –Initial and Final value theorem- Convolution theorem – Applications of Z-transforms: Solution of difference equations.

		Total Periods	45+15=60

Text Books

1.	Grewal B.S., "Higher Engineering Mathematics", 45th Edition, Khanna Publishers, Delhi, 2024.
2.	Churchill, R.V. and Brown, J. W., Fourier series and boundary value problems.(8th Edition), McGraw-Hill, 2011.

References

1.	Veerarajan T, Engineering Mathematics, McGraw Hill Education, 2013.
2.	Kreyszig, E., Advanced Engineering Mathematics (10th Edition), John Wiley (2015).
3.	Ramana.B.V., " Higher Engineering Mathematics" , Tata Mc Graw Hill Publishing Company Limited, New Delhi, 2008.
4.	P.R.Vittal, " Differential equations Fourier and Laplce Transforms", Margham Publishers, 2nd Edition, 1999.
5.	Ray Wylie. C and Barrett.C, " Advanced Engineering Mathematics " Tata Mc Graw Hill Education Pvt Ltd, Sixth Edition ,New Delhi 2012.

E-Resources

1.	https://learnengineering.in
2.	www.learnerstv.com/Free-engineering-Video-lectures
3.	www.nptel.ac.in

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Programme	B.Tech.		Programme Code	105	Regulation		2023
Department	Biotechnology				Semester		III

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23BT302	Microbiology	3	0	0	3	40	60	100

Course Objective	The main objective of this course is to • To have a basic knowledge about the microbial world • Understand the history of microbiology, nomenclature of microorganisms • Identify microbes, their structure, their metabolism • To learn about various techniques to control microbes • Analyze the applications of microbiology in various fields

Course Outcome	Students who complete this course successfully are expected to	Knowledge Level
	CO1.Outline about historical perspective of microbiology	K2
	CO2.Explain the concepts of Identification and multiplication of microorganism	K2
	CO3.Interpret the microbial requirements, growth and its metabolism	K2
	CO4.Make use of physical, chemical and biological methods to control microorganism	K3
	CO5. Illustrate the role of microbes and microbial products in various fields	K3

Pre-requisites	-

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	1	1	3		3	1				1	3	2	3
CO 2	3	1	1	1	3		3	3				2	3	2	3
CO 3	3	3	3	3	3		3	3				2	3	2	3
CO 4	3	3	3	2	3		3	3				2	3	2	3
CO 5	3	3	3	2	3		3	3				3	3	3	3

Course Assessment Methods
Direct
1. Continuous Assessment Test I, II & III
2. Assignment & Quiz
3. End-Semester examinations

Indirect
1. Course - end survey

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Content of the syllabus			
Unit – I	INTRODUCTION	Periods	8
Scope of microbiology, History of microbiology, Whittaker five kingdom classifications, nomenclature of microorganism, Identification of microbes, Principle and applications of Light and electron microscope; Principles of different staining techniques like gram staining, acid fast, capsular staining, flagellar staining.			
Unit - II	STRUCTURE AND MULTIPLICATION OF MICROBES	Periods	10
Structural organization and multiplication of microbes-bacteria, viruses, algae, fungi, bacteriophage (TMV); actinomycetes and mycoplasma. Nutrition based classification of microbes.			
Unit – III	MICROBIAL NUTRITION, GROWTH RATE AND METABOLISM	Periods	9
Nutritional requirements of different media used for bacterial culture; Cultivation of pure culture, Colony morphology study on bacteria growth curve. Factors affecting growth and different methods to quantitative bacterial growth. Microbial metabolism (aerobic and anaerobic respiration, photosynthesis);Nitrogen fixation.			
Unit - IV	CONTROL OF MICROORGANISMS	Periods	9
Physical and chemical control of Microorganisms-Sterilization and disinfection- Dry heat, Moist heat, Filtration, Pasteurization, Radiation, Ultrasound and Various chemical agents. Techniques to preserve microorganisms, Drinking water microbe and treatment, Preservation of food.			
Unit – V	APPLICATION OF MICROBIOLOGICAL APPROACH	Periods	9
Bio gas, role of Bio-fertilizers and bio-pesticides; bioremediation; leaching of ores by microorganisms; microorganisms in pollution control; Interaction between microorganisms – Synergism, Mutualism (symbiosis), Host-microbe interactions, antimicrobial drugs - mode of action and drug resistance.			
		Total Periods	45

Text Books

1.	Michael J. Pelczar, Noel R. Krieg. Microbiology, 5th Edition, Affiliated East West Press Private Limited New Delhi, 2023
2.	Prescott L.M., Harley J.P and Klein D.A. Microbiology, Wm. C. Brown Publishers, 2007

References

1.	Ray B and BhuniyaA. Fundamental Food Microbiology, (5thEdn.) CRC Press, USA, 2013.
2.	Talaron K.,Talaron A. Casita., Pelczar and Reid, Foundations in Microbiology, W.C.Brown Publishers, 2005.
3.	Cruger,Wulf and AnnelieseCrueger, Biotechnology: A Textbook of Industrial Microbiology, (3rd Edn)Panima Publishing, 2017.

E-Resources

1.	https://microbiologysociety.org/
2.	https://www.britannica.com/science/microbiology
3.	https://microbiologyonline.org/about-microbiology

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN						
	(Autonomous Institution Affiliated to Anna University Chennai), Elayampalayam, Tiruchengode – 637 205						

Programme	B.Tech.		Programme Code	105	Regulation	2023
Department	Biotechnology				Semester	III

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23BT303	Cell Biology	3	0	0	3	40	60	100

Course Objective	The student should be made to, • Understand the structure and functions of cellular components. • Articulate the events of the cell cycle and its regulatory mechanisms. • Categorize the mechanisms and regulation of membrane transport across cells. • Analyze the cell signaling pathways and signal transduction. • Categorize the types, characteristics, and management of cell lines and cultures.

Course Outcome	At the end of the course, the student should be able to,	KL
	CO1: Identify and explain the structure and function of major cellular components and their roles in cellular processes.	K2
	CO2: Integrate the stages of the cell cycle and the mechanisms that control cell cycle progression.	K3
	CO3: Distinguish the types and roles of membrane transport mechanisms.	K4
	CO4: Correlate the regulation of signal transduction at various levels.	K4
	CO5: Classify, characterize, generate, and manage cell lines and cultures, including contamination control and three-dimensional culture techniques.	K4

Pre-requisites	-

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

COs	Programme Outcomes (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	2		2	3							3	2	3
CO 2	3	2		2		3		2	2	2	2	2	2	3	2
CO 3	3	2	3		2								2	3	3
CO 4	3				3								2	3	3
CO 5	2				3			2		2	2	2	3	3	2

Course Assessment Methods
Direct
1. Continuous Assessment Test I, II & III
2. Assignment & Quiz
3. End-Semester examinations
Indirect
1. Course - end survey

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Content of the syllabus				
Unit – I	CELL STRUCTURE AND FUNCTIONS		Periods	9

History & Discovery of Cell - Cell Theory – Types of Cell – Structural organization of Prokaryotic and Eukaryotic Cells – Structure & Function of Cell Organelles: Nucleus, Cytoplasm, Plastids, Chloroplast, Endoplasmic Reticulum, Golgi Body, Peroxisomes, Lysosomal and Vacuolar membrane – Cytoskeleton: Structure and Composition – Microfilaments, Intermediate Filaments, Microtubules – Extracellular Matrix

Unit - II	CELL CYCLE AND ITS CONTROL		Periods	9

Nuclear Division – Cell cycle – Amitosis, Mitosis, Meiosis – Cytokinesis – Molecules controlling cell cycle – Cyclins, CDK, Regulation of Cell Cycle – Cell Cycle Check Points

Unit – III	MEMBRANE TRANSPORT		Periods	9

Classes of Membrane Transport Proteins – Lactose Permease –ATP Dependent Proton Pump: P Class, F Class, V-Class, ABC Superfamily – Transporters: cotransporters, Types: Symport, Antiport, Transport Process: Passive Diffusion, Primary Active Transport, Secondary Active Transport – Endocytosis & Exocytosis – Entry of virus into cells

Unit - IV	SIGNAL TRANSDUCTION		Periods	9

Cell signaling & its stages – Signal Transduction – Signal Amplification – Mechanism of action of cytosolic receptors - Structural Organization of Nuclear Receptor Estrogen receptor - Second Messengers: c AMP: Structure, Function, Mechanism and Regulation, Application - G Protein: Types – Heterotrimeric G Protein, Small G Protein, Role of G Protein in Signal Transduction, GPCR -- Structure, Role, Classification, Mechanism of Action

Unit – V	CELL CULTURE		Periods	9

Definition – Types of cell culture – Cell line and its classification, Features, Characteristics, and Requirements of the Cell line – Characterization of the cell line – Techniques for cell line generation: LEAP -- Contamination of cell culture – Source, Route cause, and its Prevention – Methods to monitor contamination – Procedures for disposal of contaminated culture – Three-Dimensional Culture – Role of matrix in Cell Growth

			Total Periods	45

Text Books

1.	Darnell J, Lodish H, Baltimore D, "Molecular Cell Biology", W.H. Freeman and Co 8th edition 2016
2.	Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., and Walter, P, "Molecular Biology of the Cell", 6th Edition, Garland Science., New York, 2014

References

1.	Lodish H, Berk A., Kaiser CA., Krieger M, Bretscher A., Ploegh H, Amon A and Scott MP. 'Molecular Cell Biology". W H Freeman & Co, New York, 1150p, 2012
2.	Nelson D.L and M.M. Cox. "Lehninger Principles of Biochemistry", 7th Edition, W. H. Freeman and Company, New York, USA. p.1328, 2017
3.	Rastogi, S C., "Cell and Molecular Biology", 3rd edition, New Age International Publishers, 2010
4.	Voet, D. and Voet, J. G, "Biochemistry" 4th edition, Wiley, 2004
5.	Karp, G. "Cell and molecular biology: Concept and experiment". 6th edition, Wiley, 2009

E-Resources

1.	https://archive.nptel.ac.in/courses/102/103/102103012/
2.	https://archive.nptel.ac.in/courses/102/106/102106025/

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Programme	B.Tech.		Programme Code	105	Regulation	2023
Department	Biotechnology				Semester	III

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Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23BT304	**Thermodynamics for Biotechnologists**	3	0	0	3	40	60	100

Course Objective	The learners are able to 1. Learnt about basic thermodynamic relations and properties of fluids. 2. Understand the phase and chemical reaction and concepts of biochemical thermodynamics. 3. Classify the various laws of thermodynamics involving in biological process. 4. Differentiate chemical thermodynamics and biological thermodynamics. 5. Equip the students for design of various equipment's

Course Outcome	At the end of the course, the student should be able to,	KL
	CO1: Understand the basic laws of thermodynamics	K1
	CO2: Compare the various thermodynamic properties of solutions and pure fluids	K2
	CO3: Analyze heat effect with and without phase change	K4
	CO4: Apply the concept of chemical reaction equilibria and equilibrium conversion	K3
	CO5: Understand the bioenergetics and thermodynamics of biochemical reactions	K2

Pre-requisites	-

CO / PO Mapping   CO/PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	1	2	2	2					1	2	1	3	3	2
CO 2	3	2	2	2	3					2	3	1	2	2	2
CO 3	2	1	2	1	3	2				1	2	2	3	2	3
CO 4	2	2	1	2	2	2				2	2	1	2	3	2
CO 5	2	2	1	2	3	2				1	1	2	2	2	3

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III
2. Assignment

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Engineering for Women,
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3.	End-Semester examinations

Indirect

1.	Course - end survey

Content of the syllabus

Unit – I	INTRODUCTION TO THERMODYNAMICS	Periods	9

Generalized concept of Thermodynamics- Law of Thermodynamics, Enthalpy, Entropy, Free energy & Chemical Equilibria - Higher energy bonds & Compounds

Unit – II	SOLUTION THERMODYNAMICS	Periods	9

Volumetric properties of pure liquids - Ideal gas law -law of corresponding state, Partial molar properties - concept of chemical potential and fugacity in solutions - activity - activity coefficients –Gibbs-Duhem equations

Unit – III	BASICS OF HEAT AND ITS APPLICATIONS	Periods	9

Heat effects- Heat capacities, equation and charts- Heat effect with and without phase changes-Standard heat of formation and combustion- Heat effect of industrial reaction

Unit – IV	THERMODYNAMICS PROPERTIES OF FLUIDS	Periods	9

Thermodynamics properties of fluids- Maxwell Relation-Thermodynamic relations-Carnot cycle - Third law of Thermodynamics-Enthalpy & Entropy changes in ideal gases

Unit – V	THERMO-BIOENERGETICS	Periods	9

Thermodynamics and energetic of metabolic pathway, Oxygen requirement and Heat generation in aerobic growth, Energy Coupling - Thermodynamics of Oxidation-reduction - Energetics of DNA- Protein Interaction.

		Total Periods	45

Text Books

1.	Sandler S.I, "Chemical and Engineering Thermodynamics", John Wiley,4th edition, 2006.
2.	Royels, JA, "Kinetics and Energetics in Biotechnology", Elsevier, 2006.

References

1.	Smith J.M, Van Ness H.C, Abbot M.M, "Chemical Engineering Thermodynamics", 6th Edition, McGraw-Hill, 2019
2.	Narayanan K.V, "A Text Book of Chemical Engineering Thermodynamics", Prentice Hall India, 2001.
3.	Nag P K, "Engineering Thermodynamics", 3rd Edition, Tata McGraw-Hill, 2017.
4.	Rathakrishnan E, "Fundamentals of Engineering Thermodynamics ,2nd Edition, PHI Learning Pvt. Ltd, 2017.
5.	Christiana D. Smolke, The Metabolic Pathway Engineering Handbook Fundamentals, CRCPress Taylor & Francis Group, 2013

E-Resources

1.	https://nptel.ac.in/courses/102106026/, "Thermodynamics (Classical) for Biological Systems" – Dr. G.K. Suraishkumar, IIT Madras
2.	ncert.nic.in >ncerts> kech106
3.	https://nptel.ac.in/couses/104105040 , "Chemistry and Biochemistry" IIT Kharagpur

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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN							
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Programme	B.Tech		Programme Code	105	Regulation		2023
Department	BIOTECHNOLOGY				Semester		III

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23BT305	BIOCHEMISTRY AND BIOENERGETICS	4	0	0	3	40	60	100

Course Objective	The student should be made to, • Familiarize different types of bio molecules, classifications and its structure. • Acquire knowledge in molecular structures and metabolic reactions. • Generalize theory of nitrogen metabolisms. • Grab knowledge about different types of energy compounds.	
Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Recall the metabolism of carbohydrates through various anabolic and catabolic pathways.	K1
	CO2: Discuss the pathway of various metabolisms related to lipids.	K2
	CO3: Classify different types amino acids and its interconnection pathways	K3
	CO4: Compare the structural properties and mechanism of different nucleic acids.	K4
	CO5: Evaluate the yield of high energy compounds for many metabolic reactions.	K5
Pre-requisites	-	

CO / PO Mapping													CO/PSO Mapping		
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak															
COs	Programme Outcomes (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	3	2	1			2	2	2	3	3	3
CO 2	3		3	2	1	1		1	1	2	3	1	2	2	2
CO 3	3	2	1	3	2		2			2	2	2	3	2	1
CO 4	3	2	3	2	3				1			2	3	3	2
CO 5	3	3	2		2	1	1	2			1	1	3	2	1

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III
2. Assignment/Quiz
3. End-Semester examinations

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Indirect	
1.	Course - End Survey

Content of the syllabus

Unit – I	CARBOHYDRATES & ITS METABOLISM	Periods	9

Types of functional groups, water, pH & buffers, Introduction to bio-molecules, Classification, Functions and Reactions of Carbohydrates - Glycolysis, TCA cycle, Gluconeogenesis, Pentose Phosphate Shunt, Glyoxylate Shunt.

Unit – II	LIPIDS & ITS METABOLISM	Periods	9

Classification, Functions and Reactions of Fatty acids and Glycerol- Saponification, Iodination and hydrogenation - Phospholipids, Glycolipids, Sphingolipids, Cholesterol, Steroids, Prostaglandins. Fatty acid synthesis andoxidation.

Unit – III	METABOLISM OF AMINO ACIDS & PROTEIN	Periods	9

Nitrogen metabolism, Classification, Functions and Reactions of Proteins. Biosynthesis and degradation of all Amino acids. Metabolic disorders and important molecules derived from amino acids, Interconnection of pathways and metabolic regulation.

Unit – IV	NUCLEIC ACIDS & ITS METABOLISM	Periods	9

Classification, Functions and Reactions of Nucleic acids. Purines, Pyrimidines, Nucleoside, Nucleotide, RNA, DNA-Watson-Crick structure of DNA, Reactions, Properties, Nucleoprotein complexes.

Unit – V	BIOENERGETICS	Periods	9

High energy compounds, Electronegative potential of compounds, Respiratory chain (Aerobic and Anaerobic), ATP cycle, Calculation of ATP yield during oxidation of glucose and fatty acids.

	Total Periods	45

Text Books

1.	Nelson D.L and Cox M.M, "Lehninger"s Principles of Biochemistry", 8ᵗʰ Edition, W.H. Freemen & Co., 2021.
2.	Berg J. M, Tymoczko J. L and Lubert Stryer, "Biochemistry", 9ᵗʰ Edition, W.H. Freeman & Co., 2019.

References

1.	Satyanarayana. "Biochemistry", 6ᵗʰ Edition, Elsevier, India, 2021.
2.	Voet D, Voet J. G and Pratt C. W, "Fundamentals of Biochemistry- Life at the Molecular level", 5ᵗʰ Edition, John Wiley & Sons, New Jersey, 2016
3.	McKee T. and McKee J. R, "Biochemistry- The Molecular Basis of Life", 6ᵗʰ Edition, Oxford University Press, London, 2015.
4.	Zubay G L, "Biochemistry", WCB/McGraw-Hill publishers, Iowa, 2015

E-Resources

1.	https://nptel.ac.in/courses/102/105/102105034/
2.	https://web.expasy.org/pathways/
3.	https://www.ncbi.nlm.nih.gov/books/NBK21208/

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
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Programme	B.Tech.		Programme code	105	Regulation	2023
Department	Biotechnology			Semester		III

Course Code	Course Name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23CTCP1	Verbal, Quantitative Aptitude and Reasoning - I	2	0	0	1	40	60	100

Course Objective	The student should be made to, • Identify and begin to apply the language features • Understand the mathematical techniques for solving the real life problems • Use number theory arguments to justify relationships involving divisors, multiples and factoring • Help in preparation of competitive exams

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Use language through acquisition of grammar rules	K2
	CO2: Demonstrate the use of mathematical reasoning by justifying the patterns and relationships	K2
	CO3: Face external competitive exams	K3
	CO4: Solve a question in a fraction of minute using shortcut methods	K3
	CO5:Enhance their problem solving skills and logical Skills	K4

Pre-Requisites	-

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 – Weak

CO/PSO Mapping

COs	Programme Outcomes (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO 1		2		3	2					3		3	3	2	3
CO 2	3	3		2	2					3		3	3	2	2
CO 3	3	3		3	2					3		3	2	3	3
CO 4	3	3		2	3					2		2	3	3	3
CO 5		2		2	2					2		2	3	3	3

Course Assessment Methods
Direct
1. Continuous Assessment Test I, II & III
2. Assignment/Quiz
3. End-Semester Examination
Indirect
1.Course -end survey

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Content of the syllabus			
Unit -I	**VERBAL ABILITY (ERROR SPOTTING)**	Periods	5

CONJUNCTIONS: Error on coordinative conjunction: The seven coordinating conjunctions are (**fan boys**): **for, and, nor, but, or, yet, so, Errors on Subordinate Conjunction** After, although, as soon as, because, before, by the time, in case, now that, since, unless, when, whether or not, while, yet...., **Errors on correlative conjunction** (Either......or, neither......nor, not only.... but also, as....as, both....and, whether.... or, so...as, such...that, the)

CONDITIONAL CLAUSES: Errors on Zero condition, Errors on first condition of If clauses, Errors on second condition of If clauses, Errors on third condition of If clauses

ADVERBS: Errors on conjunctive adverb, Errors on adverbs of frequency, Errors on adverbs of time, Errors on adverbs of manner, Errors on adverbs of place, Errors on adverbs of degree

ADJECTIVES: Errors on descriptive adjectives, Errors on demonstration adjectives, Errors on distributive adjectives, Errors on interrogative adjectives, Errors on numeral, Errors on quantitative adjectives, Errors on proper adjectives, Errors on possessive adjectives

DETERMINERS: Definite Article, Indefinite Article, Quantifying Article – few, many, Possessive Article, (my, your, his, her, its, our, your, their....)

NOUNS: Pronoun, Common Noun, Collective Noun, Abstract Noun, Material Noun

SUBJECT – VERB AGREEMENT:

Singular Subjects and Singular Verbs, Errors on plural subjects with plural verbs, Errors on indefinite pronouns, Errors on compound subjects, Errors on collective noun, Errors on singular or plural verb

Unit–II	**NUMBER SYSTEMS**	Periods	6

NUMBER SYSTEMS (Divisibility Rule, Unit Digit, Remainder Theorem(1 Or -1, Cancellation, Wilson, Fermets), Progressions(Arithmetic, Geometric, Harmonic), Log, Surds And Indices, Simplification)

Unit – III	**AVERAGE AND LCM & HCF PROBLEMS**	Periods	8

AVERAGE (Basic Model, Partial Average, 3. Overall Average, Inclusion/Exclusion of A Value in a Group, Increased or Included or Added or More and Replaced, Substituted, Cricket Based Model, Misread Model, Allegation and Mixture, Mean, Median and Mode, Miscellaneous)

LCM and HCF (Find The LCM, HCF and Its fractions, Product of Two Numbers Model, LCM, HCF with Remainders Model, Smallest/Largest Based Model, Tolling Together Model, HCF Related Questions (Keyword: Distinct, Divided, Equal Number of Rows (Distributed Equally)), Mensuration Related Questions, No. of Pairs Model, LCM, HCF With Ratios Model, Algebraic Expressions Model, Reduce To Lowest Terms

Unit– IV	**RATIO AND PROPORTION**	Periods	5

RATIO (Zig Zag Model, Finding The Individual Component, Coins & Values Based Ratios, Number Based Ratios, Increment/Decrement Based Ratios, Miscellaneous)- PROPORTION (Continuous, Third, Fourth, Mean)

Unit-V	**LOGICAL REASONING**	Periods	6

CODING-DECODING- Types of Coding and Decoding (Letter Coding, Conditional Coding, Crypt arithmetic –Addition, Crypt arithmetic – Subtraction)

BLOOD RELATION (Type 1: Pointing or Introducing, Type 2: Family Tree or Relational Puzzle, Type 3: Coded Relation)

NUMBER SERIES (Pattern 1: Perfect Square Series, Pattern 2: Perfect Cube Series, Pattern 3: Geometric Series, Pattern 4: Ratio series, Pattern 5: Multi Stage Series)

SYLLOGISM (Type 1: BASIC SYLLOGISM, Type 2: Either or Neither nor, Type 3: Only – Only a few)

		Total Periods	30
Text books			
1.	Rajeev Varma, "Fast Track Objective Arithmetics", Arihant Publications, 2024		

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2.	R.S. Aggarwal, "Modern Approach to Logical Reasoning", S Chand Publishing, 2022
3.	SP Bakshi, "Objective General English", Arihant Publications, 2024

References

1.	R.S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", S Chand Publishing, 2013
2.	Dinesh Khattar, "The Pearson guide to Quantitative Aptitude for Competitive Examinations", 3rd edition, 2016
3.	Arun Sharma, "How to Prepare for Logical reasoning for CAT", McGraw Hill Education; 2014
4.	Jaikishan and Premkishan, "How to Crack Test of Reasoning", Arihant Publications,2016
5.	R.S. Agarwal, "A modern Approach to verbal and non-verbal reasoning", S Chand Publishing,2018

E-Resources

1.	Aptitude: https://www.indiabix.com
2.	Reasoning: https://placement.freshersworld.com
3.	Verbal: https://testbook.com

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Programme	**B.Tech**		Programme Code	105	Regulation	**2023**	
Department	**Biotechnology**				Semester	**III**	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23BT306	**Cell & Microbiology Laboratory**	0	0	2	1	60	40	100

Course Objective	The main objective of this course is to • Learn to follow experimental procedures and become proficient at laboratory skills • To learn the staining techniques and culturing of microorganism. • Transfer living microbes using aseptic techniques • To demonstrate various techniques to learn the morphology, identification and propagation of cells and microbes. • Learn how to make careful observations, collect and analyze the obtained data

Course Outcomes	The students who complete this course successfully are expected to:	Knowledge Level
	CO1: Know the various aseptic techniques and sterilization methods	K1
	CO2:Describe the physiology of cells and growth requirements of bacteria	K2
	CO3:Learn various staining techniques to identify the cells & microorganisms	K3
	CO4:Identify the various stages of mitosis	K3
	CO5:Control the growth of bacteria using antimicrobial agents	K4

CO / PO Mapping													CO/PSO Mapping		
(3/2/1 indicates strength of correlation) 3-Strong. 2 – Medium, 1 - Weak															
Cos	Programme Outcomes (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2	PSO 3
CO 1	1	2	2	3	2	3	2	1	3	3	2	2	3	3	2
CO 2	2	2	2	3	1	1	2	2	2	3	3	2	2	3	3
CO 3	3	3	1	3	3	2	1	1	3	3	2	2	3	3	2
CO 4	3	3	3	3	3	3	2	2	3	3	3	2	2	2	3
CO 5	3	3	2	3	3	2	2	3	3	3	3	2	3	3	2

Pre-requisites	Nil

Direct
1. Pre lab and Post lab
2. Execution of Experiment and Viva-voce
3. End semester examination

Indirect
Course - end survey

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List of Experiments

S.No	Name of the Experiment	Course Outcome
1.	Introduction, Laboratory Safety, Use of Equipment; Sterilization Techniques	CO1
2.	Microscopy principle & identification of given plant, animal and bacterial cells	CO1
3.	Staining Techniques Simple, Differential- Gram's Staining, Acid fast staining, Capsular staining, Giemsa, and Leishman Staining	CO2
4.	Staining for different stages of mitosis in Allium cepa (Onion)	CO2
5.	Culture Techniques, Isolation and Preservation of Cultures- Broth: flask, test tubes; Solid: Pour plates, spread plates, streak plates, slants, stabs	CO3
6.	Culturing & Quantification of Microbes from different sources (Soil OR water) using Serial Dilution Technique	CO3
7.	Growth curve observation on bacteria	CO4
8.	Trypan Blue Assay	CO4
9.	Biochemical test	CO4
10.	Antibiotic sensitivity assay	CO5
	Total Periods	**60**

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Programme	B.Tech		Programme Code	105	Regulation		2023	
Department	Biotechnology				Semester		III	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23BT307	Biochemistry Laboratory	0	0	2	1	60	40	100

Course Objective	The student should be made to, • Learn fundamental approaches for experimentally investigating biochemical problems. • Able to extract living cell samples from plants and animals for genetic research

Course Outcomes	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Understand the applicability of biochemical methods to realistic solution and Analyze current biochemical and molecular techniques to plan and carry out experiments.	K1
	CO2: Perform good biochemical laboratory practices.	K2
	CO3: Adapt methods for biochemical analysis.	K3
	CO4: Carry out experiments in biomolecular separations.	K3
	CO5: Learn and understand the principles behind the qualitative and quantitative estimation of biomolecules.	K4

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak													CO/PSO Mapping		
Cos	Programme Outcomes (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO 3
CO 1	3	3	3	3	3	2	2	2	2	2	2	2	3	3	3
CO 2	3	2	3	2	2	2	3	3	3	2	3	2	2	2	2
CO 3	3	2	2	3	2	3	2	2	3	2	3	2	3	2	1
CO 4	3	2	3	2	3	3	3	3	2			2	3	3	2
CO 5	3	3	2	2	2	2	2	2	3			2	3	2	1

Pre-requisites	Nil

Direct
1. Pre lab and Post lab
2. Execution of Experiment and Viva-voce
3. End semester examination

Indirect
Course - end survey

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List of Experiments		
S.No	Name of the Experiment	Course Outcome
1.	Preparation of buffer –titration of a weak acid and a weak base.	CO1
2.	Qualitative tests for carbohydrates – distinguishing reducing from non-reducing sugars and keto from aldo sugars.	CO1
3.	Quantitative method of carbohydrate estimation by DNSA	CO2
4.	Extraction of lipids and analysis by TLC.	CO2
5.	Quantitative method for amino acid estimation using ninhydrin – distinguishing amino from imino acid.	CO3
6.	Protein estimation by Bradford method.	CO3
7.	Protein estimation by Lowry's method.	CO4
8.	Estimation of Cholestrol by Zak's methods	CO4
9.	Estimation of nucleic acids by absorbance at 260 nm	CO4
10.	Enzymatic assay: phosphatase from potato.	CO5
	Total Periods	60

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Programme	B.Tech.		Programme code	105	Regulation		2023
Department	Biotechnology				Semester		III

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23CTCP2	Personality Development	1	0	2	1	60	40	100

Course Objective	The student should be made to, • Equip comprehensive understanding of various psychological and cognitive assessment tools • Analyze, interpret, and apply these tools to improve personal and professional development • Enhance communication • Manage stress effectively

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Enhance Self-Awareness	K2
	CO2: Improve Communication Skills	K1
	CO3: Acquire Better Academic and Life Satisfaction	K2
	CO4: Enhance Problem-Solving Abilities	K3
	CO5: Effective Stress Management	K3

Pre-requisites	-

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 – Weak

COs	Programme Outcomes (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2	PSO3
CO 1						2			2	2		2	1	2	1
CO 2						2			2	2		2	3	3	3
CO 3						2			1	2		2	3	3	3
CO 4						2			2	1		2	3	3	3
CO 5						2			2	1		2	1	1	2

Course Assessment Methods
Direct
1. Self-Assessment
2. Viva-Voce
3. End-Semester Examination
Indirect
1.Course -end survey

Content of the Syllabus

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S. No.	List of Experiments	CO
1.	Rosenberg's and Hare's Self Esteem tool	CO1
2.	Myers Brigg's 16 types of Personality	CO1
3.	Social Functioning scale	CO3
4.	Huebner, Laughlin, Ash, & Gilman's Multidimensional Students Life Satisfaction Scale	CO3
5.	Body language Assessment	CO2
6.	Fleming's VARK Learning Theory, bloom's taxonomy based on learners' queries	CO2
7.	Alexi's Presentation Secrets Assessment	CO2
8.	Deductive and inductive logical reasoning assessment	CO4
9.	Procter and Gamble Assessment Gamified Tests	CO4
10.	Psychometric Test	CO3
11.	Stress buster Assessment	CO5

Total Periods : 30

References

1. Allan Pease, "Body language – how to read other's thoughts by their gestures", Sheldon press, London publication, Tenth Impression 1988
2. Alexei Kapterev, "Presentation Secrets", John Wiley and Sons, 2011

E-Resources

1. https://scales.arabpsychology.com
2. http://DOMWebserver.Hitchcock.org/mbti/
3. https://www.assessmentday.com/free/deductive-reasoning-1/DeductiveFreeTest-Solutions.pdf
4. www.prepinsta.com

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SEMESTER IV

Programme	B.Tech			Programme Code		105	Regulation		2023
Department	Biotechnology						Semester		IV

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23MA408	Biostatistics	3	1	0	4	40	60	100

Course Objective	The main objective of the course is to - Able to understand laws of Probability and the use of Baye's theorem - Proficiently understand the expected value, variance, and higher-order moments of Random variables (for both discrete and continuous types). - Identify and demonstrate suitable sampling and data collection process. - Know about the different non-parametric tests. - Introduce the basic concepts of statistical quality control.

Course Outcome	At the end of the course, the student should be able to,	Knowledge level
	CO1: Apply the concept of probability to find the outcome of random events.	K3
	CO2: Translate the density and distribution functions for discrete and continuous random variables.	K3
	CO3: Apply appropriate modern technology to explore probability/statistical concepts.	K5
	CO4: Use the different types of non parametric tests and the test of randomness.	K4
	CO5: Have the notion of sampling distributions and statistical techniques used in engineering and management problems.	K5

Pre-requisites	-

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak													CO/PSO Mapping		
COs	Programme Outcomes (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	1		1								2		
CO 2	3	2	1	1									2		
CO 3	3	2	1										2		
CO 4	3	2		1									2		
CO 5	3	2	1		1								2		

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III
2. Assignment
3. End-Semester examinations

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
Indirect	
1. Course - end survey	

Content of the syllabus

Unit – I	**INTRODUCTION TO PROBABILITY**	Periods	9+3

Introduction to Probability, Axioms of Probability: Sample spaces and events, axioms of Probability, sample spaces having equally likely outcomes – Conditional Probability and independence- Baye's theorem (without proof) and its applications.

Unit – I	**RANDOM VARIABLES**	Periods	9+3

Random variables, Probability mass function, Probability generating function, moments, moment generating function and their properties-Chebyshev inequality.

Unit - III	**ESTIMATION THEORY**	Periods	9+3

Unbiased estimators- Efficiency- Consistency- Sufficiency- Robustness- Method of moments- Method of maximum likelihood- Interval estimation of means- Differences between means, variations and ratio of two variables.

Unit – IV	**NON- PARAMETRIC TESTS**	Periods	9+3

Introduction-The sign test- The Signed- Rank test- Rank- Sum tests- The U test- The H test- Tests based on Runs- Test of randomness- The Kolmogorov tests.

Unit – V	**STATISTICAL QUALITY CONTROL**	Periods	9+3

Control charts for measurements ($\overline{X}$ and R charts)- Control charts for attributes (p,c and np charts) – Tolerance limits – Acceptance sampling.

	Total Periods	**45+15=60**

Text Books

1.	Montgomery, D.C. and Runger, C.G., Applied Statistics and Probability for Engineers, 7th Edition, Wiley Students Edition, Wiley, 2020.
2.	Ravichandran, J., Probability and statistics for Engineers, 1st Edition, Wiley India Ltd, 2012.

References

1.	Gupta S.C. and Kapoor V.K, Fundamentals of Mathematical Statistics, 12th Edition, Sultan an Sons, 2020.
2.	Devore, J.L., Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage Learning, 2014.
3.	Johnson, R.A., Miller, I. and Freund, J., Miller & Freund's Probability and Statistics for Engineers 9th Edition, Pearson Education, 2016.
4.	Ronald E.Walpole; Raymond H.M.yers; Stiaron L. Myers,"Probability and Statistics for Engineering and the Scientists",Pearson Publishers, 9th Edition,2010.
5.	Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 5th Edition, Elsevier, 2004.

E-Resources

1.	https://online.stanford.edu
2.	www.learnerstv.com/Free-engineering-Video-lectures
3.	www.nptel.ac.in

Programme	B.Tech		Programme Code		105	Regulation	2023
Department	Biotechnology				Semester		IV

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23BT408	Plant & Animal Biotechnology	3	0	0	3	40	60	100

Course Objective	The objective of this course is • To introduce students to cutting edge biotechnologies that can be used for plant, animal and human health and research. • To provide the basics of *Agrobacterium* and applications of plant Biotechnology • In this course students will analyze and discuss the primary literature on plant tissue culture and animal tissue culture. • This course will cover basic cellular and molecular biology techniques and their applications in a real world research.

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Infer the various media used in plant cell culture	K2
	CO2: Identification of plant transformation techniques	K4
	CO3: Gain the knowledge of therapy in animal cell culture	K3
	CO4: Interpret the concepts of micro manipulation technology	K3
	CO5: Application of knowledge in concepts of transgenic plant & animal technology	K2

CO / PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak

CO/PSO Mapping

COs	Programme Outcomes (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O 2	PSO 3
CO 1	2	2			2	3	2			2		2	3	3	3
CO 2	2		1		2			2			2		3	2	2
CO 3	3		2		1	3	2			2		2	3	2	2
CO 4	2			1		3	2	2	2				3	3	2
CO 5	3		2			2		2	2	2		2	3	2	2

Pre-requisites	NIL

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III
2. Assignment
3. End-Semester examinations

Indirect

1. Course - end survey			

Content of the syllabus

Unit – I	**PLANT TISSUE CULTURE TECHNIQUES**	Periods	8

Introduction-Lab Facilities, sterilization methods and nutritional requirements. Protoplast culture, Callus induction, proliferation, shoots differentiation and rooting- Pathways-organogenesis and embryogenesis. Synthetic seeds. Micropropagation-methods, applications and successful examples. Bioreactors for micro propagation. National certification system for TC plants. Cell cultures for production of secondary metabolites. Bioreactors for plant cell cultures.

Unit – II	**PLANT TRANSFORMATION TECHNIQUES**	Periods	10

Introduction- Direct (particle bombardment, PEG mediated transformation, electroporation, silicon carbide fibres) and Indirect gene transfer methods -*Agrobacterium* mediated gene transfer –Ti-plasmid- process of T-DNA transfer and integration- co-integrative and binary vectors, codon optimization, promoters and terminators, selectable markers, reporter genes - analysis and confirmation of transgenic plants -clean gene technology.

Unit – III	**ANIMAL CELL CULTURE TECHNIQUE**	Periods	10

Media for culturing cells and tissues - Chemically defined and serum free media for cell culture; Sterilization of various equipments and apparatus - Cell culture substrates – Animal cell culture; types and methods - Development of cell lines; Development, Maintenance, Preservation and Characterization of animal cells, Scaling up of animal cell cultures – Cell culture as source of valuable products-Protein production by genetically engineered mammalian cell lines, Stem cells and their applications

Unit – IV	**ANIMAL GENE TRANSFER METHODS**	Periods	8

Virus mediated gene transfer method; Biology and Construction of viral vectors like adenovirus, lentivirus, herpes virus, and adeno associated virus, baculovirus , Transfection methods; stable and transient methods.

Unit – V	**APPLICATION OF TRANSGENIC PLANTS & ANIMALS**	Periods	9

Strategies for engineering herbicide resistance- round up ready crops. Genetic engineering approaches for insect resistance – Bt gene and mode of action- Bt crops. Manipulation of Growth hormone; Somatotropic hormone and Probiotics as growth promoters; Ideal characteristics of probiotics; Mode of action and uses of probiotics- Manipulation of lactation -Lactogenesis- galactopoiesis, wool growth and rumen microbial digestive system.

		Total Periods	45

Text Books

1.	Ramadoss, P., Animal Biotechnology: Recent Concepts and Developments, MJb Publishers, Chennai, 1st Edition, 2017.
2.	Davis, D., Animal Biotechnology, National Academic Press, Washington, 1st Edition, 2002.
3.	Chawla, H.S., Introduction to Plant Biotechnology, Science Publishers, 3rd Edition, 2009.

References

1.	Freshney, R. I., Culture of Animal Cells: A manual of Basic technique, John ,Wiley & sons, 2010.
2.	Masters, J.R.W., Animal Cell Culture: Practical Approach, Oxford University Press, New York, 2000.

E-Resources

| 1.	https://nptel.ac.in/courses/102/102/102102033/
2.	https://onlinecourses.swayam2.ac.in/cec20_bt20/preview

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BoS Chairman,
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Vivekanandha College of
Engineering for Women,
Elayampalayam, Tiruchengode - 637 205

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Programme	B.Tech	Programme Code	105	Regulation	2023

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
(Autonomous Institution Affiliated to Anna University Chennai),
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Programme	B.Tech	Programme Code	105	Regulation		2023
Department	Biotechnology		Semester		IV	

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23BT409	Molecular Biology	3	0	0	3	40	60	100

Course Objective	The objectives of this course are 1. To gain conceptual understanding on central dogma of biology. 2. To acquire in-depth knowledge on prokaryotic and eukaryotic genome organization and evaluate the feasibility of gene expression and molecular biology tools.

Course Outcome	At the end of the course, the student should be able to,	KL
	CO1: Understand the composition, structure and characteristics of nucleic acids.	K2
	CO2: Critique the concepts of replication in prokaryotes and eukaryotes.	K4
	CO3: Explain how synthesis of RNA occurs in the cell	K4
	CO4: Describe the mechanism of protein synthesis and localization	K2
	CO5: Articulate applications of molecular biology in the modern world.	K3
Pre-requisites	Cell Biology	

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak													CO/PSO Mapping		
	Programme Outcomes (POs)												PSOs		
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2	PSO 3
CO 1	2	2	2	2	3		1	3	1			1	1	2	1
CO 2	2	3	2	2	2	2		3	2			3	2	3	2
CO 3	3	3	3	3	2	2	2	3	2				2	3	2
CO 4	2	2	2	2	2	1		1	1				2	3	2
CO 5	3	2	3	3	2	2	2		1	3	3	2	2	2	2

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III
2. Assignment
3. End-Semester examinations

Indirect

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1. Course - End survey			

Content of the syllabus

Unit – I	**NUCLEIC ACIDS AND THEIR PROPERTIES**	Periods	9

Introduction to nucleic acids: Nucleic acids as genetic material, Structure and physicochemical properties of DNA and RNA, Primary, Secondary and Tertiary Structure of DNA, DNA supercoiling, Molecular Structure of Genes and Chromosomes, Prokaryotic and Eukaryotic Organization of Chromosomes.

Unit – II	**DNA REPLICATION AND REPAIR**	Periods	9

Overview of Central dogma. DNA replication: Meselson & Stahl experiment, bi–directional DNA replication, Okazaki fragments, Proteomics of DNA replication, Fidelity of DNA replication, Inhibitors of DNA replication, phage replication, Telomere replication in eukaryotes. D-loop and rolling circle mode of replication. DNA Damage and Repair.

Unit – III	**TRANSCRIPTION**	Periods	9

Structure and function of mRNA, rRNA and tRNA, Characteristics of promoter and enhancer sequences, Transcription in Prokaryotes and Eukaryotes, micro RNA, RNA interference, Post-Transcriptional Modification - 5'-Capping, Splicing-Alternative splicing, Poly 'A' tail addition and base modification.

Unit – IV	**TRANSLATION**	Periods	9

Genetic Code: Elucidation of genetic code, Codon degeneracy, Wobble hypothesis and its importance. Protein Synthesis in Prokaryotes and Eukaryotes- Initiation, Elongation and Termination, inhibitors of protein synthesis, Post Translational Modification and its importance, Mutation and Mutagenesis

Unit – V	**REGULATION OF GENE EXPRESSION**	Periods	9

Prokaryotic gene regulation –lac and trp operon, DNA sequencing-classical and automated DNA sequencing methods, Tools and techniques in Molecular Biology-Overview. Molecular markers- PCR and hybridization based molecular markers.

	Total Periods	45	

Text Books

1.	Friefelder, David. "Molecular Biology." Narosa Publications, 2004
2.	S.C. Rastogi, "Cell and Molecular biology" New Age International Private Limited, 5th Edition, 2023

References

1.	Freifelders Essentials Of Molecular Biology by Jones & Bartlett 4th Edition, 2015
2.	De Robertis E.D.P., "Cell And Molecular Biology" 8th Edition, 2017
3.	James D. Watson, " Molecular Biology of the Gene" Pearson Education, 7th Edition, 2017
4.	Harvey Lodish et al., "Molecular Cell Biology" W H Freeman & Co, 9th Edition, 2021
5.	Robert F.Weaver, " Molecular Biology", McGraw-Hill Higher Education, 5th Edition,2018

Resources

1.	https://onlinecourses.swayam2.ac.in/cec20_ma13/preview
2.	https://www.biointeractive.org/classroom-resources?search=&f%5B0%5D=topics%3A26

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Programme	B.Tech		Programme Code		105	Regulation		2023
Department	Biotechnology					Semester		IV

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23BT410	Instrumental Method of Analysis	3	0	0	3	40	60	100

Course Objective	The main objective of this course is: • To discuss the basic concepts and applications of fundamental statistical, and thermal methods • To apply and interpret the data originated from spectroscopy, chromatography and electrophoretic methods • To know the concept of centrifugal technique, and apply mass spectrometry, x-ray diffraction and NMR techniques

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Understand and apply the statistical principles to solve biological issues, and apply appropriate thermal analysis method to process biological samples	K2
	CO2: Recognize the application of electromagnetic radiation in optical instruments. Compare, apply and interpret the data of biological solutions acquired from different spectroscopy techniques	K2
	CO3: Describe, apply and evaluate the data originated by chromatographic techniques to solve biological problems	K2
	CO4: Explain, apply and evaluate the data obtained from different electrophoretic techniques	K4
	CO5: Describe and apply mass spectrometry, x-ray diffraction and NMR techniques in the broad field of biotechnology and Discuss the fundamentals of centrifugation techniques	K4

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak													CO/PSO Mapping		
COs	Programme Outcomes (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2	PSO 3
CO 1	3	3	2	1	3	2			3	3		3	3	3	2
CO 2	3	3	3	3	3				3	3		3	3	3	3
CO 3	3	3	3	3	2				3	3		3	3	3	3
CO 4	3	3	3	2	2							2	3	3	2
CO 5	3	3	2	3						2			2	2	3

Pre-requisites	-

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III

| 2. | Assignment |
| 3. | End-Semester examinations |

Indirect

| 1. | Course - end survey |

Content of the syllabus

Unit – I	BASICS OF MEASUREMENT AND THERMAL ANALYSIS METHODS	Periods	9

Classification of instrumental methods; Fundamentals of accuracy, calibration, validation, precision and limits of detection (LOD) and limits of quantification (LOQ); Signal to noise ratio (S/N) - Classification and Signal to noise ratio Enhancement; Thermo-gravimetric methods, Differential thermal Analysis, Differential Scanning calorimetry.

Unit – II	SPECTROSCOPY	Periods	9

Properties of electromagnetic radiation-wave properties, Components of optical instruments; Principle and instrumentation - UV-Vis, IR, Raman,XPS and atomic absorption spectroscopy; Principle and instrumentation - Fluorometry, and Circular Dichroism (CD);

Unit – III	CHROMATOGRAPHY	Periods	9

Factors affecting the resolution of chromatography; Rate and plate theory; Van Deemter equation; Principle and instrumentation - Thin layer chromatography, Supercritical fluid chromatography, Gel permeation chromatography, ion exchange chromatography, High Performance Chromatography (HPLC), Ultra performance liquid chromatography (UPLC), Affinity chromatography and Gas chromatography (GC)

Unit – IV	ELECTROPHORESIS	Periods	9

Electrophoresis – introduction & trouble shooting parameters; Principle and Instrumentation -Paper, agarose gel, polyacrylamide gel (PAGE), SDS-PAGE, denaturing gradient gel electrophoresis (DGGE) or temperature gradient gel electrophoresis (TGGE), capillary electrophoresis, isoelectric focusing .

Unit – V	STRUCTURAL ELUCIDATION METHODS	Periods	9

Principle and instrumentation - Mass spectrometry (electron spray ionization [ESI] & chemical ionization [CI]), FTIR, GC-MS; X-ray diffraction and Nuclear magnetic resonance (NMR) – principle and instrumentation.

		Total Periods	45

Text Books

1.	Skoog, D., Holler, F., & Crouch, S, "Principles of Instrumental analysis", 6th Edition, USA: Brooks Cole Publishing Company, 2014.
2.	Chatwal.G.R, and Sham K. Anand.," Instrumental Methods of Chemical Analysis", 5th Edition, Himalaya Publishing House, 2012.
3.	Sivasankar B., "Instrumental methods of analysis" Oxford University Press,2012

References

1.	Sharma, B, "Instrumental methods of chemical analysis (analytical chemistry)", 24th Edition, GOEL Publishing House, 2014.
2.	Patil, V.P., Tathe, R. D., Devdhe, S. J., Angadi, S.S and Kale, S. H. "Ultraperfromance liquid chromatography: A review, International Research Journal of Pharmacy", 2011.
3.	Wilson, K., & Walker, J. "Principles and techniques of biochemistry and molecular biology", 7th Edition, Cambridge University Press, 2006.

E-Resources

1.	https://pharmdbm.com/instrumental-methods-of-analysis-notes/
2.	https://microbenotes.com/nuclear-magnetic-resonance-nmr-spectroscopy/
3.	https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Instrumentation_and_Analysis/Chromatography/Chromatography

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Programme	B. Tech	Programme Code		105	Regulation		2023
Department	Biotechnology				Semester		IV

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23BT411	Unit Operation	3	0	3	4	50	50	100

Course Objective	The student should be made to, 1. To ensure students to having strong fundamental knowledge about Unit operation. 2. To introduce them to the unit operation calculation for bio process and biochemical industries 3. To understand the industrial application and significance of these equipment in biotechnology.

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	1. Understand the concept of basic stochiometric calculation involved in bioprocess industries	K1
	2. Ability to make material balances and Energy balances on unit operations and processes	K2
	3. Analyze the fluid flow problems with the application of the momentum and energy equations	K3
	4. Exhibit the mechanism of different fluid flow measuring devices includes orifice meter, venturi meter, rotameter and pitotube	K4
	5. Infer knowledge on various fluid transport processes with understanding of solution approximation methods and their limitations	K4

CO / PO Mapping													CO/PSO Mapping		
(3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak															
COs	Programme Outcomes (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3					2	1	2	2	2	2	2
CO 2	3	2	1	2	2	1			1	1	2	2	2	2	1
CO 3	3	2	2	2	1		1		2	2	2	2	2	2	2
CO 4	1	2	1	2	1				2	1	2	2	2	1	2
CO 5	1	2	2	2	1			1	2	1	2	2	2	1	2

Course Assessment Methods

Direct
1. Continuous Assessment Test I, II & III
2. Assignment
3. End-Semester examinations

Indirect
1. Course - end survey

Content of the syllabus

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Unit – I	Introduction & Basic Concepts	Periods	12
Introduction concepts of units and dimension, Mole, atomic and molecular weight, Ideal gas law, Dalton's law, Specific gravity, Concept of Simpson rules and its application **Engineering Practice**: Verify the Rayliegh equation of Simple Distillation			
Unit - II	Energy Balance	Periods	12
Material balance with Chemical reactions – Distillation- Evaporation- Laws of conservation of mass- limiting and excess reactant, recycle, bypass and purging. Conservation of energy **Engineering Practice**: Determine the settling velocity and concentration of given dry solids			
Unit – III	Fluid Flow Measurement	Periods	12
Classification of flow-meter, Detailed study (Principle, construction and working) of Venturi meter- orifice meter – Rotameter - Pitot-tube - Simple numerical problems **Engineering Practice**: Determine the friction factor of the given pipe.			
Unit - IV	Particles Size Reduction	Periods	12
Principle of Comminution-Types of crushers, Grinders-Energy & power requirement for size reduction- laws of crushers & work index. Concept of sedimentation - settling velocity **Engineering practice**: Determine the effectiveness of given Screen by analysis of Oversize & Under size			
Unit – V	Fluidizations	Periods	12
Introduction to fluidization - types of fluidizations - minimum fluidization velocity - pressure drops in fluidized beds - Correlations of Ergun equation- Properties of fluidized beds. **Engineering Practice**: Calibrate the rotameter and study the characteristics of percentage error.			
		Total Periods	60

Text Books

1.	Holman, J. P., Heat Transfer, 9th Edition, McGraw Hill, Singapore, 2017
2.	Donald Q. Kern, Process Heat Transfer, Tata McGraw Hill, New Delhi, 2019

References

1.	McCabe, W. L., Smith, J. C., and Harriot, P., Unit Operations of Chemical Engineering, McGraw Hill, New York, 6TH Edition,2019
2.	Geankoplis, C. J., Transport Processes and Separation Process Principles (Includes Unit Operations), Prentice Hall of India, New Delhi, 4th Edition, 2018
3.	GK Ray, Heat and mass Transfer solved problems, Tata McGraw Hill, New Delhi 5th Edition 2018

E-Resources

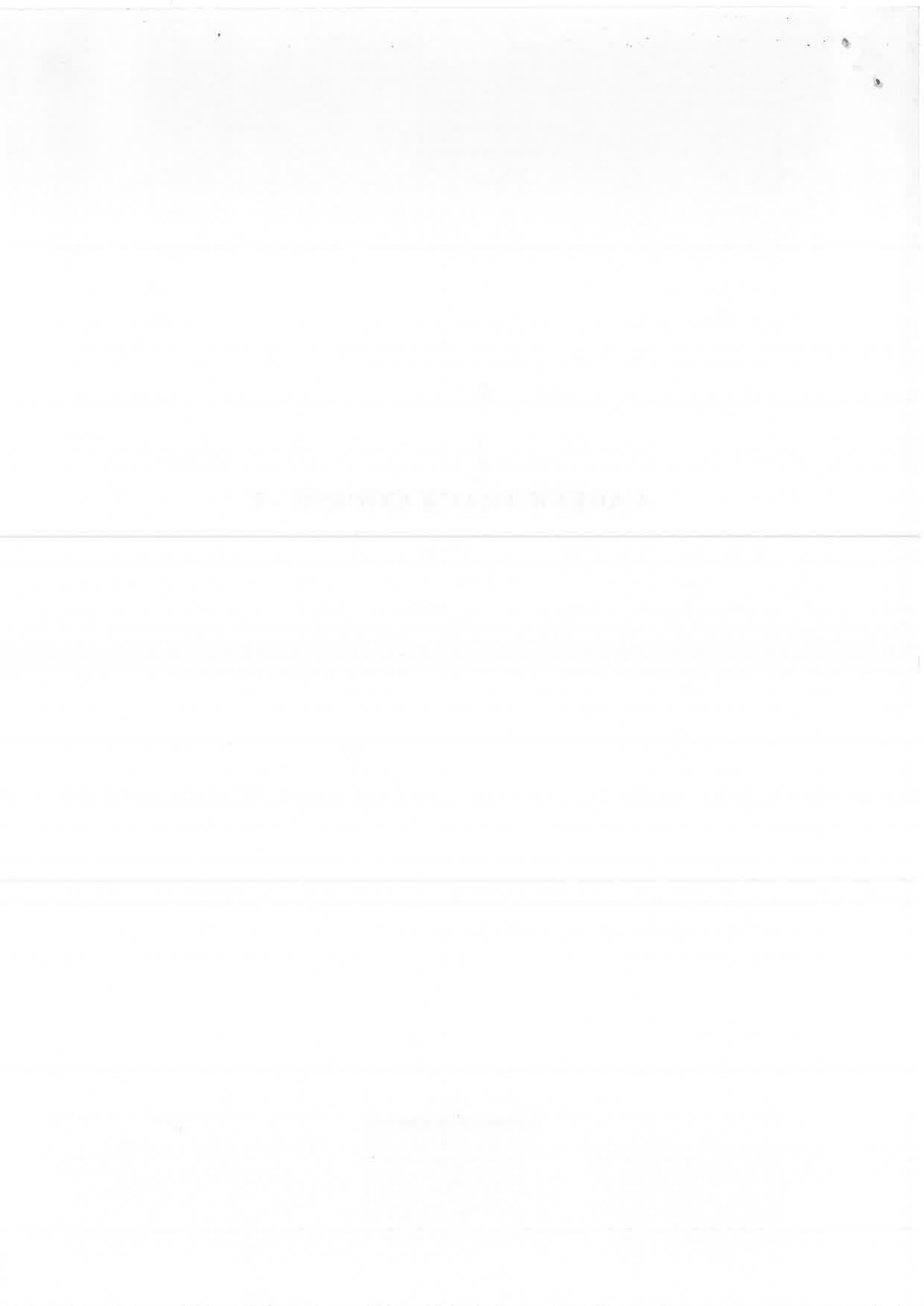| 1.	https://nptel.ac.in/courses/103/106/103106116/
2.	https://nptel.ac.in/courses/103/101/103101141/

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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
(Autonomous Institution, Affiliated to Anna University, Chennai)
Elayampalayam, Tiruchengode – 637 205

Programme	B.Tech		Programme Code	105	Regulation	2023
Department	Biotechnology				Semester	IV

Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23BT412	Plant & Animal Biotechnology Laboratory	0	0	2	1	60	40	100

Course Objective	The students should be able to 1. Understand explicitly the concepts 2. Develop their skills in the plant tissue culture techniques

	At the end of the course, the student should be able to,	Knowledge Level
Course Outcomes	CO1: Understand the various media used in plant cell culture	K1
	CO2: Identification of plant transformation techniques	K2
	CO3: Gain the knowledge of therapy in animal cell culture	K3
	CO4: Ability to gain the knowledge for development of therapeutic products	K3
	CO5: Will gain knowledge in animal cell culture technique and cell viability	K4

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2 – Medium, 1 - Weak													CO/PSO Mapping		
Cos	Programme Outcomes (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO 3
CO 1	3	3	3	3	3	2	2	2	2	2	2	2	3	3	3
CO 2	3	2	3	2	2	2	3	3	3	2	3	2	2	2	2
CO 3	3	2	2	3	2	3	2	2	3	2	3	2	3	2	1
CO 4	3	2	3	2	3	3	3	3	2			2	3	3	2
CO 5	3	3	2	2	2	2	2	2	3			2	3	2	1

Pre-requisites	Nil

Direct
4. Pre lab and Post lab
5. Execution of Experiment and Viva-voce
6. End semester examination
Indirect
Course - end survey

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\multicolumn{3}{l}{**List of Experiments**}	
S.No	**Name of the Experiment**	**Course Outcome**
1.	Preparation of Media	CO1
2.	Surface sterilization and inoculation of explants for callus induction	CO1
3.	Protoplast isolation and viability staining.	CO2
4.	Multiplication of plant through Micro propagation-Rose, chrysanthemum	CO2
5.	Preparation of synthetic Seed	CO3
6.	Sub culturing, shoot elongation rooting and hardening	CO3
7.	Agro bacterium mediated gene transformation	CO4
8.	Media Preparation for animal tissue culture.	CO4
9.	Primary cell culture-Chick Embryo Fibroblast	CO4
10.	Viability checking (Trypan Blue) and cell counting by Hemocytometer	CO5
	Total Periods	**60**

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CAREER TRACK COURSE – I

Programme	B.E. / B.TECH		Programme code	105	Regulation		2023
Department	Biotechnology				Semester		IV

Course code	Course Name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23CTCE1	Entrepreneurial Mindset and Business Model Canvas	0	0	2	1	60	40	100

Course Objective	The student should be made to, • Cultivate an entrepreneurial mindset that embraces innovation and risk-taking. • Learn the components of the Business Model Canvas and develop skills using the Business Model Canvas as a tool for business planning. • Design innovative business models based on customer needs and market opportunities. • Understand the process of transforming a business model into a comprehensive business plan. • Understand the application processes and legal implications of business licenses and permits.

Course Outcome	At the end of the course, the student should be able to,	KL
	CO1: Explain the key traits and behaviors of successful entrepreneurs.	K2
	CO2: Identify and describe the components of the Business Model Canvas.	K2
	CO3: Design innovative business models tailored to specific customer needs and market conditions.	K6
	CO4: Demonstrate the ability to write comprehensive business plans, incorporating elements such as market analysis, financial projections, and operational strategies.	K4
	CO5: Identify different types of licenses and permits necessary for various types of businesses.	K2

Pre-requisites	-

| CO / PO Mapping														CO/PSO Mapping		
(3/2/1 indicates strength of correlation) 3-Strong. 2 – Medium. 1 - Weak																
COs	Programme Outcomes (POs)													PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PS O2	PSO3
CO 1	1	1	2	1	1			1	2	1	3	3	1	1	1
CO 2	2	1	3	3	2			1	2	1	3	3	2	2	
CO 3	2	1	3	2	3			1	2	1	3	3		1	1
CO 4	1	1	3	1	2			1	2	1	3	3	1	2	2
CO 5	1	1	3	1	2			1	2	1	3	3	1		

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Course Assessment Methods

Direct
1. Continuous Assessment through Reviews
2. End Semester Examinations

Indirect
1. Course - end survey

Content of the syllabus

Unit - I	Introduction to Entrepreneurial Mindset	Periods	6

Introduction-Evolution of the Concept of Entrepreneur - Characteristics of Successful Entrepreneurs - The Charms of Becoming an Entrepreneur - The Entrepreneurial Decision Process –Need and types of Entrepreneur – Role of Entrepreneurship in Economic Development -Women Entrepreneurship and Rural Entrepreneurship – Case Study – Opportunities Identification and Selection

Unit – II	Understanding the Business Model Canvas	Periods	6

Definition of a Business Model- Types of Business Models -Customer Segments - Value Propositions – Channels and Partners - Customer Relationships - Revenue Model and Streams

Unit – III	Designing and Testing Business Models	Periods	6

Key Resources - Key Activities - Key Partnerships - Cost Structure - Prototyping Business Models - Evaluating Business Models

Unit – IV	Business Model to Business Plan	Periods	6

Business Plan - reasons for writing a Business Plan - who reads a business plan and what they're looking for - guidelines for writing an effective business plan - business plan Outline - present a business plan to potential investors.

Unit - V	Licenses, Permits and Funding	Periods	6

Ethical culture in the entrepreneurial ventures – Dealing Effectively with legal Issues - Obtaining business licenses and permits – forms of Business Organization – Creating new-venture team – Skill Profile – case study – Need for Funding –Sources of Personal Funding, equity funding, debt financing

		Total Periods	30

Text Books

1	Khanka. S.S., "Entrepreneurial Development" S.Chand and Co. Ltd., New Delhi, 2011, Revised Edition
2	Osterwalder, A., & Pigneur, Y. "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers" John Wiley & Sons, Inc., 2010
3.	R. Duane Ireland Bruce R. Barringer "Entrepreneurship: Successfully Launching New Ventures", Pearson Education. 2020, 6th Edition

References

1.	Donald F Kuratko, "Entrepreneurship – Theory, Process and Practice", Cengage Learning, 2016. 10th Edition

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2.	Ries, E." The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses ", Currency, 2017, 9th Edition

E-Resources

1.	https://fastercapital.com/content/Entrepreneurship-Education-via-Business-Model-Canvas.html
2.	https://online.bath.ac.uk/articles/business-models
3.	https://creately.com/guides/business-model-canvas-explained/

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN						
	(Autonomous Institution Affiliated to Anna University, Chennai) Elayampalayam,Tiruchengode– 637205						

Programme	B.Tech.		Programme code	105	Regulation		2023
Department	Biotechnology				Semester		IV

Course Code	Course Name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
U23CTCP3	**Verbal, Quantitative Aptitude and Reasoning - II**	2	0	0	1	40	60	100

Course Objective	The student should be made to, • Identify and begin to apply the language features • Understand the mathematical techniques for solving the real life problems • Use number theory arguments to justify relationships involving divisors, multiples and factoring • Perform well in all competitive exams

Course Outcome	At the end of the course, the student should be able to,	Knowledge Level
	CO1: Use language through acquisition of grammar rules	K2
	CO2: Demonstrate the use of mathematical reasoning by justifying the patterns and relationships	K2
	CO3: Face external competitive exams	K3
	CO4: Solve a question in a fraction of minute using shortcut methods	K3
	CO5:Enhance their problem solving skills and logical Skills	K4

Pre-requisites	-

CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong. 2 – Medium, 1 – Weak													CO/PSO Mapping		
COs	Programme Outcomes (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO 1		2		3	2					3		3	3	2	3
CO 2	3	3		2	2					3		3	3	2	2
CO 3	3	3		3	2					3		3	2	3	3
CO 4	3	3		2	3					2		2	3	3	3
CO 5		2		2	2					2		2	3	3	3

Course Assessment Methods
Direct
1. Continuous Assessment Test I, II & III
2. Assignments / Seminar/Quiz
3. End-Semester Examination
Indirect
1. Course -end survey

Content of the syllabus

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Unit -I	VERBAL ABILITY	Periods	4
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Unit -I	VERBAL ABILITY	Periods	4
Verbal Analogy, Sentence completion, Gen-Z lexis **STATEMENT ANALYSIS:** Statements and Conclusions, Statements and Assumptions, Statements and Agreements, Cause and effect, Making Judgements.			
Unit–II	PROFIT AND LOSS	Periods	8
PROBLEMS ON PROFIT AND LOSS PERCENTAGE: Profit Percentage, Cost Price and Selling Price are equal, Cost Price and Selling Price are different, Selling Price alone, Selling Price same for two objects, Selling Price and Cost Price are compared, Mixture, Profit Percentage and Loss Percentage are equal, False rate, Problems on Cost Price, Selling Price, Profit, Discount, Successive Discount and Discount Percentage. **SIMPLE AND COMPOUND INTEREST:** Simple Interest: Find Principal, Amount, Rate of Interest, Number of Years, Simple Interest based on lend into two parts, in case of instalments. Compound Interest: Find Principal, Amount, Rate of Interest, Number of Years, Compound Interest, Simple Interest in co-relation with Compound Interest, Instalments, Population, Present Worth.			
Unit – III	TIME AND WORK	Periods	6
Chain Rule, Combination of people working together, Individuals working together, Joining and Relieving, Efficiency Ratio Model, Works and Wages, Pipes open together: Doubling, Efficiency Ratio Model, Pipes opening and Closing, Capacity based model.			
Unit– IV	TIME, SPEED AND DISTANCE	Periods	6
Basic models, Ratio based model, Average speed based model, Relative speed based model, Algebra based model, Problems on Trains, Boats and Streams, Race and Games. Circular Track, Game based model.			
Unit-V	LOGICAL REASONING	Periods	6
DIRECTION SENSE: Direct yourself, based on Angle, Directional reference point, correct map based on wrong map, Direction in Clocks, Shadowing. **SEATING ARRANGEMENT:** Linear Seating Arrangement, Single row Uni-Directional and Bi-Directional, Dual row, Triple row, Square, Rectangular and Triangular Arrangement, Seating Arrangement in photograph, Circular Arrangement, Inside and Outside (Linear and Circular), Concentric Arrangement.			
		Total Periods	30

Text books

1.	Rajeev Varma, "Fast Track Objective Arithmetics", Arihant Publications, 2024
2.	R.S. Aggarwal, "Modern Approach to Logical Reasoning", S Chand Publishing, 2022
3.	SP Bakshi, "Objective General English", Arihant Publications, 2024

References

1.	R.S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", S Chand Publishing, 2013
2.	Dinesh Khattar, "The Pearson guide to Quantitative Aptitude for Competitive Examinations", 3rd edition, 2016
3.	Arun Sharma, "How to Prepare for Logical reasoning for CAT", McGraw Hill Education; 2014
4.	Jaikishan and Premkishan, "How to Crack Test of Reasoning", Arihant Publications,2016
5.	R.S. Agarwal, "A modern Approach to verbal and non-verbal reasoning", S Chand Publishing,2018

E-Resources

1.	Aptitude: https://www.indiabix.com
2.	Reasoning: https://placement.freshersworld.com
3.	Verbal: https://testbook.com

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