K.S. Rangasamy College of Technology
(Autonomous Institution affiliated to Anna University, Chennai)

Curriculum & Syllabus

for

B.Tech., Biotechnology Department

(For the batch admitted in 2022– 2023)

R2022

Courses Accredited by NBA, Accredited by NAAC with A++,
Approved by AICTE, Affiliated to Anna University, Chennai.

KSR Kalvi Nagar, Tiruchengode – 637 215.
Namakkal District, Tamil Nadu, India.

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

Department of B.Tech., Biotechnology

VISION

To produce competent Scientists, Technologists, Entrepreneurs and Researchers in Biotechnology through quality education.

MISSION

- To be recognized as a place of excellence in teaching-learning through continual improvement process (**Place of excellence** and **continual improvement)**
- To work in close liaison with the industry to achieve socio-economic development through biotechnological ventures (**Socio-economic development)**
- To facilitate students to perform as competent professional Biotechnologists (**Professional Competence)**

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Fundamentals: Graduates are professionally competent in Biotechnology to solve problems in environmental, food, biochemical and biomedical engineering and technology.

PEO2: Career Growth: Graduates demonstrate proficiency in theory and practice of biotechniques through life-long learning.

PEO3: Professional Practices: Graduates perform as an individual and / or member of a team with professional and ethical behaviour.

PROGRAMME OUTCOMES (POs)
Engineering Graduates will be able to

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 teamwork**: 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

Engineering Graduates will be able to:

PSO1: Developing Technocrats: Design and execute industry oriented experiments in biotechnology using modern tools and techniques.

PSO2: Research and Technology Transfer: Apply the knowledge of bioengineering and Technology to demonstrate research skills and develop technology for commercialization .

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) WITH PROGRAMME OUTCOMES (POs)

The B.Tech Biotechnology Programme outcomes leading to the achievement of the objectives are summarized in the following Table.

Programme	Programme Outcomes											
Educational	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO 1	3	1	3	2	2	1	1	1	2	2	3	1
PEO 2	3	3	3	2	2	1	1	1	2	2	3	1
PEO 3	3	2	3	2	2	1	1	1	3	2	3	1

Contributions: 1- low, 2- medium, 3- high

MAPPING-UG-BIOTECHNOLOGY- COURSE WITH PROGRAMMEOUTCOMES (POs)

Year	Sem	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
I	I	Professional English- I								2	3	3	2	3	1	3
		Matrices and Calculus	3	3	2.8	2.4	2.4							2	3	

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Approved in Academic Council Meeting held on 23/12/2023

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		Basic Electrical and Electronics Engineering	2.6	2.8	1.6	1.6	2	2	2.3	1.5	2	2	2	2.2	3	
		Physics for Biotechnology	3	2.8	2.8	2.8	2.6	2.6	2.4	2	2.2	2.2	2.2	2.2	1	3
		Chemistry for Life science	3	3	3	3	2	2.8	2.8	2	2.6	2.8	3	3	3	3
		Environmental Studies and Climate Change	2.8	2.8	3	2.8	2.7	2.6	3	3	2.2	2.2	1.8	2.8	2	2
		Applied Physics Laboratory	3	2.8	2.8	2.6	2.4	2.4	2.4	1.4	2	1.9	2	2.2	1	3
		Applied Chemistry Laboratory	3	3	2.8	2.8	2	2.8	2.6	2.6	2.2	2	1.4	2.4	3	3
	II	Professional English- II								2	3	3	2	3	1	3
		Integrals, Partial Differential Equations and Laplace Transform	3	3	2.6	2.4	2.6							2	3	
		C Programming	3	3	3		3				2	2	2	2	3	3
		Engineering Graphics	3	2.6	3	3	3	1	1	1		3	1.4	2	1	3
		Engineering Mechanics	3	2	2	3								2	3	1
		Heritage of Tamils								3	3		2			
		Fabrication and Reverse Engineering Laboratory	3	2.6	2.8	1.6	3	2		2.2	3	2	1.6	3		
		C Programming	3	3	3		3				3	3	2	2	2	1
		Career Skill Development-I								2	3	3	2	3		
		Internship	2	3	3	3	2	2	1	1	2	2	2	3		
II	III	Fourier Transform and Numerical Methods	3	3	2	2	2							3	3	
		Biochemistry	1	2	3	2	1	1	1		2	1		1	2.4	2.6
		Microbiology	3	2	2	2	1	2	2	1	2	2	1	2	2.8	2.6
		Cell Biology and Genetics	3	3	2		1							2	2.4	3
		Principles of Chemical Engineering	2	3	1	2	1		2				1	2	3	3
		Molecular Biology	3	3	2	2	2	3	3	3	3	3	2	1	2.8	2.6
		Tamils and Technology							3	3		2		3		
		NCC/NSS/NSO/YRC/RRC/ Fine arts	3	2	1	1	3	3	3	3	3	3	3	3		
		Biochemistry Laboratory	1	2	1	2	3	1		1	2	1	1	1	2.6	2.6
		Microbiology Laboratory	3	2	2	3	2	2	1	1	2	2	2	3	2.6	2.6
		Career Skill Development-II	1	1	1	1	1	2	1	2	3	3	2	3		
		Internship	2	3	3	3	2	2	1	1	2	2	2	3		
		Probability and Statistics	3	3	3	3	3							3	2	2.2

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Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

II	IV	Genetic Engineering	3	2	2	1				1	1			1	3	2.4
		Protein and Enzyme Engineering	2	3	3	3	2	2	1	1	3	1	2	2	3	3
		Biochemical Thermodynamics	3	2	2	3	3	3	2	1	1	2	3	2	2.6	2.4
		Universal Human Values (UHV)*						3	3	3	2.8	3	2	3	2.4	2.6
		Molecular Biology and Genetic Engineering Laboratory	3	2	2	1				1	1			1	2.6	2.6
		Protein and Enzyme Engineering Laboratory	2	3	3	3	3	2	1	1	2	2	2	3	3.0	3.0
		Career Skill Development - III	2	2	1	1	1	2	1	1	2	3	2	3		
		Internship	2	3	3	3	2	2	1	1	2	2	2	3		
III	V	Plant and Animal Biotechnology	3	2	1	1				1	1			1	3	3
		Bioinformatics	3	3	3	2	3	1	1			1	1	3	3.0	2.6
		Bioprocess Technology	2	3	3	3	3	3	3	1	1	3	3	3	3.0	3.0
		Heat and Mass Transfer Operations	3	3	3	3	2	3	2	1	1	3	2	3	2.8	2.8
		Start-ups and Entrepreneurship	2.8	2.6	3	2.4	2.4	2.5	2.5	2.3	2.7	2	2.3	2.4	2.4	2.8
		NCC/NSS/NSO/YRC/RRC/ Fine arts	3	2	1	1	3	3	3	3	3	3	3	3		
		Plant and Animal Biotechnology Laboratory	3	2	2	2				1	1			2	3	3
		Bioprocess Technology Laboratory	3	3	2	2	3	2	2	1	1	2	3	3	3	3
		Career Skill Development – IV	2	1	2	2	1	1	1	1	2	3	2	3		
		Internship	2	3	3	3	2	2	1	1	2	2	2	3		
	VI	Biopharmaceutical Technology	3	2	2	2				1	1			1	3	3
		Chemical Reaction Engineering	3	2	1	2	1		1						2.6	2.6
		Computer-Aided Drug Design														
		Bioinformatics and Molecular Modeling Laboratory	3	2	2	2	3	2	1	1	1	2	2	3	2.4	2.8

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Approved in Academic Council Meeting held on 23/12/2023

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		Chemical Engineering Laboratory	3	2	1	2	1		2						3	3
		Mini project														
		Comprehension Test														
		Internship	2	3	3	3	2	2	1	1	2	2	2	3		
IV	VII	Engineering Economics and Financial Accounting	3	2	3	2	1	3	2	1	2	2	3	1		
		Immunology	3	3	3	2	2	2	2	1	2	1	2	3	3	3
		Downstream Processing	2	3	3	3	2	2	2	1	2	2	2	3	2.8	2.8
		Research Skill Development -I	3	3	2	2	2	2	1	2	1	3	2	1	3	3
		Biological data analysis Laboratory	3	2	3	3	2	2	2	1	1	2	2	2	2.4	3
		Downstream Processing Laboratory	2	2	3	3	3	2	1	1	2	1	2	2	2.8	2.8
		Project Work - Phase I	3	3	3	3	2	2	1	1	2	1	2	3	3	3
		Internship	2	3	3	3	2	2	1	1	2	2	2	3	3	3
	VIII	Research Skill Development -II	3	3	3	2	2	2	1	1	1	2	2	1	3	3
		Project Work - Phase II	3	3	3	3	2	2	1	1	2	1	2	3	3	3
		Internship	2	3	3	3	2	2	1	1	2	2	2	3	3	3

PROFESSIONAL ELECTIVES (PE)3

Year	Semester	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ELECTIVE – I																
III	V	Environmental Biotechnology	3	3	3	2	3	2	3	1				3	3	3
		Biodiversity and its conservation	3	3	3	2	3	2	3	1				3	3	3
		Environmental Hazards and Management	1	2	3	1	3	1	3	1	1	1	1	1	3	3
		Food Biotechnology		3	3	3	3	2	2	3	2		3	3	3	3
		Fermentation Technology	2	3	3	3	3	3	3	1		2	3	3	3	3
ELECTIVE – II																
III	VI	Cancer Biotechnology		3	2	3	3			1			2	3	3	3
		Clinical Immunology		3		3	3						2	3	3	3
		Stem Cell Technology		3	2	3	3			2			2	3	3	3
		Tissue Engineering		3	2	3	3			2			2	3	3	3

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BoS Chairman Signature

		Biomedical Instrumentation	3	3	2	3	3						2	3	3	3
ELECTIVE – III																
III	VI	Bioresource Technology	3	3	2	3	3						3	3	3	3
		Biophysics	3	3	3	2	2	2	2	2	2	1	2	2	3	3
		Metabolic Engineering	2	3	2	2	3			1			2	3	3	3
		Bioreactor Design	3	3	3	3	3	3	3	1	1	3	3	3	3	3
		Bioprocess Modeling and Simulation	2	3	3	3	3	3	3	1	1	3	3	3	3	3
ELECTIVE – IV																
IV	VII	Nanobiotechnology	3	2	3	3	3	2					2	3	3	3
		Bioinstrumentation	3	3	3	3	3			1			2	3	3	3
		Toxicology		3	2	3	3			2			2	3	3	3
		Genomics and Proteomics	3	3	3	3	3			1			3	3	3	3
		Agricultural Biotechnology	3	3	3	2	3	2	3	1				3	3	3
ELECTIVE – V																
	VIII	Research Design and Analysis	3	2	3	3	3	2		2			2	3	3	3
		Marine Biotechnology		3	3	2	3			1			2	3	3	3
		Bioethics and Biosafety		3		3	3			1			2	3	3	3
		Biofuel Technology		2		3	2			1			2	3	3	3
		Systems Biology	3	3	3	3	3							3	3	3

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BoS Chairman Signature

K.S. RANGASAMY COLLEGE OF TECHNOLOGY

Credit Distribution for B.TECH (BT) Programme – 2022 –2023 Batch

S.No.	Category	Credits Per Semester								Total Credits	Percentage %
		I	II	III	IV	V	VI	VII	VIII		
1	HS	2	2	-	-	-	-	3	-	07	4.32
2.	BS	17	4	04	04	-	-	-	-	29	17.90
3	ES	-	15	-	-	-	-	-	-	18	11.11
4	PC	-	-	20	14	18	11	12		74	45.67
5	PE	-	-	-	-	3	6	3	3	15	9.25
6	OE	-	-	-	3	3	3	3	-	12	7.40
7	CGC	-	-	-	-	-	-	2	8	10	6.17
8.	MC	MC I	-	-	MC II	MC III	-	-	-		-
9	AC	-				-	-	AC I	AC II	-	-
10	GE		GE I	GE II						-	-
Total		19	21	24	21	24	20	23	11	163	100

HS - HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES

BS - BASIC SCIENCE COURSES

ES - ENGINEERING SCIENCE COURSES

PC - PROFESSIONAL CORE COURSES

PE - PROFESSIONAL ELECTIVE COURSES

MC - MANDATORY COURSES

OE - OPEN ELECTIVE COURSES

CGC - CAREER GUIDANCE COURSES

AC - AUDIT COURSES

GE - GENERAL ELECTIVE COURSES

- **Open Electives are courses offered by different departments that do not have any prerequisites and could be of interest to students of any branch.**

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K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
(An Autonomous Institution affiliated to Anna University)
HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 EN 001	Professional English-I	HS	3	1	0	2	2	Basic knowledge of reading and writing in English
2.	60 EN 002	Professional English-II	HS	3	1	0	2	2	Basic knowledge of reading and writing in English and should have completed Professional English I.
3.	60 HS 001	Engineering Economics and Financial Accounting	HS	3	3	0	0	3	Nil
4.	60 AB 001	National Cadet Corps (Air wing)	HS	4	2	0	2	3*	Nil
5.	60 AB 002	National Cadet Corps (Army wing)	HS	4	2	0	2	3*	Nil

BASIC SCIENCE COURSES

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 MA 001	Matrices and Calculus	BS	4	3	1	0	4	Nil
2.	60 EE 001	Basic Electrical and Electronics Engineering	BS	4	3	1	0	4	Nil
3.	60 PH 005	Physics for Biotechnology	BS	3	3	0	0	3	Nil
4.	60 PH 0P2	Applied Physics Laboratory	BS	4	0	0	4	2	Nil
5.	60 CH 0P1	Applied Chemistry Laboratory	BS	4	0	0	4	2	Nil
6.	60 MA 003	Integrals, Partial Differential Equations and Laplace Transform	BS	4	3	1	0	4	Nil
7.	60 MA 012	Fourier Transform and Numerical Methods	BS	4	3	1	0	4	Nil
8.	60 MA 021	Probability and Statistics	BS	4	3	1	0	4	Nil

ENGINEERING SCIENCE COURSES

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 ME 001	Engineering Drawing	ES	3	3	0	0	3	Nil
2.	60 ME 0P1	Fabrication and Reverse Engineering Laboratory	ES	4	0	0	4	2	Nil
3.	60 EE 002	Basic Electrical, Electronics and Instrumentation	ES	3	3	0	0	3	Nil
4.	60 ME 004	Engineering Mechanics	ES	4	3	1	0	4	Nil
5.	60 CS 001	C Programming	ES	3	3	0	0	3	Nil
6.	60 EE 0P2	Basic Electrical, Electronics and Instrumentation Laboratory	ES	4	0	0	4	2	Nil
7.	60 CS 0P1	C Programming Laboratory	ES	4	0	0	4	2	Nil

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Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

PROFESSIONAL CORE COURSES

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 BT 301	Biochemistry	PC	3	3	0	0	3	Basics of Bioorganic chemistry
2.	60 BT 302	Microbiology	PC	3	3	0	0	3	Basic Biology
3.	60 BT 303	Cell Biology and Genetics	PC	3	3	0	0	3	Basic Biology
4.	60 BT 304	Principles of Chemical Engineering	PC	4	3	1	0	4	Basic knowledge in Chemistry and Mathematics
5.	60 BT 305	Molecular Biology	PC	3	3	0	0	3	Chemistry, Biochemistry, Cell Biology
6.	60 BT 3P1	Biochemistry Laboratory	PC	4	0	0	4	2	Basic Biology and Biochemistry
7.	60 BT 3P2	Microbiology Laboratory	PC	4	0	0	4	2	Introductory Biology and Microbiology
8.	60 BT 401	Genetic Engineering	PC	3	3	0	0	3	Molecular Biology and Biochemistry
9.	60 BT 402	Protein and Enzyme Engineering	PC	3	3	0	0	3	Basic knowledge on Chemistry, Cell Biology and Biochemistry
10.	60 BT 403	Biochemical Thermodynamics	PC	4	3	1	0	4	Basic knowledge of Engineering Mathematics ,Physics and Principles of Chemical Engineering.
11.	60 BT 4P1	Molecular Biology and Genetic Engineering Laboratory	PC	4	0	0	4	2	Molecular Biology, Genetic Engineering and Cell Biology
12.	60 BT 4P2	Protein and Enzyme Engineering Laboratory	PC	4	0	0	4	2	Basic knowledge of extraction and purification is needed
13.	60 BT 501	Plant and Animal Biotechnology	PC	3	3	0	0	3	Basics of Biology ,Cell biology and Genetics
14.	60 BT 502	Bioinformatics	PC	3	3	0	0	3	Biochemistry and Molecular Biology
15.	60 BT 503	Bioprocess Technology	PC	4	3	1	0	3	Fermentation Technology
16.	60 BT 504	Heat and Mass Transfer Operations	PC	4	3	1	0	4	Basic knowledge in Fluid mechanics, Thermodynamics and Unit operations
17.	60 BT 5P1	Plant and Animal Biotechnology Laboratory	PC	4	0	0	4	2	Basics of Biology ,Cell biology and Genetics,plant Biotechnology
18.	60 BT 5P2	Bioprocess Technology Laboratory	PC	4	0	0	4	2	Fermentation Technology

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BoS Chairman Signature

19.	60 BT 601	Biopharmaceutical Technology	PC	3	3	0	0	3	Basic knowledge on bioorganic chemistry and cell structure
20.	60 BT 602	Chemical Reaction Engineering	PC	4	3	1	0	4	Basic knowledge in Fluid flow, Thermodynamics and Heat and Mass transfer operations
21.	60 BT 603	Computer-Aided Drug Design	PC	3	3	0	0	4	Biochemistry, Molecular Biology and Bioinformatics concepts
22.	60 BT 6P1	Bioinformatics and Molecular Modelling Laboratory	PC	4	0	0	4	2	Nil
23.	60 BT 6P2	Chemical Engineering Laboratory	PC	4	0	0	4	2	Basic knowledge in Fluid flow, Thermodynamics and Heat and Mass transfer operations
24.	60 BT 701	Immunology	PC	4	3	0	1	4	Biochemistry and Immunology
25.	60 BT 702	Downstream Processing	PC	4	3	1	0	4	Chemical Engineering and Process Engineering
26.	60 BT 7P1	Biological data analysis Laboratory	PC	4	0	0	4	2	Biochemistry and Immunology
27.	60 BT 7P2	Downstream Processing Laboratory	PC	4	0	0	4	2	Chemical Engineering and Process Engineering

PROFESSIONAL ELECTIVE COURSES SEMESTER V, ELECTIVE I

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 BT E11	Environmental Biotechnology	PE	3	3	0	0	3
2.	60 BT E12	Biodiversity and its conservation	PE	3	3	0	0	3
3.	60 BT E13	Environmental Hazards and Management	PE	3	3	0	0	3
4.	60 BT E14	Food Biotechnology	PE	3	3	0	0	3
5.	60 BT E15	Fermentation Technology	PE	3	3	0	0	3

SEMESTER VI, ELECTIVE II

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 BT E21	Cancer Biotechnology	PE	3	3	0	0	3
2.	60 BT E22	Clinical Immunology	PE	3	3	0	0	3
3.	60 BT E23	Stem Cell Technology	PE	3	3	0	0	3
4.	60 BT E24	Tissue Engineering	PE	3	3	0	0	3
5.	60 BT E25	Biomedical Instrumentation	PE	3	3	0	0	3

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SEMESTER VI, ELECTIVE III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 BT E31	Bioresource Technology	PE	3	3	0	0	3
2.	60 BT E32	Biophysics	PE	3	3	0	0	3
3.	60 BT E33	Metabolic Engineering	PE	3	3	0	0	3
4.	60 BT E34	Bioreactor Design	PE	3	3	0	0	3
5.	60 BT E35	Bioprocess Modelling and Simulation	PE	3	3	0	0	3

SEMESTER VII, ELECTIVE IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 BT E41	Nanobiotechnology	PE	4	2	0	2	3
2.	60 BT E42	Bioinstrumentation	PE	4	2	0	2	3
3.	60 BT E43	Toxicology	PE	4	2	0	2	3
4.	60 BT E44	Genomics and Proteomics	PE	4	2	0	2	3
5.	60 BT E45	Agricultural Biotechnology	PE	4	2	0	2	3

SEMESTER VII, ELECTIVE V

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 BT E51	Research Design and Analysis	PE	3	3	0	0	3
2.	60 BT E52	Marine Biotechnology	PE	3	3	0	0	3
3.	60 BT E53	Bioethics and Biosafety	PE	3	3	0	0	3
4.	60 BT E54	Biofuel Technology	PE	3	3	0	0	3
5.	60 BT E55	Systems Biology	PE	3	3	0	0	3

MANDATORY COURSES (MC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 MY 001	Environmental Studies and Climate Change	MC	2	2	0	0	0
2.	60 MY 002	Universal Human Values	MC	1	2	1	0	3
3.	60 MY 003	Start-ups and Entrepreneurship	MC	2	2	0	0	0

SEMESTER VII & SEMESTER VIII, AUDIT COURSES (AC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 AC 001	Research Skill Development- I	AC	1	1	0	0	0
2.	60 AC 002	Research Skill Development-II	AC	1	1	0	0	0

GENERAL ELECTIVE COURSES (GE)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	**60 GE 001**	**Heritage of Tamils /** *தமிழர் மரபு*	**AC**	**1**	**1**	**0**	**0**	**1**
2.	**60 GE 002**	**Tamils and Technology /** *தமிழரும் தொழில்நுட்பமும்*	**AC**	**1**	**1**	**0**	**0**	**1**

OPEN ELECTIVE COURSES I / II / III (OE)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 BT L01	Agricultural Engineering	OE	3	3	0	0	3
2.	60 BT L02	Animal Studies in Research	OE	3	3	0	0	3
3.	60 BT L03	Production Technology of Agricultural and Food Processing Machinery	OE	3	3	0	0	3

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Approved in Academic Council Meeting held on 23/12/2023

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4.	60 BT L04	Pollution and its management	OE	3	3	0	0	3
5.	60 BT L05	Organic farming for sustainable agriculture	OE	3	3	0	0	3
6.	60 BT L06	Basics of Bioinformatics	OE	3	3	0	0	3

CAREER GUIDANCE COURSES (CGC)

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C	Prerequisite
1.	60 CG 0P1	Career Skill Development I	CGC	2	2	0	0	0	-
2.	60 CG 0P2	Career Skill Development II	CGC	2	2	0	0	0	-
3.	60 CG 0P3	Career Skill Development III	CGC	2	2	0	0	0	-
4.	60 CG 0P4	Career Skill Development IV	CGC	2	2	0	0	0	-
5.	60 CG 0P5	Comprehension Test	CGC	2	0	0	2	0	-
6.	60 CG 0P6	Internship	CGC	0	0	0	0	1/2/3* *	-
7.	60 BT 7P3	Project Work I	CGC	4	0	0	4	2	-
8.	60 BT 8P1	Project Work II	CGC	16	0	0	16	8	-

ONE CREDIT/ SKIL BASED/ VALUE ADDED COURSE

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	60 BT SE01	Medical Coding and Pharmacovigilance	OC	3	3	0	0	1
2.	60 BT SE02	Phytochemical and Natural products	OC	3	3	0	0	1
3.	60 BT SE03	Quality Control in Biotechnology	OC	3	3	0	0	1
4.	60 BT SE04	Biobusiness Development	OC	3	3	0	0	1
5.	60 BT SE05	Molecular Diagnostics	OC	3	3	0	0	1

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215

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COURSES OF STUDY

(For the candidates admitted from 2022-2023 onwards)

SEMESTER I

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
	-	Induction Programme	-	-	-	-	-	-
THEORY								
1.	60 EN 001	Professional English-I	HS	3	3	0	2	2
2.	60 MA 001	Matrices and Calculus	BS	4	3	1	0	4
3.	60 EE 001	Basic Electrical and Electronics Engineering	BS	3	3	0	0	3
4.	60 PH 005	Physics for Biotechnology	BS	3	3	0	0	3
5.	60 CH 005	Chemistry for Life Sciences	BS	3	3	0	0	3
6.	60 MY 001	Environmental Studies and Climate Change	MC	2	2	0	0	0
PRACTICALS								
7.	60 PH 0P2	Applied Physics Laboratory	BS	4	0	0	4	2
8.	60 CH 0P1	Applied Chemistry Laboratory	BS	4	0	0	4	2
			Total	**26**	**17**	**1**	**10**	**19**

SEMESTER II

***NCC/NSS/NSO/YRC/RRC/Fine Arts - 3 credits can be waived or offered as extra credits**

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 EN 002	Professional English-II	HS	4	3	0	2	2
2.	60 MA 003	Integrals, Partial Differential Equations and Laplace Transform	BS	4	3	1	0	4
3.	60 CS 001	C Programming	ES	3	3	0	0	3
4.	60 ME 002	Engineering Graphics	ES	6	2	0	4	4
5.	60 ME 004	Engineering Mechanics	ES	4	3	1	0	4
6.	60 GE 001	Heritage of Tamils / தமிழ் மரபு	GE	3	1	0	0	1**
PRACTICALS								
7.	60 ME 0P1	Fabrication and Reverse Engineering Laboratory	ES	4	0	0	4	2
8.	60 CS 0P1	C Programming Laboratory	ES	4	0	0	4	2
9.	60 CG 0P1	Career Skill Development I	CGC	2	0	0	2	0
			Total	**34**	**17**	**2**	**18**	**21**

****Heritage of Tamils / தமிழ் மரபு -extra credit is offered**

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Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

SEMESTER III

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 MA 012	Fourier Transform and Numerical Methods	BS	4	3	1	0	4
2.	60 BT 301	Biochemistry	PC	3	3	0	0	3
3.	60 BT 302	Microbiology	PC	3	3	0	0	3
4.	60 BT 303	Cell Biology and Genetics	PC	3	3	0	0	3
5.	60 BT 304	Principles of Chemical Engineering	PC	4	3	1	0	4
6.	60 BT 305	Molecular Biology	PC	3	3	0	0	3
7.	60 GE 002	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	GE	3	1	0	0	1**
PRACTICALS								
8.	60 BT 3P1	Biochemistry Laboratory	PC	4	0	0	4	2
9.	60 BT 3P2	Microbiology Laboratory	PC	4	0	0	4	2
10.	60 CG 0P2	Career Skill Development – II	CGC	2	0	0	2	0
11.	60 CG 0P6	Internship	CGC	-	-	-	-	1/2/3***
			Total	**30**	**17**	**2**	**10**	**24**

****Tamils and Technology / தமிழரும் தொழில்நுட்பமும் - Extra 1 credit is offered**

***** Internship extra credits is offered based on duration**

SEMESTER IV

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 MA 021	Probability and Statistics	BS	4	3	1	0	4
2.	60 BT 401	Genetic Engineering	PC	3	3	0	0	3
3.	60 BT 402	Protein and Enzyme Engineering	PC	3	3	0	0	3
4.	60 BT 403	Biochemical Thermodynamics	PC	4	3	1	0	4
5.	60 BT L**	Open Elective – I	OE	3	3	0	0	3
6.	60 MY 002	Universal Human Values (UHV)	MC	3	3	0	0	3****
PRACTICALS								
7.	60 BT 4P1	Molecular Biology and Genetic Engineering Laboratory	PC	4	0	0	4	2
8.	60 BT 4P2	Protein and Enzyme Engineering Laboratory	PC	4	0	0	4	2
9.	60 CG 0P3	Career Skill Development – III	CGC	2	0	0	2	0
10.	60 CG 0P6	Internship	CGC	-	-	-	-	1/2/3***
			Total	**27**	**18**	**2**	**10**	**21**

******UHV- additional 3 credit is offered and not accounted for CGPA**

***** Internship extra credits is offered based on duration**

SEMESTER V

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S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 BT 501	Plant and Animal Biotechnology	PC	3	3	0	0	3
2.	60 BT 502	Bioinformatics	PC	3	3	0	0	3
3.	60 BT 503	Bioprocess Technology	PC	4	3	1	0	4
4.	60 BT 504	Heat and Mass Transfer Operations	PC	4	3	1	0	4
5.	60 BT E1*	Elective – I	PE	3	3	0	0	3
6.	60 BT L**	Open Elective – II	OE	3	3	0	0	3
7.	60 MY003	Start-ups and Entrepreneurship	MC	2	2	0	0	0
8.	60 AB 00*	NCC/NSS/NSO/YRC/RRC/Fine Arts	-	2	2	0	2	3*
PRACTICALS								
9.	60 BT 5P1	Plant and Animal Biotechnology Laboratory	PC	4	0	0	4	2
10.	60 BT 5P2	Bioprocess Technology Laboratory	PC	4	0	0	4	2
11.	60 CG 0P4	Career Skill Development – IV	CGC	2	0	0	2	0
12.	60 CG 0P6	Internship	CGC	-	-	-	-	1/2/3 ***
			Total	**32**	**20**	**2**	**10**	**24**

***NCC/NSS/NSO/YRC/RRC/Fine Arts - 3 credits can be waived in VII semester or offered as extra credits**

***** Internship extra credits is offered based on duration**

SEMESTER VI

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 BT 601	Biopharmaceutical Technology	PC	4	3	0	0	3
2.	60 BT 602	Chemical Reaction Engineering	PC	4	3	1	0	4
3.	60 BT 603	Computer-Aided Drug Design	PC	3	3	0	0	3
4.	60 BT E2*	Elective – II	PE	3	3	0	0	3
5.	60 BT** L**	Open Elective – III	OE	3	3	0	0	3
PRACTICALS								
6.	60 BT 6P1	Bioinformatics and Molecular Modelling Laboratory	PC	4	0	0	4	2
7.	60 BT 6P2	Chemical Engineering Laboratory	PC	4	0	0	4	2
8.	60 BT 6P3	Mini project	PC	2	0	0	2	1[&]
9.	60 CG 0P5	Comprehension Test	CGC	2	2	0	0	1[$]
10.	60 CG 0P6	Internship	CGC	-	-	-	-	1/2/3***
			Total	**29**	**17**	**1**	**10**	**20**

[&] Miniproject - 1 additional credit is offered and not accounted for CGPA calculation

[$] Comprehension Test-one additional credit is offered and not accounted for CGPA calculation

***** Internship extra credits is offered based on duration**

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SEMESTER VII

S. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 HS 001	Engineering Economics and Financial Accounting	HS	3	3	0	0	3
2.	60 BT 701	Immunology	PC	4	3	0	1	4
3.	60 BT 702	Downstream Processing	PC	4	3	1	0	4
	60 BT E3*	Elective – III	PE	3	3	0	0	3
4.	60 BT E4*	Elective – IV	PE	3	3	0	2	3
6.	60 AC 001	Research Skill Development – I	AC	1	1	0	0	0
PRACTICALS								
7.	60 BT 7P1	Biological data analysis Laboratory	PC	4	0	0	4	2
8.	60 BT 7P2	Downstream Processing Laboratory	PC	4	0	0	4	2
9.	60 BT 7 P3	Project Work - Phase I	CGC	4	0	0	4	2
10.	60 CG 0P6	Internship	CGC	-	-	-	-	1/2/3$
			Total	**30**	**16**	**1**	**15**	**23**

$ Internship extra credits is offered based on duration

SEMESTER VIII

S.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	60 BT E5*	Elective – V	OE	3	3	0	0	3
2.	60 AC 002	Research Skill Development – II	AC	1	1	0	0	0
PRACTICALS								
3.	60 BT 8 P1	Project Work - Phase II	EEC	16	0	0	16	8
	60 CG 0P6	Internship	CGC	-	-	-	-	1/2/3$
			Total	**20**	**4**	**0**	**16**	**11**

TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 163

Note: HS- Humanities and Social Sciences including Management Courses, BS- Basic Science Courses, ES-Engineering Science Courses, PE-Professional Core Courses, PE-Professional Elective Courses, OE- Open Elective Courses, EEC-Employability Enhancement Courses, MC- Mandatory Courses, AC – Audit Courses& GE – General Elective

Note:

1 Hour Lecture is equivalent to 1 credit

2 Hours Tutorial is equivalent to 1credit

2 Hours Practical is equivalent to1credit

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K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
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B.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS
(For the candidates admitted from 2022-2023 onwards)

FIRST SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1	60 EN 001	Professional English-I	2	40	60	100	45	100
2	60 MA 001	Matrices and Calculus	2	40	60	100	45	100
3	60 EE 001	Basic Electrical and Electronics Engineering	2	40	60	100	45	100
4	60 PH 005	Physics for Biotechnology	2	40	60	100	45	100
5	60 CH 005	Chemistry for Life Sciences	2	40	60	100	45	100
6	60 MY 001	Environmental Studies and Climate Change	2	100	-	100	-	-
PRACTICAL								
7	60 PH 0P2	Applied Physics Laboratory	3	60	40	100	45	100
8	60 CH 0P1	Applied Chemistry Laboratory	3	60	40	100	45	100

* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for the award of terminal examination marks

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Approved in Academic Council Meeting held on 23/12/2023

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60 EN 001	PROFESSIONAL ENGLISH I

Category	L	T	P	Credit
EN	1	0	2	2

Objective

- To help learners improve their vocabulary and to enable them to use words appropriately in different academic and professional contexts
- To help learners develop strategies that could be adopted while reading texts
- To help learners acquire the ability to speak effectively in English in real life and career related situations
- To equip students with effective speaking and listening skills in English
- To facilitate learners to enhance their writing skills with coherence and appropriate format effectively

Prerequisite

Basic knowledge of reading and writing in English.

Course Outcomes

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

CO1	Listen and comprehend complex academic texts	Understand
CO2	Read and infer the denotative and connotative meanings of technical texts	Analyze
CO3	Write definitions, descriptions, narrations, and essays on various topics	Apply
CO4	Speak fluently and accurately in formal and informal communicative contexts	Apply
CO5	Express their opinions effectively in both oral and written medium of communication	Analyze

Mapping with Programme Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								2	3	3	2	3		
CO2								2	3	3	2	3		
CO3								2	3	3	2	3	1	2
CO4								2	3	3	2	3	3	3
CO5								2	3	3	2	3	1	1
3- Strong; 2-Medium; 1-Some														

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Knowledge (Kn)	10	10	10
Apply (Ap)	20	20	40
Analyse (An)	30	30	50
Create (Cr)	0	0	0

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Approved in Academic Council Meeting held on 23/12/2023

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K.S.Rangasamy College of Technology – Autonomous R2022								
60 EN 001- Professional English I								
Common to All Branches								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	1	0	2	45	2	40	60	100

Introduction to Fundamentals of Communication **Listening:** General information-specific details-conversation: introduction to classmates – audio / video (formal & informal). **Speaking:** Self Introduction; Introducing a friend; conversation - politeness strategies. **Reading:** Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. **Writing:** Writing letters – informal and formal – basics and format orientation **Language Focus:** Present Tenses; word formation (affixes); synonyms, antonyms and contranyms, and phrasal verbs; abbreviations & acronyms (as used in technical contexts).	**[9]**
Narration and Summation **Listening:** Podcast, anecdotes / stories / event narration; documentaries and interviews with celebrities. **Speaking:** Narrating personal experiences / events; Interviewing a celebrity; reporting / and summarizing of documentaries / podcasts/ interviews. **Reading:** Biographies, travelogues, newspaper reports, excerpts from literature, and travel & technical blogs. **Writing:** Paragraph writing, short report on an event (field trip etc.). **Language Focus:** Past tenses and prepositions; One-word substitution.	**[9]**
Description of a process / product **Listening:** Listen to a product and process descriptions; advertisements about products or services **Speaking:** Picture description; giving instruction to use the product; presenting a product. **Reading:** Advertisements, gadget reviews and user manuals. **Writing:** Definitions; instructions; and product /process description. **Language Focus:** Imperatives; comparative adjectives; future tenses. Homonyms; and Homophones, discourse markers (connectives & sequence words)	**[9]**
Classification and Recommendations **Listening:** TED Talks; scientific lectures; and educational videos. **Speaking:** Small Talk; Mini presentations **Reading:** Newspaper articles and Journal reports **Writing:** Note-making / Note-taking; recommendations; Transferring information from non-verbal (chart, graph etc, to verbal mode) **Language Focus:** Articles; Pronouns -Possessive & Relative pronouns; ; subject-verb agreement; collocations.	**[9]**
Expression **Listening:** Debates/ discussions; different viewpoints on an issue; and panel discussions. **Speaking:** Group discussions, debates & role plays. **Reading:** Editorials; and opinion blogs. **Writing:** Essay Writing (Descriptive or narrative). **Language Focus:** Punctuation; Compound Nouns; simple, compound & complex sentences. cause & effect expressions.	**[9]**
Total Hours	**45**

Text book(s):

1.	*'English for Engineers & Technologists'* Orient Blackswan Private Ltd. Department of English, Anna University, 2020
2.	Norman Lewis, *'Word Power Made Easy - The Complete Handbook for Building a Superior Vocabulary Book'*, Penguin Random House India, 2020

Reference(s):

1.	Paul Emmerson and Nick Hamilton, *'Five Minute Activities for Business English',* Cambridge

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

	University Press, New York, 2005
2.	Arthur Brookes and Peter Grundy,' *Beginning to Write: Writing Activities for Elementary and Intermediate Learners',* Cambridge University Press, New York, 2003
3.	Michael McCarthy and Felicity O Dell, *'English Vocabulary in Use: Upper Intermediate',* Cambridge University Press, N.York, 2012
4.	Lakshmi Narayanan, *'A Course Book on Technical English'* Scitech Publications (India) Pvt. Ltd. 2020

Course Contents and Lecture Schedule

S.No	Topic	No.of Hours
1	**Introduction to Fundamentals of Communication**	
1.1	Listening for general information and Specific details	1
1.2	Self-introduction	1
1.3	Narrating personal experiences	1
1.4	Reading relevant to technical contexts and emails	1
1.5	Writing letters – informal	1
1.6	Writing letters – formal	1
1.7	Present Tenses	1
1.8	synonyms, antonyms and contranyms, and affixes	1
1.9	phrasal verbs; abbreviations & acronyms	1
2	**Narration and Summation**	
2.1	Listening to podcasts, documentaries and interviews with celebrities	1
2.2	Narrating personal experiences	1
2.3	Summarizing of documentaries	1
2.4	Reading travelogues, and excerpts from literature	1
2.5	Paragraph writing	1
2.6	Short report on an event (field trip etc.).	1
2.7	Past tenses	1
2.8	Prepositions	1
2.9	One-word substitution	1
3	**Description of a process / product**	
3.1	Listen to a product and process descriptions	1
3.2	Picture description	1
3.3	Giving instruction to use the product	1
3.4	Reading Advertisements, gadget reviews and user manuals	1
3.5	Writing Definitions and instructions	1
3.6	Future Tenses	1
3.7	Homonyms and Homophones	1
3.8	Imperatives	1
3.9	comparative adjectives, and discourse markers	1
4	**Classification and Recommendations**	
4.1	Listening to TED Talks and educational videos	2
4.2	Listening to scientific lectures	1
4.3	Small Talk and mini presentations	2
4.4	Reading newspaper articles and journal reports	2
4.5	Note-making / Note-taking	1
4.6	Recommendations	1
4.7	Transferring information from non-verbal	1

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Approved in Academic Council Meeting held on 23/12/2023

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4.8	Articles and Pronouns	2
4.9	Subject-verb agreement and collocations	
5	**Expression**	
5.1	Listening to debates and panel discussions	1
5.2	Group discussions	2
5.3	Role plays	1
5.4	Reading editorials and opinion blogs	1
5.5	Essay Writing (Descriptive or narrative)	1
5.6	Punctuation and cause & effect expressions.	1
5.7	Compound Nouns	1
5.8	Simple, compound & complex sentences	1
	Total	**60**

Course Designers

1. Dr.A.Palaniappan - palaniappan@ksrct.ac.in

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60 MA 001	MATRICES AND CALCULUS	Category	L	T	P	Credit
		BS	3	1	0	4

Objective

- To familiarize the basic concepts in Cayley-Hamilton theorem and orthogonal transformation.
- To get exposed to the fundamentals of differentiation.
- To acquire skills to understand the concepts involved in Jacobians and maxima and minima.
- To solve various linear differential equations and method of variation of parameters.
- To learn various techniques and methods in solving definite and indefinite integrals.

Prerequisite

NIL

Course Outcomes

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

CO1	Apply the concepts of Cayley-hamilton theorem and orthogonal transformation to the matrix.	Remember Understand Apply
CO2	Apply the concepts of differentiation in solving various Engineering problems.	Remember Understand Apply
CO3	Obtain Jacobians and maxima and minima of functions of two variables.	Remember Understand Apply
CO4	Employ various methods in solving differential equations.	Remember Understand Apply
CO5	Apply different techniques to evaluate definite and indefinite integrals.	Remember Understand Apply

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3							2		3
CO2	3	3	2	2	3							2		3
CO3	3	3	3	2	3							2		3
CO4	3	3	3	3	3							2		3
CO5	3	3	3	2	3							2		3
3 - Strong; 2 - Medium; 1 – Some														

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	10	10
Understand (Un)	10	10	20	20
Apply (Ap)	40	40	70	70
Analyze (An)	0	0	0	0
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

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K. S. Rangasamy College of Technology – Autonomous (R 2022)								
60 MA 001 - Matrices and Calculus								
Common to MECH, ECE, EEE, CSE, MCT, CIVIL, IT, TXT, BT, FT, AI&DS, AI&ML								
Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	3	1	0	60	4	40	60	100

Matrices Characteristic equation - Eigen values and Eigen vectors of a real matrix - Properties of Eigen values and Eigen vectors - Cayley-Hamilton theorem - Orthogonal transformation of a symmetric matrix to diagonal form - Reduction of quadratic form to canonical form by an Orthogonal transformation - Nature of quadratic form - Applications: Stretching of an elastic membrane.	[9]
Differentiation Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Successive Differentiation - Leibnitz's theorem **- Applications: Maxima and Minima of functions of one variable*.**	[9]
Functions of Several Variables Partial differentiation - Homogeneous functions and Euler's theorem - Jacobians - Taylor's series for functions of two variables - **Applications: Maxima and minima of functions of two variables - Constrained maxima and minima: Lagrange's Method of Undetermined Multipliers*.**	[9]
Differential Equations Linear differential equations of second and higher order with constant coefficients - R.H.S is of the form $e^{\alpha x}$, $\sin \alpha x$, $\cos \alpha x$, x^n, $n > 0$ - Differential equations with variable coefficients: Cauchy's and Legendre's form of linear equations - Method of variation of parameters.	[9]
Integration Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications: Hydrostatic force and pressure, moments and centres of mass.	
Total Hours: 45 + 15 (Tutorial)	**60**

Text Book(s):

1.	Grewal B.S, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2017.
2.	Kreyszig Erwin, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons (Asia) Limited, New Delhi, 2016.

Reference(s):

1.	Dass H.K, "Higher Engineering Mathematics", 3rd (Revised) Edition, S.Chand & Company Ltd, New Delhi, 2014.
2.	Veerarajan T, "Engineering Mathematics", for Semesters I & II, 1st Edition, Tata McGraw Hill Publishing Co., New Delhi, 2019.
3.	Kandasamy P, Thilagavathy K and Gunavathy K, "Engineering Mathematics - I", S.Chand & Company Ltd, New Delhi, 2017.
4.	Bali N P and Manish Goyal," A text book of Engineering Mathematics",10th Edition, Laxmi Publications (P) Ltd, 2016.

*SDG:4 – Quality Education

Passed in BoS Meeting held on 21.11.2023
Approved in Academic Council Meeting held on 23.12.2023

BoS Chairman Signature

Course Contents and Lecture Schedule

S.No.	Topic	Number of Hours	Mode of Content Delivery
1	**Matrices**		
1.1	Characteristic equation	1	Black Board
1.2	Eigen values and Eigen vectors of a real matrix	1	Black Board
1.3	Properties of Eigen values and Eigen vectors	1	Black Board
1.4	Cayley-Hamilton theorem	1	Black Board
1.5	Tutorial	2	
1.6	Orthogonal transformation of a symmetric matrix to diagonal Form	1	Black Board
1.7	Reduction of quadratic form to canonical form by Orthogonal Transformation	1	Black Board
1.8	Nature of quadratic form	1	Flipped Class
1.9	Stretching of an elastic membrane	1	Black Board
1.10	Tutorial	2	
2	**Differentiation**		
2.1	Representation of functions	1	Black Board
2.2	Limit of a function and Continuity	1	Black Board
2.3	Differentiation rules (sum, product, quotient, chain rules)	2	Flipped Class
2.4	Successive differentiation	1	Black Board
2.5	Tutorial	2	
2.6	Leibnitz's theorem	1	Black Board
2.7	Maxima and minima of functions of one variable	2	Black Board
2.8	Tutorial	2	
3	**Functions of Several Variables**		
3.1	Partial differentiation	1	Black Board
3.2	Homogeneous functions and Euler's theorem	1	Flipped Class
3.3	Jacobians	2	Black Board
3.4	Tutorial	2	
3.5	Taylor's series for functions of two variables	1	Black Board
3.6	Maxima and minima of functions of two variables	1	Black Board
3.7	Lagrange's Method of Undetermined Multipliers	2	Black Board
3.8	Tutorial	2	

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4	**Differential Equations**		
4.1	Linear differential equations of second and higher order with constant co-efficient	1	Flipped Class
4.2	R.H.S is of the form $e^{\alpha x}$, $sin\,\alpha\,x$, $cos\,\alpha\,x$, $x^n, n > 0$	2	Black Board
4.3	Tutorial	2	
4.4	Differential equations with variable coefficients: Cauchy's form of linear equations	2	Black Board
4.5	Differential equations with variable coefficients: Legendre's form of linear equations	2	Black Board
4.6	Method of variation of parameters	1	Black Board
4.7	Tutorial	2	
5	**Integration**		
5.1	Definite and Indefinite integrals	1	Black Board
5.2	Substitution rule	1	Black Board
5.3	Techniques of Integration: Integration by parts	1	Black Board
5.4	Integration of rational functions by partial fraction	1	Black Board
5.5	Tutorial	2	
5.6	Integration of irrational functions	1	Black Board
5.7	Improper integrals	1	Black Board
5.8	Hydrostatic force.	1	Black Board
5.9	Pressure, moments and centres of mass.	1	Flipped Class
5.10	Tutorial	2	
	Total	60	

Course Designers

2. Dr.C.Chandran - cchandran@ksrct.ac.in

3. Mr.G.Mohan - mohang@ksrct.ac.in

List of MATLAB Programs:

1. Introduction to MATLAB.
2. Matrix Operations - Addition, Multiplication, Transpose, Inverse and Rank.
3. Solution of system of linear equations.
4. Compute of Eigen values and Eigen vectors of a Matrix.
5. Solve first and second order ordinary differential equations.
6. Compute Maxima and Minima of a function of one variable.

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BoS Chairman Signature

60 EE 001	Basic Electrical and Electronics Engineering	Category	L	T	P	Credit
		BS	3	0	0	3

Objective

- To familiarize the basic concept on electrical circuits and its various parameters
- To facilitate the various types of electrical machines and their uses
- To gain knowledge on Electrical safety
- To provide exposure on the functions of various semiconductor devices
- To familiarize the use of various measuring instruments

Prerequisite

NIL

Course Outcomes

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

CO1	Apply the basic laws of electric circuits to calculate the unknown quantities.	Remember, Understand and Apply
CO2	Acquire knowledge on different electrical machines and select suitable machines for industrial applications.	Remember, Understand and Analyze
CO3	Recognize the significance of various components of low voltage electrical installations and create awareness on electrical safety.	Remember, Understand
CO4	Realize the operation and characteristics of semiconductor devices.	Remember, Understand and Analyze
CO5	Understandthe operating principles of measuring instruments and choose suitable instrument for measuring the parameters.	Remember, Understand

Mapping with Programme Outcomes

COs	PO1	PO2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	2	-	-	-	-	2	3	-		3
CO2	3	3	1	1	-	-	2	-	2	-	2	1		3
CO3	3	3	-	2	-	2	-	-	-	-	2	2		3
CO4	2	2	3	-	2	-	2	1	-	2	1	3		3
CO5	2	3	1	2	-	-	3	2	-	-	2	3		3
3- Strong;2-Medium;1-Some														

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination(Marks)
	1	2	
Remember	10	20	30
Understand	20	25	30
Apply	20	10	30
Analyse	10	5	10
Evaluate	0	0	0
Create	0	0	0

Passed in BoS Meeting held on 21.11.2023
Approved in Academic Council Meeting held on 23.12.2023

BoS Chairman Signature

K.S.Rangasamy College of Technology – Autonomous R2022								
60 EE 001 - Basic Electrical and Electronics Engineering								
Common to CSE, IT, AIDS, AIML, MECH, MCT, BT, FT and CIVIL Branches								
Semester	Hours/Week			Totalhrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I/II	3	0	0	45	3	40	60	100

ELECTRICAL CIRCUITS DC Circuits: Circuit Components: Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws–Simple problems. Introduction to AC Circuits and Parameters: Waveforms, Average value and RMS Value of Sinusoidal Waveform real power, reactive power and apparent power, power factor – Steady state analysis of RLC	[10]
ELECTRICAL MACHINES Construction and Working principle - Separately and Self excited DC Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phases Alternator, Synchronous motor and Three Phase Induction Motor.	[10]
ELECTRICAL INSTALLATIONS Domestic wiring, types of wires and cables, earthing,protective devices- switch fuse unit- Miniature Circuit Breaker-Moulded Case Circuit Breaker- Earth Leakage Circuit Breaker, Batteries and types, UPS,Safety precautions and First Aid.	[9]
ANALOG ELECTRONICS Introduction to Semiconductor Materials– PN Junction Diodes, Zener Diode –Characteristics and Applications – Bipolar Junction Transistor-Biasing and Configuration (NPN) - Regulated power supply unit, switched mode power supply.	[8]
MEASUREMENTS AND INSTRUMENTATION Functional elements of an instrument, Standards and calibration, Operating Principle, types -Moving Coil and Moving Iron meters, Operating principles and Types of Wattmeter, Energy Meter, Instrument Transformers-CT and PT, DSO- Block diagram- Data acquisition**.**	[8]
Total Hours	45

TextBook(s):

1.	Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020.
2	A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.

Reference(s):

1.	Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019.
2.	Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017.
3.	Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.
4.	H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010.

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Course Contents and Lecture Schedule

S.No	Topic	No. of. Hours
1	**ELECTRICAL CIRCUITS**	
1.1	Circuit Components: Resistor, Inductor, Capacitor	1
1.2	Ohm's Law - Kirchhoff's Laws	1
1.3	Ohm's Law - Kirchhoff's Laws – Problems	2
1.4	Introduction to AC Circuits and Parameters: Waveforms, Average value and RMS Value of Sinusoidal Waveform	2
1.5	Real power, reactive power and apparent power, power factor	1
1.6	Steady state analysis of RLC series circuits	1
1.7	RLC series circuits – Problems	1
1.8	Introduction to three phase system	1
2	**ELECTRICAL MACHINES**	
2.1	Construction and Working principle of DC Generator	1
2.2	Types and Applications of Separately and Self excited DC Generators	1
2.3	EMF equation of DC Generator	1
2.4	Working Principle of DC motors	1
2.5	Torque Equation	1
2.6	Types and Applications	1
2.7	Construction, Working principle and Applications of Transformer	1
2.8	Construction, Working principle and Applications of Three phase Alternator	1
2.9	Construction, Working principle and Applications of Synchronous motor	1
2.10	Construction, Working principle and Applications of Three Phase Induction Motor	1
3	**ELECTRICAL INSTALLATIONS**	
3.1	Domestic wiring, types of wires and cables	1
3.2	Earthing, protective devices	2
3.3	Switch fuse unit- Miniature Circuit Breaker	1
3.4	Molded Case Circuit Breaker- Earth Leakage Circuit Breaker	1
3.5	Batteries and types	2
3.6	UPS	1
3.7	Safety precautions and First Aid	1
4	**ANALOG ELECTRONICS**	
4.1	Introduction to Semiconductor Materials	1
4.2	Characteristics and Applications of PN Junction Diodes	1
4.3	Characteristics and Applications of Zener Diode	1
4.4	Bipolar Junction Transistor	1
4.5	Biasing & Configuration (NPN)	2
4.6	Regulated power supply unit	1
4.7	Switched mode power supply	1
5	**MEASUREMENTS AND INSTRUMENTATION**	
5.1	Functional elements of an instrument	1
5.2	Standards and calibration	1
5.3	Moving Coil meters - Operating Principle, types	1
5.4	Moving Iron meters - Operating Principle, types	1
5.5	Operating principles and Types of Wattmeter	1
5.6	Energy Meter	1
5.7	Instrument Transformers – CT& PT	1
5.9	DSO- Block diagram- Data acquisition	1
	Total	45

Course Designers

1. Mr.S.Srinivasan - srinivasan@ksrct.ac.in
2. Ms.R.Radhamani -radhamani@ksrct.ac.in
3. Ms.S.Jaividhya- jaividhya@ksrct.ac.in
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Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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60 PH 005	PHYSICS FOR BIOTECHNOLOGY

Category	L	T	P	Credit
BS	3	0	0	3

Objective

1. To analyze the crystal parameters to investigate crystal structures and to classify the type of the defect present in the crystal
2. To enable the students in understanding the importance of quantum physics and its applications.
3. To introduce the basics of laser, optical fiber and its applications in biomedical field.
4. To study the basic concept of ultrasonic waves, production of ultrasonic waves and its applications
5. To obtain fundamental concepts and current knowledge of biomaterials and nanotechnology for engineering applications.

Prerequisite

NIL

Course Outcomes

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

CO1	Recognize the basics of crystallography, crystal imperfections and nucleation	Understand
CO2	Acquire the fundamentals of quantum mechanics and apply to one dimensional motion of particles.	Understand
CO3	Assess a strong foundational knowledge in lasers and fiber optics and its applications	Apply & Analyse
CO4	Comprehend the principle, production, properties and applications of ultrasonic waves	Apply
CO5	Assess the properties of bio materials and nano materials for potential applications ions	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2			2	3		2		2		
CO2	3	3	2	2			2	3		2		2		
CO3	3	3	2	2			3	3		2		2	2	2
CO4	3	3	2	2			3	3		2		2	2	2
CO5	3	3	2	2			3	3		2		2	2	3
3- Strong; 2-Medium; 2-Low														

Assessment Pattern

Bloom'sCategory	Continuous Assessment Tests(Marks)		End Sem Examination(Marks)
	1	2	
Remember	10	10	30
Understand	20	20	30
Apply	30	30	30
Analyse	0	0	10
Evaluate	0	0	0
Create	0	0	0

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

K. S. Rangasamy College of Technology – Autonomous (R 2022)								
60 PH 005- PHYSICS FOR BIOTECHNOLOGY								
Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	40	60	100

CRYSTALLOGRAPHY Lattice - Unit cell – crystal systems and Bravais lattice - Crystal planes and Miller indices - d spacing in cubic lattice – Packing factor for HCP – Crystal imperfections- edge and screw dislocations, Burgers vector and elastic strain energy- surface imperfections – grain and twin boundaries – Polymorphism – phase changes – nucleation and growth – homogeneous and heterogeneous nucleation.	[9]
QUANTUM MECHANICS* Introduction to Quantum mechanics-Wave nature of Particles- de-Broglie hypothesis – Matter waves - Time-dependent and time independent Schrodinger equation for wave function- Applications: Particle in a box (one dimensional and three dimensional) - Uncertainty principle and its applications- Electron microscope: Scanning electron microscope	[9]
LASER AND FIBER OPTICS Introduction - characteristics - Einstein's coefficients - population inversion - Nd:YAG and CO_2 lasers - applications of Lasers in therapy and diagnosis – Endoscopy- blood flow measurement. Optical fibre-principle - Classification - Expression for acceptance angle and numerical aperture- Fiber optic sensors: liquid level sensors, Temperature and Displacement sensors- Optical fibers in bio-sensing applications.	[9]
ULTRASONICS AND APPLICATIONS** Introduction-Properties - Production: Magnetostriction effect, Magnetostriction generator- piezoelectric effect, piezoelectric generator – Ultrasonic detection- acoustical grating- Ultrasound application in medicine - Ultrasound interactions with the tissues (reflection, diffraction, refraction, absorption, scattering) - safety Aspects of diagnostic and therapeutic ultrasound- cardiology, neurology, ultrasonic imaging (A, B and TM-	[9]
BIO MATERIALS AND NANOTECHNOLOGY Biocompatibility - Bio functionality- Classification of biomaterials and its application - Nanomaterials: Properties- Top-down process: Ball Milling method - Bottom-up process: Vapour Phase Deposition method-Carbon NanoTube (CNT): Properties, preparation (electric arc method) - CNT Applications: Anti-cancer treatment, Gene therapy, Bio molecule sensor, Drug delivery and radioactive nano particles in biomedical applications.	[9]
Total Hours: 45	**60**

Text Book(s):	
1.	M. N. Avadhanulu, P. G. Kshirsagar, TVS Arun Murthy "A Text Book of Engineering Physics", S Chand
2.	H. K. Malik, A. K. Singh "Engineering Physics" McGraw Hill Education Private Limited, New Delhi. 2021
3.	Joon Park and R.S.Lakes, Biomaterials: An Introduction, Springer, 2007.
Reference(s):	
1.	S.O. Pillai "A Textbook Of Engineering Physics" New Age International (P) Limited, New Delhi, 2014
2.	B. B. Laud " Lasers and Non-Linear Optics" New Age International Publications, New Delhi, 2015
3.	Palanisamy, P.K., "Physics of Materials", Scitech Publications, Chennai. 2012

*SDG 4 – Quality Education

**SDG 3 – Healthy life and promote wellbeing

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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Course Contents and Lecture Schedule

S. No.	Topic	No. of hours
1.0	**CRYSTALLOGRAPHY**	
1.1	Lattice - Unit cell – crystal systems and Bravais lattice	2
1.2	Crystal planes and Miller indices	1
1.3	d spacing in cubic lattice	1
1.4	Packing factor for HCP	1
1.5	Crystal imperfections- edge and screw dislocations, Burgers vector and elastic strain energy	2
1.6	Surface imperfections – grain and twin boundaries – Polymorphism	1
1.7	Phase changes – nucleation and growth – homogeneous and heterogeneous nucleation.	1
2.0	**QUANTUM MECHANICS**	
2.1	Introduction to Quantum mechanics	1
2.2	Wave nature of Particles- de-Broglie hypothesis – Matter waves	2
2.3	Time-dependent and time independent Schrodinger equation for wave function	2
2.4	Applications: Particle in a box (one dimensional and three dimensional)	2
2.5	Uncertainty principle and its applications	1
2.6	Electron microscope: Scanning electron microscope.	1
3.0	**LASER AND FIBER OPTICS**	
3.1	Introduction – characteristics	1
3.2	Einstein's coefficients	1
3.3	Population inversion - Nd:YAG Laser	1
3.4	CO_2 laser	1
3.5	Applications of Lasers in therapy and diagnosis – Endoscopy- blood flow measurement.	1
3.6	Optical fibre- principle - Classification - Expression for acceptance angle and numerical aperture	2
3.7	Fiber optic sensors: liquid level sensors, Temperature and Displacement sensors	1
3.8	Optical fibers in bio-sensing applications.	1
4.0	**ULTRASONICS AND APPLICATIONS**	
4.1	Introduction-Properties -	1
4.2	Production: Magnetostriction effect, Magnetostriction generator-	1
4.3	piezoelectric effect, piezoelectric generator	1
4.4	Ultrasonic detection- acoustical grating	1
4.5	Ultrasound application in medicine - Ultrasound interactions with the tissues (reflection, diffraction, refraction, absorption, scattering)	2
4.6	Safety Aspects of diagnostic and therapeutic ultrasound- cardiology, neurology	2
4.7	Ultrasonic imaging (A, B and TM-Scan)- Sonogram.	1
5.0	**BIO MATERIALS AND NANOTECHNOLOGY**	
5.1	Biocompatibility - Bio functionality- Classification of biomaterials and its application	2
5.2	Nanomaterials: Properties- Top-down process: Ball Milling method	1
5.3	Bottom-up process: Vapour Phase Deposition method	2
5.4	Carbon NanoTube (CNT): Properties, preparation (electric arc method)	1
5.5	CNT Applications: Anti- cancer treatment, Gene therapy, Bio molecule sensor, Drug delivery	2
5.6	Radioactive nano particles in biomedical applications.	1

Course Designers

1. Dr. V. Vasudevan- Vasudevan.vi@gmail.com
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3. Dr. M. Malarvizhi – malarvizhi@ksrct.ac.in

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023 BoS Chairman Signature

60 CH 005	CHEMISTRY FOR LIFE SCIENCES (B.Tech. BT & FT)

Category	L	T	P	Credit
BS	3	0	0	3

Objective

- To help the learners, analyze the hardness of water and its removal.
- To endow an overview of solutions and its applications.
- To rationalize the significance of chemical kinetics and catalysis.
- To analyze the concepts, functions of electrochemistry.
- To recall the basics and application of chemical sensors.

Prerequisite

NIL

Course Outcomes

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

CO1	Identify the types of hardness of water and its removal.	Understand, Apply & Analyse
CO2	Understand the concept of solutions.	Understand & Apply
CO3	Interpret the kinetics of the reaction and its significance.	Apply
CO4	Analyze the applications of electro chemistry.	Apply & Analyse
CO5	Interpret the principles of sensors in various applications.	Understand, Apply & Analyse

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO1**	**PSO2**
CO1	3	2			3			3		3	3	3		3
CO2	3	2			3		2			3		2	3	2
CO3	3	2			2				3		3	2	2	
CO4	3	3		2	3				3				3	2
CO5	3	3	3	2	3		3		3	3		3	3	3
3- Strong; 2-Medium; 2-Low														

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	**2**	**3**	
Remember	20	20	20	20
Understand	40	40	40	40
Apply	40	40	40	40
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

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Syllabus

K. S. Rangasamy College of Technology – Autonomous (R 2022)								
60 CH 005- CHEMISTRY FOR LIFE SCIENCES								
Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	3	0	0	45	3	40	60	100

WATER TECHNOLOGY* Introduction – Commercial and industrial uses of water - hardness - types – estimation of hardness by EDTA method- Internal conditioning (colloidal, phosphate, Calgon and carbonate conditioning methods) – external conditioning (Zeolite process, demineralization process) - Desalination methods (Reverse Osmosis and Electro dialysis). Flash evaporation.	[7]
SOLUTIONS** Normality, molarity, molality, percentage solution, mole fractions (simple numerical problems). Buffer solutions – types – applications- Henderson-Hasselbach equation. Membrane permeability - Principle of diffusion & osmosis - Donon membrane equilibrium. Definition of osmotic pressure, isotonic, hypotonic & hypertonic solutions. Relationship of osmotic pressure to gas laws. The general equation for dilute solutions, the influence of ionization & molecular size on osmotic pressure. Biological importance of osmosis. Colloids - Definition and Types, Gold Number, Preparation and Properties of colloids – lyophilic and lyophobic sols. Brownian movements and Tyndall Effect. Emulsion & emulsifying agents.	[10]
CHEMICAL KINETICS AND CATALYSIS*** Rate of reaction, order and molecularity-– derivation of first order rate equation – half-life period of First order reaction – determination of rate constant of hydrolysis of ester - factors influencing rate of reaction – activation energy -Arrhenius equation –Transition state theory- Catalyst– Auto catalyst – Enzyme catalyst – Michaelis–Menten equation and its significance. Catalytic Promoters – Catalytic poisons – Active center, homogeneous and heterogeneous catalysis – Reactivity – Coenzymes – Proton transfer – metal ions – Intra molecular reactions – Covalent catalysis – Inclusion complexation - Industrial application of catalysts.	[12]
ELECTROCHEMISTRY*** Electrode potential - Nernst Equation - derivation and problems - reversible and irreversible cells - Types of Electrodes and its applications - reference electrodes – measurement of pH, conductometric and Potentiometric titrations.	[6]
CHEMICAL SENSORS**** Sensors – Chemical Sensors – Characteristics – Elements and Characterization - Potentiometric Sensors - Amperometric Sensors – Sensors Based on Electrochemical Methods – Electrochemical Biosensors – Optical Biosensors: Enzyme Sensors – Bio affinity Sensors - DNA Sensors. Chemical Sensors as Detectors and Indicators: Indicators for Titration Processes – Separation Methods. Nano technology in	[10]
Total Hours:	**45**

Text Book(s):	
1.	O.G. Palanna “Engineering Chemistry” Tata McGraw-Hill Pub.Co. Ltd, New Delhi, 2017.
2	P.C. Jain and Monica Jain, A Textbook of Engineering Chemistry, DhanpatRaipublications, New Delhi, 16th edition, 2015.
Reference(s):	
1.	Peter Grundler “Chemical Sensors” ISBN 978-3-540-45742-8 Springer Berlin Heidelberg New York, 2007
2.	B. R. Puri, L.R. Sharma, and S. P. Madan. Principles of Physical Chemistry: Vishal Publishing Company. Gumber Market, Old Railway Road, Jalandhar.
3.	Upadhyay, A.; Upadhyay, K.; Nath, N. Biophysical chemistry: Principles and Techniques; Himalaya Publishing House, Bombay.,1993
4.	B.S. Bahl, G.D. Tuli, Arun Bahl. Essentials of Physical Chemistry. S.Chand and Company, Ltd. New Delhi.

*SDG 6 and 11 – Improve clean water and sanitation and Sustainable Cities and Communities

**SDG 11 – Good health and wellbeing

***SDG 9 and 13 – Industry Innovation and Infrastructure and Climate Action

****SDG 13 – Decent Work and Economic Growth

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023 BoS Chairman Signature

Course Contents and Lecture Schedule

S. No.	Topic	No. of hours
1.0	**Water Technology**	
1.1	Introduction – Commercial and Industrial uses of water	1
1.2	Hardness – types	1
1.3	Estimation of Hardness of ater by EDTA method	1
1.4	Internal conditioning (Colloidal, Phosphate, Calgon and Carbonate)	1
1.5	External conditioning (Zoelite process & Demineralization process)	1
1.6	Desalination methods (Reverse Osmosis and Electrodialysis)	1
1.7	Flash Evaporation	1
2.0	**SOLUTIONS**	
2.1	Normality, molarity, molality, percentage solution, mole fractions (simple numerical problems).	1
2.2	Buffer solutions – types - applications-	1
2.3	Henderson-Hasselbach equation	1
2.4	Membrane permeability - Principle of diffusion & osmosis - Donon membrane equilibrium	1
2.5	Definition of osmotic pressure, isotonic, hypotonic & hypertonic solutions.	1
2.6	Relationship of osmotic pressure to gas laws.	1
2.7	The general equation for dilute solutions, the influence of ionization & molecular size on osmotic pressure.	1
2.8	Biological importance of osmosis.	1
2.9	Colloids - Definition and Types, Gold Number, Preparation and Properties of colloids – lyophilic and lyophobic sols.	1
2.10	Brownian movements and Tyndall Effect. Emulsion & emulsifying agents.	1
3.0	**CHEMICAL KINETICS AND CATALYSIS**	
3.1	Rate of reaction, order and molecularity	1
3.2	Derivation of first order rate equation – half life period of First order reaction	1
3.3	Determination of rate constant of hydrolysis of ester	1
3.4	Factors influencing rate of reaction	1
3.5	Activation energy -Arrhenius equation	1
3.6	Transition state theory	1
3.7	Catalyst– Auto catalyst	1
3.8	Enzyme catalyst – Michaelis–Menten equation and its significance	1
3.9	Catalytic Promoters – Catalytic poisons	1
3.10	Active center, homogeneous and heterogeneous catalysis	1
3.11	Reactivity – Coenzymes – Proton transfer – metal ions – Intra molecular reactions	1
3.12	Covalent catalysis – Inclusion complexation - Industrial application of catalysts.	1
4.0	**ELECTROCHEMISTRY**	
4.1	Electrode potential - Nernst Equation - derivation and problems	1
4.2	reversible and irreversible cells	1
4.3	Types of Electrodes and its applications	2
4.4	reference electrodes – measurement of pH	1

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4.5	conductometric and Potentiometric titrations.	1
5.0	**CHEMICAL SENSORS**	
5.1	Sensors – Chemical Sensors - Characteristics	1
5.2	Elements and Characterization	1
5.3	Potentiometric Sensors, Amperometric Sensors	1
5.4	Sensors Based on Electrochemical Methods	1
5.5	Electrochemical Biosensors	1
5.6	Optical Biosensors : Enzyme Sensors – Bio affinity Sensors	1
5.7	DNA Sensors. Chemical Sensors as Detectors and Indicators	1
5.8	Indicators for Titration Processes	1
5.9	Separation Methods. Nano technology in chemical sensors.	2

Course Designers

1. Dr.T.A.Sukantha – tasukantha@gmail.com
2. Dr.K.Prabha – prabhak@ksrct.ac.in
3. Dr.S.Meenachi – meenachi@ksrct.ac.in

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60 MY 001	ENVIRONMENTAL STUDIES AND CLIMATE CHANGE

Category	L	T	P	Credit
MC	2	0	0	0

Objective

- To understand the importance of ecosystem and biodiversity.
- To analyze the impacts of pollution, control and legislation.
- To enlighten awareness and recognize the social responsibility in environmental issues.
- To enlighten the waste management

Prerequisite

Nil

Course Outcomes

On the successful completion of the course, students will be able to		
CO1	Understand the impacts of pollution on climate change	Understand
CO2	Enhance the awareness the methods of waste management.	Apply
CO3	Examine the value of sustainable future	Evaluate
CO4	Evaluate the clean and green development for environmental problem	Evaluate
CO5	Analyze the role of Geo-science in environmental management	Analyze

Mapping with Programme Outcomes

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

3- Strong; 2-Medium; 1-Some

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	10	10	10	-
Understand	20	20	20	
Apply	30	30	30	
Analyze	30	30	30	-
Evaluate	-	-	-	-
Create	-	-	-	-

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K. S. Rangasamy College of Technology – Autonomous (R 2022)								
60 MY 001- Environmental Studies and Climate Change								
Common to MECH, ECE, EEE, CSE, MCT, CIVIL, IT, TXT, BT, FT, AI&DS, AI&ML								
Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
I	3	0	0	20	0	0	0	0

Pollution and its impact on climate change * Pollution: Sources and impacts of air pollution – greenhouse effect- global warming- climate change - ozone layer depletion - acid rain. Carbon Footprint - Climate change on various sectors – Agriculture, forestry and ecosystem – climate change mitigation and adaptation. Action plan on climate change. IPCC, UNFCCC, Kyoto Protocol, Montreal Protocol on Climatic Changes.	[4]
Integrated Waste Management ** Waste - Types and classification. Principles of waste management (5R approach) - Swachh Bharat Abhiyan – Commercial waste, plastic waste, domestic waste, e-waste and biomedical waste - risk management: Collection, segregation, treatment and disposal methods. Waste water treatment- ASP	[4]
Sustainable development practices*** Sustainable development goals (SDGs) **–** Green computing- Carbon trading - Green building – Eco- friendly plastic – Alternate energy: Hydrogen – Bio-fuels – Solar energy – Wind – Hydroelectric power. Water scarcity- Watershed management, ground water recharge and rainwater harvesting.	[4]
Environment and Agriculture:****** Organic farming – bio-pesticides- composting, bio composting, vermi-composting, roof gardening and irrigation. Waste land reclamation. Climate resilient agriculture. Green auditing	[4]
Geo-science in natural resource management Data base software in environment information, Digital image processing applications in forecasting. GPS, Remote Sensing and Geographical Information System (GIS), World wide web (www), Environmental information system (ENVIS).	[4]
Total Hours:	**20**

Text Book(s):	
1.	Anubha Kaushik , C P Kaushik. Perspectives In Environmental Studies, New Age International publishers;
Reference(s):	
1.	G.Tyler Miller Environmental Science 14th Edition Cengage Publications, Delhi, 2013
2.	Gilbert M.Masters and Wendell P. Ela,"Environmental Engineering And Science", Phi Learning Private Limited, 3rd Edition,2015
3.	Erach Bharucha. Textbook of Environmental Studies for Undergraduate Courses, Universities Press, 2000

*SDG 13 – Climate Action

** SDG 4 – Clean water and sanitation

***SDG 6 – Affordable and clean energy

****SDG 3 – Good health and wellbeing

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Course Contents and Lecture Schedule

S.No	Topic	No. of hours
1.0	**Pollution and its impact on climate change**	
1.1	Pollution: Sources and impacts of air pollution – greenhouse effect- Global warming- climate change - ozone layer depletion - acid rain	2
1.2	Climate change on various sectors: Agriculture, forestry and ecosystem. – climate change mitigation and adaptation	1
1.3	Action plan on climate change - IPCC, UNFCCC, Kyoto Protocol, Montreal Protocol on Climatic Changes	1
2.0	**Integrated Waste Management**	
2.1	Waste - Types and classification. Principles of waste management (5R approach) - Swachh Bharat Abhiyan	1
2.2	Commercial waste, plastic waste, domestic waste, e-waste and biomedical waste	1
2.3	Risk management: Collection, segregation, treatment and disposal methods.	1
2.4	Waste water treatment- ASP	1
3.0	**Sustainable development practices**	
3.1	Sustainable development goals (SDGs) **–** Green computing- Carbon trading - Green building – Eco- friendly plastic	1
3.2	Alternate energy: Hydrogen – Bio-fuels – Solar energy – Wind – Hydroelectric power	2
3.3	Water scarcity- Watershed management, ground water recharge and rainwater harvesting	1
4.0	**Environment and Agriculture**	
4.1	Organic farming – bio-pesticides	1
4.2	Composting, bio composting, vermi-composting	1
4.3	Roof gardening and irrigation	1
4.4	Waste land reclamation. Climate resilient agriculture, green auditing	1
5.0	**Geo-science in natural resource management**	
5.1	Data base software in environment information, Digital image processing applications in forecasting	2
5.2	GPS, Remote Sensing and Geographical Information System (GIS)	1
5.3	World wide web (www), Environmental information system (ENVIS)	1
	Total	**20**

Course Designers

1. Dr.T.A.Sukantha - tasukantha@gmail.com
2. Dr.S.Meenachi – meenachi@ksrct.ac.in
3. Mr.K.Tamilarasu – tamilarasu@ksrct.ac.in

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BoS Chairman Signature

60 PH 0P2	**APPLIED PHYSICS LABORATORY (BT)**

Category	L	T	P	Credit
BS	0	0	4	2

Objective

1. To infer the practical knowledge by applying the experimental methods to correlate with the Physics theory.
2. To demonstrate an ability to make physical measurements and understand the limits of precision in measurements
3. To introduce different experiments to test basic understanding of physics concepts applied in optics and electronics
4. To make ability to develop and fabricate engineering and technical equipment
5. To analyze the behavior and characteristics of various materials for its optimum utilization

Prerequisite

NIL

Course Outcomes

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

CO1	Apply the concept of stress, strain and elastic limit for a given sample to find their properties	Apply
CO2	Recognize the concept of quantum Physics & magnetic properties by experimental verification	Apply
CO3	Recall the knowledge of properties of light and fiber optic cable	Apply
CO4	Assess the dielectric behavior of a given material	Apply
CO5	Apply the photovoltaic effect to demonstrate the working of solar cell	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	3	3	2	3	2	2	3	3	3
CO2	3	3	3	2	2	2	2	2	1	3	2	1	3	3
CO3	3	2	3	3	3	2	3	-	2	2	-	2	3	3
CO4	3	3	3	3	2	2	2	1	2	1	2	3	3	3
CO5	3	3	2	2	3	3	2	2	2	1	2	2	3	3
3- Strong; 2-Medium; 2-Low														

List of Experiments

1. Uniform bending - Determination of Young's modulus.
2. Non-Uniform bending - Determination of Young's modulus.
3. Determination of rigidity modulus of a wire by torsional pendulum.
4. Determination of Planck's constant.
5. Determination of Stefan's Constant.
6. V-I characteristics of solar cell.
7. a) Laser- Determination of the wave length of the laser using grating.
   b) Optical fibre -Determination of Numerical Aperture and acceptance angle.
8. Determination of wavelength of mercury spectral lines – spectrometer grating.
9. Magnetic field along the axis of current carrying coil – Stewart and Gee.
10. Determination of dielectric constant.

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Course Designers

1. Dr. V. Vasudevan – vasudevan.vi@gmail.com
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3. Dr. M. Malarvizhi- malarvizhi@ksrct.ac.in

60CH0P1	APPLIED CHEMISTRY LABORATORY (B.Tech BT)

Category	L	T	P	Credit
BS	0	0	4	2

Objective

- Test the knowledge of theoretical concepts.
- To develop the experimental skills of the learners.
- To facilitate data interpretation.
- To expose the learners to various industrial and environmental applications

Prerequisite

NIL

Course Outcomes

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

CO1	Estimate the hardness in water sample by complexometric method.	Apply
CO2	Determine the amount of dissolved oxygen in given samples.	Apply
CO3	Estimate the amount of acid by pH meter, mixture of acids by conductivity meter and ferrous ion by potentiometer	Apply
CO4	Determine the rate constant of ester.	Apply
CO5	Determine the adsorption of acetic acid	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3			2				2	2			2	3
CO2	2	3			2				2	2			3	
CO3	3	3			2				3	2			3	2
CO4	3	3			2				2	2			2	
CO5	3	3			3				2	2			2	3
3- Strong; 2-Medium; 1-Low														

List of Experiments

1. Estimation of hardness of water sample by complexometric method.
2. Determination of Dissolved Oxygen in water sample by Winkler's method.
3. Estimation of HCl by pH meter.
4. Estimation of mixture of acids by conductivity meter.
5. Determination of ferrous ion by Potentiometric titration.
6. Determination of Rate constant of ester catalyzed by an acid.
7. Adsorption of acetic acid by Charcoal.

Course Designers

1. Dr.T.A.Sukantha – tasukantha@gmail.com
2. Dr.B.Srividhya – srividhyab@ksrct.ac.in
3. Dr.K.Prabha – prabhak@ksrct.ac.in

4. Dr.S.Meenachi – meenachi@ksrct.ac.in

**SDG 3 – Good health and wellbeing

*SDG 6 – Improve Clean water and sanitation

* SDG 12 – Responsible Consumption and Production

**SDG 13 – Climate action

***SDG 14 – Life Below Water

K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
(An Autonomous Institution affiliated to Anna University)

B.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS
(For the candidates admitted from 2022-2023 onwards)

SECOND SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1	60 EN 002	Professional English-II	2	40	60	100	45	100
2	60 MA 003	Integrals, Partial Differential Equations and Laplace Transform	2	40	60	100	45	100
3	60 CS 001	C Programming	2	40	60	100	45	100
4	60 ME 002	Engineering Graphics	2	40	60	100	45	100
5	60 ME 004	Engineering Mechanics	2	40	60	100	45	100
6	**60 GE 001**	**Heritage of Tamils** *தமிழர் மரபு*	2	100	-	100	-	-
PRACTICAL								
7	60 ME 0P1	Fabrication and Reverse Engineering Laboratory	3	60	40	100	45	100
8	60 CS 0P1	C Programming Laboratory	3	60	40	100	45	100
9	60 CG 0P1	Career Skill Development I	3	60	40	100	45	100

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* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put

a process in place to ensure that the actual test paper follow the declared pattern.

** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for the award of terminal examination marks

60 EN 002	**PROFESSIONAL ENGLISH II**

Category	L	T	P	Credit
EN	1	0	2	2

Objective

- To help learners improve their vocabulary and enable them to use words appropriately in different academic and professional contexts.
- To help learners develop strategies that could be adopted while reading texts.
- To help learners acquire the ability to speak and write effectively in English in real life and career related situations.
- Improve listening, observational skills, and problem-solving capabilities
- Develop message generating and delivery skills

Prerequisite

Basic knowledge of reading and writing in English and should have completed Professional English I.

Course Outcomes

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

CO1	Compare and contrast products and ideas in technical texts.	Analyze
CO2	Identify cause and effects in events, industrial processes through technical texts	Analyze
CO3	Analyze problems in order to arrive at feasible solutions and communicate them orally and in the written format.	Analyze
CO4	Report events and the processes of technical and industrial nature.	Apply
CO5	Articulate their opinions in a planned and logical manner, and draft effective résumés in context of job search.	Apply

Mapping with Programme Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								2	3	3	2	3	3	3
CO2								2	3	3	2	3	3	3
CO3								2	3	3	2	3	3	3
CO4								2	3	3	2	3	2	2
CO5								2	3	3	2	3	2	2
3- Strong; 2-Medium; 1-Some														

Assessment Pattern

	Continuous Assessment Tests	

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Bloom's Category	(Marks)		End Sem Examination (Marks)
	1	2	
Remember (Re)	10	10	10
Apply (Ap)	20	20	40
Analyse (An)	30	30	50
Create (Cr)	0	0	0

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K.S.Rangasamy College of Technology – Autonomous R2022								
60 EN 002 -Professional English II								
Common to All Branches								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	1	0	2	45	2	40	60	100

Making Comparisons **Listening:** Evaluative Listening: Advertisements, Product Descriptions, - Audio / video; filling a graphic organiser (choosing a product or service by comparison) **Speaking:** Marketing a product, persuasive speech techniques. **Reading:** Reading advertisements, user manuals and brochures. **Writing:** Professional emails, Email etiquette - compare and contrast essay. **Language Focus:** mixed tenses, prepositional phrases, same words used in different contexts and	**[9]**
Expressing Causal Relations in Speaking and Writing **Listening:** Listening to longer technical talks and completing– gap filling exercises. Listening technical information from podcasts – Listening to process/event descriptions to identify cause & effects. **Speaking:** Describing and discussing the reasons of accidents or disasters based on news reports. **Reading:** longer technical texts– cause and effect essays, and letters / emails of complaint, **Writing:** Writing responses to complaints **Language Focus:** Active Passive Voice transformations, Infinitive and Gerunds – Word Formation (Noun-Verb-Adj-Adv), Adverbs.	**[9]**
Problem Solving **Listening:** Listening to / watching movie scenes/ documentaries depicting a technical problem and suggesting solutions. **Speaking:** Group Discussion (based on case studies), - techniques and Strategies. **Reading:** Case Studies, excerpts from literary texts, news reports etc. **Writing:** Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay **Language Focus:** Error correction; If conditional sentences - Compound Words, Sentence Completion.	**[9]**
Reporting of Events and Research **Listening:** Listening Comprehension based on new report and documentaries – **Speaking:** Interviewing, presenting oral reports, Mini presentations on select topics. **Reading:** Newspaper articles. **Writing:** Recommendations, Transcoding, Accident Report, Precis writing and Summarising, and Plagiarism **Language Focus:** Reported Speech – Modals - Conjunctions- use of Prepositions	**[9]**
The Ability to put Ideas or Information Coherently **Listening:** Listening to TED Talks, Presentations, Formal job interviews, (analysis of the interview performance). **Speaking:** Participating in role plays, virtual interviews, making presentations with visual aids **Reading:** excerpts of interview with professionals **Writing:** Job / Internship application – Cover letter & Résumé **Language Focus:** Numerical Adjectives, question types: Wh/ Yes or No/ and Tags; Relative Clauses - Idioms.	**[9]**
Total Hours	**45**

Text book(s):	
1.	*'English for Engineers & Technologists'* Orient Blackswan Private Ltd. Department of English, Anna University, 2020
2.	Norman Lewis, *'Word Power Made Easy - The Complete Handbook for Building a Superior Vocabulary Book'*, Penguin Random House India, 2020
Reference(s):	
1.	Raman. Meenakshi, Sharma. Sangeeta, *'Professional English'*. Oxford university press. New Delhi.

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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	2019
2.	Arthur Brookes and Peter Grundy,' *Beginning to Write: Writing Activities for Elementary and Intermediate Learners',* Cambridge University Press, New York, 2003
3.	Prof. R.C. Sharma & Krishna Mohan, *'Business Correspondence and Report Writing'*, Tata McGraw Hill & Co. Ltd., New Delhi, 2001
4.	V.N. Arora and Laxmi Chandra, *'Improve Your Writing'*, Oxford University Press, New Delhi, 2001

Course Contents and Lecture Schedule

S.No	Topic	No.of Hours	Mode of content Delivery
1	**Making Comparisons**		
1.1	Evaluative Listening	1	Activity Based
1.2	Product Descriptions and filling a graphic organiser	1	Activity Based
1.3	Marketing a product by using persuasive techniques	2	Activity Based
1.4	Reading advertisements, user manuals and brochures	1	Activity Based
1.5	Writing professional emails	1	Lecture
1.6	Compare and contrast essay	1	Lecture
1.7	mixed tenses and prepositional phrases	1	Lecture
1.8	Same words used in different contexts	1	Lecture
2	**Expressing Causal Relations in Speaking and Writing**		
2.1	Listening to longer technical talks	1	
2.2	Listening to process/event descriptions	1	Activity Based
2.3	Describing and discussing the reasons of accidents or disasters	1	Activity Based
2.4	Reading longer technical texts– cause and effect essays	1	Activity Based
2.5	Writing responses to complaints	1	Lecture
2.6	Active Passive Voice transformations	2	Lecture
2.7	Infinitive and Gerunds	1	Lecture
2.8	Word Formation (Noun-Verb-Adj-Adv), Adverbs.	1	Lecture
3	**Problem Solving**		
3.1	Listening to documentaries and suggesting solutions	1	Activity Based
3.2	Group Discussion (based on case studies)	2	Activity Based
3.3	Reading Case Studies, excerpts from literary texts and news reports	1	Activity Based
3.4	Letter to the Editor	1	Lecture
3.5	Checklists	1	Lecture
3.6	Problem solution and argumentative essays	1	Lecture
3.7	Error correction and Sentence Completion	1	Lecture
3.8	If conditional sentences	1	Lecture
4	**Reporting of Events and Research**		
4.1	Listening Comprehension	1	Activity Based

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Approved in Academic Council Meeting held on 23/12/2023

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4.2	Interviewing and presenting oral reports	1	Activity Based
4.3	Mini presentations on select topics	1	Activity Based
4.4	Reading newspaper articles	1	Activity Based
4.5	Recommendations	1	Lecture
4.6	Transcoding	1	Lecture
4.7	Precis writing, Summarising and Plagiarism	1	Lecture
4.8	Reported Speech, Modals	1	Lecture
4.9	Conjunctions	1	Lecture
5	**The Ability to put Ideas or Information Coherently**		
5.1	Listening to Formal job interviews	1	Activity Based
5.2	Role plays	2	Activity Based
5.3	Virtual interviews	1	Activity Based
5.4	Reading Company profiles	1	Lecture
5.5	Writing Statement of Purpose (SoPs)	1	Lecture
5.6	Writing Résumé	1	Lecture
5.7	Numerical Adjectives and Relative Clauses - Idioms	1	Lecture
5.8	question types: Wh/ Yes or No/ and Tags	1	Lecture
	Total	**45**	

Course Designers

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BoS Chairman Signature

60 MA 003	Integrals, Partial Differential Equations and Laplace Transform	Category	L	T	P	Credit
		BS	3	1	0	4

Objective

- To acquire the knowledge about multiple integrals.
- To familiarize the basic concepts of vector calculus.
- To get exposed to the fundamentals of analytic functions.
- To solve various types of partial differential equations.
- To familiarize the concepts of Laplace transform.

Prerequisite

NIL

Course Outcomes

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

CO1	Understand the concepts of double and triple integrals.	Remember Understand Apply
CO2	Understand the basic concepts of vector calculus.	Remember Understand Apply
CO3	Construct the analytic functions and evaluate complex integrals.	Remember Understand Apply
CO4	Compute the solution of partial differential equations using different methods.	Remember Understand Apply
CO5	Apply Laplace transform techniques for solving differential equations.	Remember Understand Apply

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3							2	3	2
CO2	3	3	2	2	3							2	3	2
CO3	3	3	3	2	2							2	3	2
CO4	3	3	3	3	2							2	3	2
CO5	3	3	2	3	3							2	3	2
3 - Strong; 2 - Medium; 1 - Some														

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	10	10
Understand (Un)	10	10	20	20
Apply (Ap)	40	40	70	70
Analyze (An)	0	0	0	0
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

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K.S. Rangasamy College of Technology – Autonomous (R 2022)								
60 MA 003 – Integrals, Partial Differential Equations and Laplace Transform								
Common to MECH, ECE, EEE, CSE, MCT, CIVIL, IT, TXT, BT, FT								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	1	0	60	4	40	60	100

MULTIPLE INTEGRALS Double integration – Cartesian and polar co-ordinates – Change of order of integration – Area as double integral – Triple integration in Cartesian co-ordinates – Change of variables - Cartesian to polar co-ordinates and Cartesian to Cylindrical co-ordinates.	[9]
VECTOR CALCULUS* Introduction - Gradient of a scalar point function –Directional derivative – Angle of intersection of two surfaces – Divergence and curl (excluding vector identities) – Solenoidal and irrotational vectors – Application : Green's theorem in the plane – Gauss divergence theorem -Stokes' theorem (statement only) .	[9]
ANALYTIC FUNCTIONS AND INTEGRALS Analytic function – Necessary and Sufficient conditions (statement only)-Properties – Harmonic function – Construction of an analytic function – Cauchy's Integral theorem (statement only) – Cauchy's integral formula – Classification of singularities – Application: Cauchy's residue theorem.	[9]
PARTIAL DIFFERENTIAL EQUATIONS Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions – Non-Linear partial differential equations of first order – Lagrange's linear equations – Application: Homogeneous Linear partial differential equations with constant coefficients	[9]
LAPLACE TRANSFORM Conditions for existence – Transforms of elementary functions – Basic properties - Derivatives and integrals of transforms - Initial and final value theorem – Transform of periodic functions. Inverse Laplace transform – Convolution theorem (excluding proof) – Application: Solution of second order ordinary differential equations with constant co-efficients.	
Total Hours: 45 + 15 (Tutorial)	**60**

Text Book(s):	
1.	Grewal B.S, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2017.
2.	Kreyszig Erwin, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons (Asia) Limited, New Delhi, 2016.
Reference(s):	
1.	Dass H.K, "Higher Engineering Mathematics", 3rd (Revised) Edition, S.Chand & Company Ltd, New Delhi, 2014.
2.	Veerarajan T, "Engineering Mathematics", for Semesters I & II, 1st Edition, Tata McGraw Hill Publishing Co., New Delhi, 2019.
3.	Kandasamy P, Thilagavathy K and Gunavathy K, "Engineering Mathematics - I", S.Chand & Company Ltd, New Delhi, 2017
4.	Bali N P and Manish Goyal, "A text book of Engineering Mathematics",10th Edition, Laxmi Publications (P) Ltd, 2016.

***SDG 4 – Quality Education**

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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Course Contents and Lecture Schedule

S.No	Topic	No. of Hours	Mode of content Delivery
1	**MULTIPLE INTEGRALS**		
1.1	Double integration	1	Black Board
1.2	Cartesian and polar coordinates	1	Black Board
1.3	Change of order of integration	1	Black Board
1.4	Area as double integral	1	Black Board
1.5	Tutorial	2	
1.6	Triple integration in Cartesian coordinates	1	Black Board
1.7	Change of variables	1	Black Board
1.8	Cartesian to polar coordinates	1	Black Board
1.9	Cartesian to Cylindrical coordinates	1	Flipped class
1.10	Tutorial	2	
2	**VECTOR CALCULUS**		
2.1	Introduction: Gradient of a scalar point function	1	Black Board
2.2	Directional derivative	1	Black Board
2.3	Angle of intersection of two surfaces	1	Black Board
2.4	Divergence and curl (excluding vector identities)	1	Black Board
2.5	Tutorial	2	
2.6	Solenoidal and irrotational vectors	1	Black Board
2.7	Application: Green's theorem in the plane	1	TPS
2.8	Gauss divergence theorem	1	Black Board
2.9	Stokes' theorem (statement only)	1	Black Board
2.10	Tutorial	2	
3	**ANALYTIC FUNCTIONS AND INTEGRALS**		
3.1	Analytic function	1	Black Board
3.2	Necessary and Sufficient conditions (statement only)	1	Black Board
3.3	Properties	1	Black Board
3.4	Harmonic function	1	Black Board
3.5	Tutorial	2	
3.6	Construction of an analytic function	1	Black Board
3.7	Cauchy's Integral theorem (statement only), Cauchy's integral formula	1	Black Board
3.8	Classification of singularities	1	Black Board
3.9	Applications : Cauchy's residue theorem.	1	TPS
3.10	Tutorial	2	
4	**PARTIAL DIFFERENTIAL EQUATIONS**		
4.1	Formation of partial differential equations by eliminating arbitrary constants	1	Black Board
4.2	Formation of partial differential equations by eliminating arbitrary functions	2	Black Board
4.3	Tutorial	2	
4.4	Non- linear partial differential equations of first order	2	PPT

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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4.5	Lagrange's linear equations	1	Black Board
4.6	Application : Homogeneous Linear partial differential equations with constant coefficients.	2	TPS
4.7	Tutorial	2	
5	**LAPLACE TRANSFORM**		
5.1	Conditions for existence	1	Black Board
5.2	Transforms of elementary functions	1	Black Board
5.3	Basic properties	1	PPT
5.5	Derivatives and integrals of transforms, Initial and final value theorem	1	Black Board
5.6	Tutorial	1	
5.7	Transform of periodic functions	2	Black Board
5.8	Inverse Laplace transform	1	Black Board
5.9	Convolution theorem (excluding proof)	1	Black Board
5.10	Application: Solution of second order ordinary differential equation with constant co-efficient.	1	TPS
5.11	Tutorial	2	
	Total	60	

Course Designers

1. Dr.C.Chandran - cchandran@ksrct.ac.in
2. Dr.K.Prabakaran - prabakaran@ksrct.ac.in

List of MATLAB Programs:

1. Evaluating double and triple integrals.
2. Area as double integral.
3. Volume as triple integral.
4. Plotting and visualizing single variable functions.
5. Plotting and visualizing functions of two and three variables.
6. Evaluating Gradient, divergence and curl.
7. Evaluating Laplace & Inverse Laplace transforms.
8. Applying Laplace transform techniques to solve differential equations

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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60 CS 001	C PROGRAMMING

Category	L	T	P	Credit
CSE	3	0	0	3

Objectives

- To learn most fundamental element of the C language and to examine the execution of branching, looping statements,
- To examine the concepts of arrays, its characteristics and types and strings.
- To understand the concept of functions, pointers and the techniques of putting them to use
- To apply the knowledge of structures and unions to solve basic problems in C language
- To enhance the knowledge in file handling functions for storage and retrieval of data

Prerequisite

Nil

Course Outcomes

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

CO1	Construct the fundamental building blocks of structured Programming in C	Apply
CO2	Implement the different operations on arrays and strings	Apply
CO3	Develop simple real world applications utilizing functions, recursion and pointers.	Apply
CO4	Demonstrate the concepts of structures, unions ,user defined data types and preprocessor	Apply
CO5	Interpret the file concepts using proper standard library functions for a given application	Apply

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3		3				2	2		2	3	3
CO2	3	3	3		3				2	2		2	3	3
CO3	3	3	3		3				2	2		2	3	3
CO4	3	3	3		3				2	2		2	3	3
CO5	3	3	3		3				2	2		2	3	3
3- Strong;2-Medium;1-Some														

Assessment Pattern

Cognitive Levels	Continuous Assessment Tests		End Semester Examination(Marks)
	1	2	
Remember	10	10	20
Understand	10	10	20
Apply	40	40	60
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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Syllabus

K. S. Rangasamy College of Technology – Autonomous R2022								
60 CS 001 – C Programming								
Common to CSE, CSBS, AI&ML, IT, AI&DS								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	0	0	45	3	40	60	100

Basics of C, I/O, Branching and Loops* Structure of a C Program – Data types – Keywords - Variables – Type Qualifiers - Constants – Operators–expressions and precedence- Console I/O– Unformatted and Formatted Console I/O - Conditional Branching and Loops-Writing and evaluation of conditionals and consequent branching	[9]
Arrays and Strings* Arrays: One Dimensional Arrays - Two Dimensional Arrays – Matrix Manipulation - Character arrays – Strings: String Manipulation with and without String Handling Functions.	[9]
Functions and Pointers* Functions: Scope of a Function – Library Functions and User defined functions - Function Prototypes – Call by value and Call by reference – Function Categorization- Arguments to main function— Recursion and application - Passing Arrays to Functions– Storage class Specifiers. Introduction to Pointer Variables - The Pointer Operators - Pointer Expressions - Pointers and Arrays - Generating a Pointer to an Array - Indexing Pointers– Function and pointers - Dynamic memory allocation.	[11]
Structures, Unions, Enumerations, Typedef and Preprocessors* Structures - Introduction to Structures and Initialization - Arrays of Structures- Arrays and Structures, Nested Structures - Passing Structures to Functions - Structure Pointers - Unions – Bit Fields - Enumerations - typedef –The preprocessor and commands.	[9]
File Handling* File: Streams –Reading and Writing Characters - Reading and Writing Strings - File System functions – File Manipulation-Sequential access - Random Access Files – Command Line arguments.	[9]
Total Hours	**45**

Text Book(s):	
1.	Herbert Schildt, “The Complete Reference C”, Fourth Edition, Tata McGraw Hill Edition, 2010.
2.	Byron Gottfried, “Programming with C”, Third Edition, McGraw Hill Education, 2014.
Reference(s):	
1.	E. Balagurusamy, “Programming in ANSI C”, Seventh Edition, Tata McGraw Hill Edition, New Delhi, 2016.
2.	Brian W. Kernighan and Dennis M. Ritchie, “C Programming Language”, Prentice-Hall.
3.	ReemaThareja, “Computer Fundamentals and Programming in C”, Second Edition, Oxford Higher Education, 2016.
4.	K N King, “C Programming: A Modern Approach”, Second Edition, W.W.Norton, New York, 2008.

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Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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Course Contents and Lecture Schedule

Module No	Topic	No. of Hours
1	**Basics of C, I/O, Branching and Loops**	
1.1	Structure of a C Program, Keywords	1
1.2	Data types, Type Qualifiers	1
1.3	Variables and Constants	1
1.4	Operators–expressions and precedence	1
1.5	Console I/O– Unformatted and Formatted Console I/O	1
1.6	Conditional Branching	1
1.7	Iteration and loops	2
1.8	Writing and evaluation of conditionals and consequent branching	1
2	**Arrays and Strings**	
2.1	One Dimensional Array	1
2.2	Two-Dimensional Array and Matrix Manipulation	1
2.3	Character arrays and Strings Basics	1
2.4	String Manipulation without String Handling Functions	2
2.5	String Manipulation with String Handling Functions	2
3	**Functions and Pointers**	
3.1	Scope of a Function – Library Functions, User defined functions and Function Prototypes	1
3.2	Function Call by value and Function Call by reference, Function Categorization	2
3.3	Arguments to main function	1
3.4	Recursion and application	1
3.5	Passing Arrays to Functions	1
3.6	Storage class Specifiers	1
3.7	Introduction to Pointer Variables - The Pointer Operators - Pointer Expressions	1
3.8	Pointers and Arrays - Generating a Pointer to an Array - Indexing Pointers	1
3.9	Function and pointers	1
3.10	Dynamic memory allocation	1
4	**Structures, Unions, Enumerations, Typedef and Preprocessors**	
4.1	Introduction to Structures and Initialization	1
4.2	Arrays and Structures, Arrays of Structures	1
4.3	Structures within Structures, Passing Structures to Functions	2
4.4	Structure Pointers	1
4.5	Unions and Bit Fields.	1
4.6	Enumerations - typedef	1
4.7	Preprocessor commands	2
5	**File Handling**	
5.1	File Streams –Reading and Writing Characters - Reading and Writing Strings	2
5.2	File System functions and File Manipulation	2
5.3	Sequential access	2
5.4	Random Access Files	2
5.5	Command Line arguments and files	1
	Total Hours	**45**

Course Designers

1. Dr.P.KALADEVI - kaladevi@ksrct.ac.in

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Approved in Academic Council Meeting held on 23/12/2023

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60 ME 002	ENGINEERING GRAPHICS	Category	L	T	P	Credit
		ES	2	0	4	4

Objective

- To acquire various concepts of dimensioning, conventions and standards.
- To impart the graphic skills for converting pictorial views of solids in to orthographic views.
- To learn the concept in projection of solids, section of solids and development of different types of surfaces.
- To learn the concept of isometric projection.
- To learn the geometry and topology of engineered components

Prerequisite

NIL

Course Outcomes

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

CO1	Demonstrate the Impact of computer technologies on graphical communication	R/U/A
CO2	Convert the pictorial views in to orthographic views using drafting software	R/U/A
CO3	Draw the projection of simple solids, true shape of sections and development of surfaces	R/U/A
CO4	Construct the isometric projections of objects using drafting software.	R/U/A
CO5	Interpret a design project illustrating engineering graphical skills.	R/U/A

Mapping with Programme Outcomes

COs	PO1	PO2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3										1	2
CO2	3	3	3										2	2
CO3	3	3	3		3			3					2	2
CO4	3	3	3		3			3					2	2
CO5	3	3	3										2	2
3- Strong; 2-Medium; 1-Some														

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	20	20	30
Apply	30	30	50
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Passed in BoS Meeting held on 21/11/2023
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K. S. Rangasamy College of Technology – Autonomous (R 2022)								
60 ME 002- ENGINEERING GRAPHICS								
Common to MECH, ECE, EEE, CSE, MCT, CIVIL, IT, TXT, BT, FT, AI&DS, AI&ML								
Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	2	0	4	90	4	40	60	100

Introduction to Computer Aided Drafting (CAD) software Theory of CAD software – Menu System, Tool bars (Standard, Object Properties, Draw, Modify and Dimension) – Drawing Area (Background, Crosshairs, Coordinate System) – Dialog boxes and windows – Shortcut menus (Button Bars) – The Command Line and Status Bar – Different methods of zoom – Select and erase objects.	**[6+12]**
Orthographic Projection Theory of projection – Terminology and Methods of projection – first angle and third angle projection – Conversion of pictorial views into orthographic views	**[6+12]**
Projection of Solids and Sections of Solids Projections of simple solids: prism, pyramid, cylinder and cone (Axis parallel to one plane and perpendicular to other, axis inclined to one plane and parallel to other). Sections of simple solids: prism, pyramid, cylinder and cone in simple positions (cutting plane is inclined to one of the principal planes and perpendicular to the other) – True shape of sections	**[6+12]**
Development of Surfaces Principle of development-Methods of development: Parallel line development-Cube, Prism and Cylinder. Radial line development – Pyramid and cone	**[6+12]**
Isometric Projection Principles of Isometric projection – Isometric scale, Isometric views, Conventions – Isometric views of lines, Planes, Simple and compound Solids – Conversion of Orthographic views in to Isometric view	**[6+12]**
Application of Engineering Graphics Geometry and topology of engineered components: Creation of engineering models and their presentation in standard 2D blueprint form, 3D wire-frame and shaded solids – Geometric dimensioning and Tolerance – Use of solid modeling software for creating associative models – Floor plans: windows, doors, and fixtures such as water closet (WC), bath sink, shower, etc. – Applying colour coding according to building drawing practice – Drawing sectional elevation showing foundation to ceiling – Introduction to Building Information Modelling (BIM).	**[6+12]**
Total Hours:	**90**

Text Book(s):

1. Bhatt N.D., —Engineering Drawing, Charotar Publishing House Pvt. Ltd., 53rd Edition, Gujarat, 2019.
2. Venugopal K., —Engineering Graphics‖, New Age International (P) Limited, 2014.

Reference(s):

1. Shah M.B., Rana B.C., and V.K.Jadon., —Engineering Drawing‖, Pearson Education, 2011.
2. Natarajan K.V., —A Text Book of Engineering Graphics‖, Dhanalakshmi Publishers, Chennai, 2014.
3. Agrawal B. & Agrawal C. M., —Engineering Graphics‖, TMH Publication, 2012.
4. Narayana, K.L. & P Kannaiah, —Text book on Engineering Drawing‖, Scitech Publishers, 2008.

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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Course Contents and Lecture Schedule

S.No	Topic	No. of Hours	Mode of content Delivery
1	**Introduction to Computer Aided Drafting (CAD) software**		PPT
1.1	Theory of CAD software	1	PPT
1.2	Menu System, Tool bars (Standard, Object Properties, Draw, Modify and Dimension)	2	PPT
1.3	Drawing Area (Background, Crosshairs, Coordinate System)	3	PPT
1.4	Dialog boxes and windows – Shortcut menus	3	PPT
1.5	The Command Line and Status Bar	1	PPT
1.6	Different methods of zoom – Select and erase objects.	2	PPT
2	**Orthographic Projection**		PPT
2.1	Introduction to orthographic projections	2	PPT
2.2	Planes of projection,	2	Demonstration
2.3	Projection of points	1	PPT
2.4	Projection of lines inclined to both planes.	2	Demonstration
2.5	Projection of planes	2	PPT
2.6	Projection of planes Inclined to both planes	1	PPT
2.7	Conversions of pictorial views to orthographic views.	3	PPT
2.8	Practice class for pictorial views to orthographic views.	2	PPT
2.9	Practice class for pictorial views to orthographic views.	1	PPT
3	**Projection of Solids**		PPT
3.1	Projections of simple solids: prism	2	Demonstration
3.2	Projections of simple solids: cylinder	3	Demonstration
3.3	Projections of simple solids: pyramid	2	Demonstration
3.4	Projections of simple solids: Cone	2	Demonstration
3.5	Practice class for Projection of Solids	2	PPT
3.6	Axis of solid inclined to both HP and VP	5	PPT
3,7	Section of solids for Prism,	2	PPT
3,8	Section of solids for Cylinder,	2	Demonstration
3,9	Section of solids for Pyramid,	2	Demonstration
3,10	Section of solids for Cone	2	PPT
3,11	Auxiliary Views - Draw the sectional orthographic views of geometrical solids.	3	PPT
3.12	Draw the sectional orthographic views of objects from industry.	3	PPT
3,13	Development of surfaces of Right solids Prism,	2	PPT
3.14	Development of surfaces of Right solids Pyramid	2	PPT
3.15	Development of surfaces of Right solids Cylinder and Cone	2	PPT
4	**Isometric Projection and Introduction to AutoCAD**		PPT
4.1	Principles of isometric projection	1	PPT
4.2	Isometric scale	2	PPT
4.3	Isometric projections of simple solids: Prism,	2	PPT
4.4	Isometric projections of simple solids: Pyramid,	2	PPT

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

4.5	Isometric projections of simple solids: Cylinder	1	PPT
4.6	Isometric projections of simple solids: Cone	2	PPT
4.7	Isometric projections of frustum	2	PPT
4.8	Isometric projections of truncated solids	2	PPT
4.9	Combination of two solid objects in simple vertical positions.	3	PPT
5	**\Application of Engineering Graphics**		PPT
5.1	Geometry and topology of engineered components:	2	PPT
5.2	Creation of engineering models and their presentation in standard 2D blueprint form,	3	PPT
5.3	3D wire-frame and shaded solids – Geometric dimensioning and Tolerance – Use of solid modeling software for creating associative models	3	Demonstration
5.4	Floor plans: windows, doors, and fixtures such as water closet (WC), bath sink, shower, etc.	3	Demonstration
5.5	Applying colour coding according to building drawing practice	2	PPT
5.6	Drawing sectional elevation showing foundation to ceiling	2	Demonstration
5.7	Introduction to Building Information Modelling (BIM).	2	PPT

Course Designers

1. Dr.K.Mohan- mohank@ksrct.ac.in

60 ME 004	ENGINEERING MECHANICS	Category	L	T	P	Credit
		ES	3	1	0	4

Objective

- To learn a process for analysis of static objects, concepts of force, moment, and mechanical equilibrium in two and three dimensions.
- To learn the equilibrium of rigid bodies such as frames, trusses, beams.
- To identify the properties of surfaces and solids by using different theorem.
- To learn the principle of frictional forces at the contact surfaces and impart basic concept of dynamics of particles.
- To acquire the concept of elements of rigid body dynamics

Prerequisite

NIL

Course Outcomes

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

CO1	Use scalar and vector analytical techniques for analysing forces in statically determinate structures.	Understand & Apply
CO2	Apply basic knowledge of scientific concepts to solve real-world problems.	Understand & Apply
CO3	Calculate the properties of surfaces and solids using various theorems.	Understand & Apply
CO4	Determine the effect of frictional forces and the dynamic forces exerted in the particle	Understand & Apply
CO5	Analysis of rigid body dynamics and calculation of member forces in the rigid body	Understand & Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PS03
CO1	3	3	3											3	3
CO2	3	3	3											3	3
CO3	3	3	3		3			3						3	3
CO4	3	3	3		3			3						3	3
CO5	3	3	2											3	3
3- Strong;2-Medium;1-Some															

Assessment Pattern

Bloom'sCategory	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	20	20	30
Apply	30	30	50
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Passed in BoS Meeting held on 21/11/2023
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Syllabus

K. S. Rangasamy College of Technology – Autonomous (R 2022)								
60 ME 004- ENGINEERING MECHANICS								
Semester	Hours / Week			Total Hours	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	3	1	0	60	4	40	60	100

Basics and Statics of Particles Introduction -Units and Dimensions-Laws of Mechanics–Principle of transmissibility-Lame's theorem, Parallelogram and triangular Law of forces–Vectors–Vectorial representation of forces and moments.	[12]
Vector operations Addition, subtraction, dot product, cross product-Coplanar Forces–Resolution and Composition of forces–Equilibrium of a particle–Forces in space-Equilibrium of a particle in space-Equivalent systems of forces-Single equivalent force.	[12]
Equilibrium of Rigid Bodies Free body diagram–Types of supports and their reactions–requirements of stable equilibrium–Static determinacy, Moments and Couples–Moment of a force about a point and about an axis–Vectorial representation of moments and couples–Varignon's theorem-Equilibrium of Rigid bodies in two dimensions.	[12]
Properties of Surfaces and Solids Determination of Areas and Volumes-Centroid, Moment of Inertia of plane area (Rectangle, circle, triangle using Integration Method; T section, I section, Angle section, Hollow section using standard formula) - Parallel axis theorem and perpendicular axis theorem- Polar moment of inertia -Mass moment of inertia of thin rectangular section.	[12]
Friction Frictional force–Laws of Coloumb friction–Simple contact friction–Ladder friction-Rolling resistance–Ratio of tension in belt.	[12]
Dynamics of Particles Displacement, Velocity, acceleration and their relationship–Relative motion -Projectile motion in horizontal plane– Newton's law–Work Energy Equation – Impulse and Momentum.	[12]
Elements of Rigid Body Dynamics Translation and Rotation of Rigid Bodies: Velocity and acceleration–General Plane motion: Crank and Connecting rod mechanism	[12]
Total Hours: 45	**60**

Text Book(s):	
1.	Rajasekaran, S., Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., 3rd Edition, 2017.
2	Beer, F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers", Statics and Dynamics, McGraw-Hill International, 11th Edition, 2016.
Reference(s):	
1.	Jayakumar, V. and Kumar, M, "Engineering Mechanics", PHI Learning Private Ltd, New Delhi, 2012
2.	Hibbeller, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd.,
3.	Bansal R.K," Engineering Mechanics" Laxmi Publications (P) Ltd, 2011.
4.	Irving H. Shames, Engineering Mechanics: Statics and Dynamics", Pearson Education Asia Pvt. Ltd, 4thEdition, 2003.
5.	James M. Gere and Timoshenko, "Mechanics of Materials", CBS Publisher, New Delhi, 6th Edition, 2012

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**BASICS AND STATICS OF PARTICLES**	
1.1	Introduction, Units and Dimensions, Laws of Mechanics	1
1.2	Principle of transmissibility, Lame's theorem,	1
1.3	Parallelogram and triangular Law of forces	1
1.4	Tutorial	2
1.5	Vectors, Vectorial representation of forces and moments	1
1.6	Vector operations, Coplanar Forces–Resolution and Composition of forces	2
1.7	Equilibrium of a particle, Forces in space	1
1.8	Equivalent systems of forces-Single equivalent force.	1
1.9	Tutorial	2
2	**EQUILIBRIUM OF RIGID BODIES**	
2.1	Free body diagram, Types of supports and their reactions	1
2.2	Requirements of stable equilibrium, Static determinacy	1
2.3	Moments and Couples–Moment of a force about a point and about an axis	2
2.4	Vectorial representation of moments and couples	1
2.5	Tutorial	2
2.6	Varignon's theorem	1
2.7	Equilibrium of Rigid bodies in two dimensions	2
2.8	Tutorial	2
3	**PROPERTIES OF SURFACES AND SOLIDS**	
3.1	Determination of Areas and Volumes-Centroid	1
3.2	Moment of Inertia of plane area (Rectangle, circle, triangle using Integration Method)	2
3.3	Tutorial	2
3.4	Moment of Inertia of plane area(T section, I section, Angle section)	1
3.5	Moment of Inertia of plane area(Hollow section)	1
3.6	Parallel axis theorem and perpendicular axis theorem	1
3.7	Polar moment of inertia	1
3.8	Mass moment of inertia of thin rectangular section.	1
3.9	Tutorial	2
4	**FRICTION & DYNAMICS OF PARTICLES**	
4.1	Frictional force, Laws of Coloumb friction, Simple contact friction	1
4.2	Ladder friction	1
4.3	Rolling resistance–Ratio of tension in belt	1
4.4	Tutorial	2
4.5	Displacement, Velocity, acceleration and their relationship, Relative motion	1
4.6	Projectile motion in horizontal plane	1
4.7	Newton's law	1
4.8	Work Energy Equation	1
4.9	Impulse and Momentum	1

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

4.10	Tutorial	2
5	**ELEMENTS OF RIGID BODY DYNAMICS**	
5.1	Translation and Rotation of Rigid Bodies	1
5.2	Translation and Rotation of Rigid Bodies - Velocity	2
5.3	Translation and Rotation of Rigid Bodies - acceleration	2
5.4	Tutorial	2
5.5	General Plane motion	1
5.6	General Plane motion - Crank and Connecting rod mechanism	2
5.7	Tutorial	2
	Total	60

Course Designers

4. Mr.S.KARTHICK -skarthick@ksrct.ac.in

60 GE 001	**Heritage of Tamils** (Common to all Branches)	Category	L	T	P	Credit
		GE	1	0	0	1

Objectives:

- To learn the extensive literature of classical Tamil
- To review the fine arts heritage of Tamil culture
- To realize the contribution of Tamils in Indian freedom struggle

Prerequisite:

Nil

Course Outcomes:

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

CO1	Recognize the extensive literature of Tamil and its classical nature.	Understand
CO2	Apprehend the heritage of sculpture, painting and musical instruments of ancient people.	Understand
CO3	Review on folk and martial arts of Tamil people.	Understand
CO4	Insight thinai concepts, trade and victory of Chozha dynasty.	Understand
CO5	Realize the contribution of Tamil in Indian freedom struggle, self-esteem movement and siddha medicine.	Understand

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1							3	3		2		3	**3**	**3**
CO2							3	3		2		3	**2**	**2**
CO3							3	3		2		3	**3**	**3**
CO4							3	3		2		3	**2**	**2**
CO5							3	3		2		3	**3**	**3**
3- Strong; 2-Medium; 1-Low														

ASSESSMENT PATTERN

Bloom's Category	Continuous Assessment Tests(Marks)		End Sem Examination(Marks)
	1	2	
Remember	10	10	20
Understand	20	20	40
Apply	20	20	20
Analyse	10	10	20
Evaluate	-	-	-
Create	-	-	-

SYLLABUS

K. S. Rangasamy College of Technology – Autonomous R2022								
60 GE 001 – Heritage of Tamils								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	1	0	0	15	1	100	-	100
Language and Literature 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 Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.								3
Heritage - Rock Art Paintings to Modern Art – Sculpture Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.								3
Folk and Martial Arts Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.								3
Thinai Concept of Tamils Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.								3
Contribution of Tamils to Indian National Movement and Indian Culture 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.								3

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

Total Hours	**15**
Text Book(s):	
1.	தமிழக வரலாறு - மக்களும் பண்பாடும் கே. கே . பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2.	கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3.	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு).
4.	பொருநை - ஆற்றங்கரை நாகரீகம் (தொல்லியல் துறை 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) (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.

60 GE 001	***தமிழர் மரபு*** (அனைத்து துறைகளுக்கும் பொதுவானது)

Category	L	T	P	Credit
GE	1	0	0	1

பாடத்தின் நோக்கங்கள்:

- தமிழ் மொழியின் இலக்கணச் செறிவைக் கற்றுணர்தல்.
- தமிழர் பண்பாட்டின் நுண்கலைகள் பற்றிய ஒரு மீள்பார்வை.
- இந்திய சுதந்திரப் போராட்டத்தில் தமிழர்களின் பங்களிப்பை உணருதல்.

முன்கூட்டிய துறைசார் அறிவு:

தேவை இல்லை

பாடம் கற்றதின் விளைவுகள்:

பாடத்தை வெற்றிகரமாக கற்று முடித்த பின்பு, மாணவர்களால் முடியும் விளைவுகள்

CO1	தமிழ் மொழியின் செந்தண்மை மற்றும் இலக்கியம் குறித்த தெரிதல்.	புரிதல்
CO2	தமிழர்களின் சிற்பக்கலை, ஓவியக்கலை மற்றும் இசைக்கருவிகள் குறித்த தெளிவு.	புரிதல்
CO3	தமிழர்களின் நாட்டுப்புறக்கலைகள் மற்றும் வீரவிளையாட்டுகள் குறித்த தெளிவு.	புரிதல்
CO4	தமிழர்களின் திணைக் கோட்பாடுகள், சங்ககால வணிகம் மற்றும் சோழர்களின் வெற்றிகள் குறித்த தகவல்கள்.	புரிதல்
CO5	இந்திய தேசிய இயக்கம், சுயமரியாதையை இயக்கம் மற்றும் சித்த மருத்துவம் பற்றிய புரிதல்.	புரிதல்

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1							3	3		2		3	**3**	**3**

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

CO2							3	3		2		3	**2**	**2**
CO3							3	3		2		3	**3**	**3**
CO4							3	3		2		3	**2**	**2**
CO5							3	3		2		3	**3**	**3**
		3- Strong; 2-Medium; 1-Low												

Assessment Pattern

Bloom's Category	Continuous Assessment Tests(Marks)		End Sem Examination(Marks)
	1	2	
Remember	10	10	20
Understand	20	20	40
Apply	20	20	20
Analyse	10	10	20
Evaluate	-	-	-
Create	-	-	-

Syllabus

K. S. Rangasamy College of Technology – Autonomous R2022								
60 GE 001 – *தமிழர் மரபு*								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	1	0	0	15	1	100	-	100

***மொழி மற்றும் இலக்கியம்*:** *இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள் - தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.*	3
***மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை–சிற்பக் கலை*:** *நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.*	3
***நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்*:** *தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.*	3
***தமிழர்களின் திணைக் கோட்பாடுகள்*:** *தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.*	3

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.	3
Total Hours	**15**

Text Book(s):

1.	தமிழக வரலாறு - மக்களும் பண்பாடும் கே. கே . பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2.	கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3.	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு).
4.	பொருநை - ஆற்றங்கரை நாகரீகம் (தொல்லியல் துறை 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
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
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.

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

60 ME 0P1	FABRICATION AND REVERSE ENGINEERING LABOTORY (COMMON TO ALL BRANCHCES)

Category	L	T	P	Credit
ES	0	0	4	2

Objective

- To acquire skills in operating hand tools and instruments.
- To provide hands-on training on Carpentry, Sheet metal, Fitting and Welding.
- To provide hands-on training on household wiring and electronic circuits.
- To offer real time activity on plumbing connections in domestic applications.
- To provide hands-on activities on dismantling, and assembling the Home Appliance, Center lathe operations, computer's internal components and peripherals.

Prerequisite

Nil

Course Outcomes

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

CO1	Perform power tools operations.	Apply
CO2	Make a wooden model using carpentry Process	Apply
CO3	Make a model using sheet metal, filing and joining a MS Plate	Apply
CO4	Repair and Maintenances of water lines for home applications	Apply
CO5	Trouble shoots the electrical and electronic circuits, Electrical Machines and realizes the reputation of house wiring, home Appliance, computer internal components and peripherals.	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3		2		3		3	2	3		2	3	3	2
CO2	3	3	3		3	2		2	3	3		3	3	2
CO3	3	3	3		3	2	2	2	3	3	2	3	3	2
CO4	3	3	3	2	3	3	2	3	3			3	3	2
CO5	3	3	3	3	3	2	2	2	3	2	2	3	3	2
3- Strong; 2-Medium; 1-Low														

Syllabus

Performs of Power Tools

Drilling in different Walls and Materials Fitting of Hand shower mount, Shirt hanger, Towel hanger and Pipe with clamps.

Carpentry Process

Design and Development of Wooden Model using the Carpentry Process T / Cross Joint / different joints

Sheet Metal and Filling Process

Design and Development of Metal Model - Make a Tray Components using Sheet Metal Process and Mating of Square joint in MS Plate using the Filling Process

Welding Process

Fabrication of Models with MS Plate using Arc Welding- Lap Joint, Butt Joint, T Joint

Plumbing Process

Repair and Maintenances of Pipe Fitting for Home Applications Study of plumbing tools, assembly of G.I. pipes/ PVC and pipe fittings, cutting of threads in G.I. Pipes by thread cutting dies.

Residential house wiring

Design and Excusion of Residential house wiring With and Without UPS- 1 BHK - 2 BHK. Design and fabrication of domestic LED lamps - Circuit designing (calculation of components)

Electronic Circuit wiring

PCB fabrication – Soldering - Assembling of Audio Amplifiers- Connecting USB/Bluetooth MP3 player board -

Connecting Volume controllers - Connecting bass & treble filter boards - Connecting Surround and sub-woofer filter board

Assembling and dismantling of Electronics Machines

Iron box, Induction stove, Water heater, Mixer, Table fan, Ceiling fan

Study Exercises

Demonstration of Centre Lathe operations Facing, Turning, and drilling and its components.

Assemble and dismantle of Vacuum Cleaner / Refrigerator and its components

Computer Hardware Study Exercises

Identify internal components of computer - Assemble and dismantle desktop computer systems

List of Experiments

1. **Fitting of Wall mounting Parts using Power Tools**
    a) Drilling in different Walls and Materials
    b) Fitting of Hand shower mount, Shirt hanger, Towel hanger and Pipe with Clamps.
2. **Making of Wooden model using the Carpentry Process**
    a) T / Cross Joint
    b) Mortise and Tenon Joint / different joints
3. **Making of Metal Model**
    a) Making of Components using Sheet Metal Process
    b) Mating of Components using the Filling Process
4. **Fabrication of Welded model**
5. **Repair and Maintenance of Pipe Fitting for Home Applications**

a) Assembly of GI pipes/PVC and Pipe Fitting

b) Cutting of Threads in GI pipes by thread Cutting Dies

6. Assembling and dismantling of

a) Iron box

b) Induction stove

c) Water heater

d) Mixer

e) Table fan

f) Ceiling fan

7. Design and Execution of Residential house wiring

a) 1 BHK

b) 2 BHK

8. Design and Execution of Residential house wiring with UPS.

a) 1 BHK

b) 2 BHK

9. Design and fabrication of domestic LED lamps

a) Circuit designing (calculation of components)

b) PCB fabrication

c) Soldering

10. Assembling of Audio Amplifiers

a) Connecting USB/Bluetooth MP3 player board

b) Connecting Volume controllers

c) Connecting bass & treble filter boards

d) Connecting Surround and sub-woofer filter board

Study Exercises

1. Demonstration of Centre Lathe and its operations like Facing, Turning, and drilling.
2. Dismantle and Assemble of Vacuum Cleaner / Refrigerator.
3. Study of components of computer. Dismantle and assemble of desktop computer systems

Course Designers

1. Mr.S Sakthivel - sakthivel_s@ksrct.ac.in
2. Dr. D Sri Vidya - srividhya@ksrct.ac.in
3. Mr. K. Raguvaran – raguvaran@ksrct.ac.in

Passed in BoS Meeting held on 21/11/2023

Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

60 CS 0P1	C PROGRAMMING LABORATORY	Category	L	T	P	Credit
		ES	0	0	4	2

Objective

- To enable the students to apply the concepts of C to solve simple problems
- To use selection and iterative statements in C programs
- To apply the knowledge of library functions in C programming
- To implement the concepts of arrays, functions, structures and pointers in C
- To implement the file handling operations through C

Prerequisite

NIL

Course Outcomes

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

CO1	Read, display basic information and use selection and iterative statements.	Apply
CO2	Demonstrate C program to manage collection of related data.	Apply
CO3	Design and Implement different ways of passing arguments to functions, Recursion and implement pointers concepts.	Apply
CO4	Develop a C program to manage collection of different data using structures, Union, user-defined data types and preprocessor directives.	Apply
CO5	Demonstrate C program to store and retrieve data using file concepts.	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	3	3		3				2	2		2	3	3
CO2	3	3	3		3				2	2		2	3	3
CO3	3	3	3		3				2	2		2	3	3
CO4	3	3	3		3				2	2		2	3	3
CO5	3	3	3		3				2	2		2	3	3
3- Strong; 2-Medium; 1-Low														

List of Experiments

1. Implementation of Simple computational problems using various formulas.

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2. Implementation of Problems involving Selection statements.
3. Implementation of Iterative problems e.g., sum of series.
4. Implementation of 1D Array manipulation.
5. Implementation of 2D Array manipulation.
6. Implementation of String operations.
7. Implementation of Simple functions and different ways of passing arguments to functions and Recursive Functions.
8. Implementation of Pointers
9. Implementation of structures and Union.
10. Implementation of Bit Fields, Typedef and Enumeration.
11. Implementation of Preprocessor directives.
12. Implementation of File operations.

Course Designers

1. Dr.P.Kaladevi - kaladevi@ksrct.ac.in

Passed in BoS Meeting held on 21/11/2023
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60 CG 0P1	CAREER SKILL DEVELOPMENT I

Category	L	T	P	Credit
CGC	0	0	2	0

Objective

- To help learners improve their vocabulary and to enable them to use words appropriately in different academic and professional contexts
- To help learners develop strategies that could be adopted while reading texts
- To help learners acquire the ability to speak effectively in English in real life and career related situations
- To equip students with effective speaking and listening skills in English
- To facilitate learners to enhance their writing skills with coherence and appropriate format effectively

Prerequisite

Basic knowledge of reading and writing in English.

Course Outcomes

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

CO1	Listen and comprehend complex academic texts	Understand
CO2	Read and infer the denotative and connotative meanings of technical texts	Analyze
CO3	Write definitions, descriptions, narrations, and essays on various topics	Apply
CO4	Speak fluently and accurately in formal and informal communicative contexts	Apply
CO5	Appraise the verbal ability skills in the career development and professional contexts	Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								2	3	3	2	3	**3**	**3**
CO2								2	3	3	2	3	**2**	**2**
CO3								2	3	3	2	3	**3**	**3**
CO4								2	3	3	2	3	**2**	**2**
CO5								2	3	3	2	3	**3**	**3**
3- Strong; 2-Medium; 1-Some														

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Syllabus

K.S.Rangasamy College of Technology – Autonomous R2022								
60 CG 0P1 Career Skill Development I								
Common to All Branches								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
II	0	0	2	45	0	100	00	100

Listening Listening for general information-specific details - audio / video (formal & informal) - Listen to podcasts/ TED talks/ anecdotes / stories / event narration / documentaries and interviews with celebrities - Listen to a product and process descriptions, advertisements about products or services.	[5]
Speaking Self-Introduction; Introducing a friend; conversation - politeness strategies - Narrating personal experiences / events; Interviewing a celebrity; reporting / and summarizing of documentaries / podcasts/ interviews - Picture description; giving instruction to use the product; presenting a product - Small Talk; Mini presentations - Group discussions, debates & role plays.	[5]
Reading Loud reading vs Silent reading, Skimming & Scanning of passages, reading brochures (technical context), social media messages relevant to technical contexts and emails - Biographies, travelogues, newspaper reports and travel & technical blogs - Advertisements, gadget reviews and user manuals - Newspaper articles and Journal reports - Editorials; and opinion blogs	[5]
Writing Writing letters – informal and formal – basics and format orientation - paragraph texting, short report on an event (field trip etc.) - Definitions; instructions; and product /process description - Note-making / Note-taking; recommendations; transferring information from non-verbal (charts, graphs to verbal mode) - Essay texting	[5]
Verbal Ability I Reading Comprehension (MCQs) – Cloze Test - Sequencing of sentences – Summarizing and paraphrase – Error Detection – Spelling Test – Sentence Improvement - Preposition	[5]
Total Hours	25

Reference(s):

1.	'English for Engineers & Technologists' Orient Blackswan Private Ltd. Department of English, Anna University, 2020
2.	Norman Lewis, 'Word Power Made Easy - The Complete Handbook for Building a Superior Vocabulary Book', Penguin Random House India, 2020
3.	Michael McCarthy and Felicity O Dell, 'English Vocabulary in Use: Upper Intermediate', Cambridge University Press, N.York, 2012
4.	Lakshmi Narayanan, 'A Course Book on Technical English' Scitech Publications (India) Pvt. Ltd. 2020

Course Contents and Lecture Schedule

S.No	Topic	No.of Hours
1		
1.1	Listening for general information and Specific details	1
1.2	Listening to podcasts, documentaries and interviews with celebrities	1
1.3	Narrating personal experiences	1

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1.4	Reading relevant to technical contexts and emails	1
1.5	Listen to a product and process descriptions	1
2	**Speaking**	
2.1	Self-introduction	1
2.2	Summarizing of documentaries & Picture Narration	1
2.3	Small Talk; Mini presentations	1
2.4	Group discussions, debates & role plays.	1
2.5	Group discussions	1
3	**Reading**	
3.1	Loud reading vs Silent reading, Skimming & Scanning of passages	1
3.2	Reading social media messages relevant to technical contexts	1
3.3	Reading newspaper reports and travel & technical blogs	1
3.4	Reading advertisements, gadget reviews and user manuals	1
3.5	Reading newspaper articles and journal reports	1
4	**Writing**	
4.1	Writing letters – informal and formal	1
4.2	Paragraph Texting	1
4.3	Definitions and instructions	1
4.4	Note-making / Note-taking	1
4.5	Essay texting	1
5	**Verbal Ability**	
5.1	Reading Comprehension (MCQs) and Cloze Test	1
5.2	Sequencing of sentences	1
5.3	Paraphrasing and Summarizing	1
5.4	Error Detection and Spelling Test	1
5.5	Prepositions	1
	Total	**25**

Course Designer

1. Dr.A.Palaniappan - palaniappan@ksrct.ac.in

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60 CG 0P6	INTERNSHIP

Category	L	T	P	Credit
CGC	0	0	0	1/2/3

Objective

- To expose the students to understand the processes at industry and R&D
- To identify the existing and evolving problems at industry
- To solve the problems at industry and environment need
- To prepare the report of solved problems for further action
- To summarize the data in a presentation mode

Prerequisite

Nil

Course Outcomes

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

CO1	Identify the root causes and problem-solving process	Understand
CO2	design the experiment from literature survey	Analyze
CO3	execute and trouble shoot through pilot study	Apply
CO4	interpret the raw and calculated data to conclude the problem	Apply
CO5	writing the reports and documenting the data for publication	Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	3	2			3			3	3	3
CO2	3	3	3	3	3	2						3	2	2
CO3	3	3	2	3	3	2						3	3	3
CO4	3	3	2	3	2	2						3	2	2
CO5	2	3	2	3	2	2		3		3	3	3	3	3
3- Strong; 2-Medium; 1-Some														

1. Students undergo internship during second semester summer vacation (minimum of two weeks)
2. Students should submit an internship / innovation project report along with observation note book in the beginning of semester
3. The observation note book of the students after the training with their personal comments / suggestions and attestedby the trainer at industry or R&D
4. A technical presentation to be done by the students to the committee, immediately after submission of the report atthe beginning of semester
5. A committee constitute a senior faculty, HoD and along with industry person

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K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
(An Autonomous Institution affiliated to Anna University)

B.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS
(For the candidates admitted from 2022-2023 onwards)

THIRD SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1	60 MA 012	Fourier Transform and Numerical Methods	2	40	60	100	45	100
2	60 BT 301	Biochemistry	2	40	60	100	45	100
3	60 BT 302	Microbiology	2	40	60	100	45	100
4	60 BT 303	Cell Biology and Genetics	2	40	60	100	45	100
5	60 BT 304	Principles of Chemical Engineering	2	40	60	100	45	100
6	60 BT 305	Molecular Biology	2	40	60	100	45	100
7	60 GE 002	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	2	100	-	100	-	-
PRACTICAL								
8	60 BT 3P1	Biochemistry Laboratory	3	60	40	100	45	100
9	60 BT 3P2	Microbiology Laboratory	3	60	40	100	45	100
10	60 CG 0P2	Career Competency Development – II	3	100	-	100	-	-
11	60 CG 0P6	Internship	-	100	-	100	-	100

* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for the award of terminal examination marks

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60 MA 012	FOURIER TRANSFORM AND NUMERICAL METHODS	Category	L	T	P	Credit
		BS	3	1	0	4

Objective

- To provide exposure and ability to use Fourier series.
- To familiarize the basic concepts of Fourier transform.
- To get exposed to various techniques to solve equations numerically.
- To know the concepts of interpolation and numerical integration.
- To learn the basics concepts of initial value problems.

Prerequisite

Nil

Course Outcomes

At the end of the course, the students will be able to

CO1	Obtain the Fourier series expansion for the periodic functions.	Remember Understand Apply
CO2	Apply Fourier transform techniques for the continuous functions.	Remember Understand Apply
CO3	Employ various iteration techniques for solving algebraic, transcendental and system of linear equations.	Remember Understand Apply
CO4	Apply different techniques to find the intermediate values and to evaluate single definite integrals.	Remember Understand Apply
CO5	Compute the solution for initial value problems using single and multi-step methods.	Remember Understand Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2							3	2		
CO2	3	3	2	2	2							3	2		
CO3	3	3	3	3	2							3	2		
CO4	3	3	3	3	2							3	2		
CO5	3	3	3	3	2							3	2		
3 – Strong; 2 – Medium; 1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Semester Examination (Marks)
	1	2		
Remember (Re)	10	10	10	10
Understand (Un)	10	10	20	20
Apply (Ap)	40	40	70	70
Analyze (An)	0	0	0	0
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

Passed in BoS Meeting held on 21/11/2023
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K.S.Rangasamy College of Technology – Autonomous R2022								
60 MA 012 – Fourier Transform and Numerical Methods								
Common to Biotechnology and Food Technology								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	1	0	60	4	40	60	100

Fourier Series Dirichlet's conditions - Fourier series - Odd and Even functions - Half range Fourier series - Root mean square value of a function - Parseval's identity - Harmonic analysis.	**[9]**
Fourier Transform Fourier transform pair - Fourier transform of simple functions - Fourier sine and cosine transform - Properties - Convolution theorem - Parseval's identity.	**[9]**
Solution of Equations and Eigen Value Problem Algebraic and Transcendental equations - Newton Raphson method – Horner's method - Gauss elimination method – Gauss Jordan method – Iterative methods: Gauss Jacobi method – Gauss Seidel method – Eigen value of a matrix by Power method.	**[9]**
Interpolation and Numerical Integration Lagrange's and Newton's divided difference interpolations (unequal intervals) - Newton's forward and backward interpolation (equal intervals)* - Two point and three point Gaussian quadrature – Trapezoidal, Simpson's 1/3 and 3/8 rule (single integral).	**[9]**
Numerical Solution of Ordinary Differential Equations Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods: Milne's predictor and corrector method - Adam's predictor and corrector method.	**[9]**
Total Hours: 45 + 15 (Tutorial)	**60**

Text book(s):	
1.	Grewal B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi, 2018.
2.	Faires, J D and Burden R L, "Numerical Methods", Thomson publications, Fourth Edition, New Delhi, 2012.
Reference(s):	
1.	Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons (Asia) Limited, New Delhi, Reprint 2012.
2.	Grewal B.S and Grewal J.S, "Numerical Methods in Engineering and Science", 10th Edition, Khanna Publishers, New Delhi, 2012.
3.	Veerarajan T, "Transforms and Partial Differential Equations", 3rd Edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2016.
4.	Kandasamy P, Thilagavathy K and Gunavathi K, "Numerical Methods", 3rd Edition, Sultan Chand & Sons, New Delhi, 2010.

*SDG 4 – Quality Education

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Course Contents and Lecture Schedule

S.No.	Topic	Number of Hours	Mode of Content Delivery
1.	**Fourier Series**		
1.1	Dirichlet's conditions	1	Black Board
1.2	Fourier series - Even functions	2	Black Board
1.3	Fourier series - Odd functions	1	Flipped Class
1.4	Half range Fourier series	1	Black Board
1.5	Tutorial	2	
1.6	Root mean square value of a function	1	Black Board
1.7	Parseval's identity	1	Black Board
1.8	Harmonic analysis	1	Black Board
1.9	Tutorial	2	
2.	**Fourier Transform**		
2.1	Fourier transform pair	1	Black Board
2.2	Fourier transform of simple functions	1	Black Board
2.3	Fourier sine transform	1	Black Board
2.4	Fourier cosine transform	1	Black Board
2.5	Tutorial	2	
2.6	Properties of Fourier transform	1	Flipped Class
2.7	Convolution theorem	2	Black Board
2.8	Parseval's identity	1	Black Board
2.9	Tutorial	2	
3.	**Solution of Equations and Eigen Value Problem**		
3.1	Newton-Raphson method	1	Black Board
3.2	Horner's method	1	Black Board
3.3	Gaussian elimination method	1	Black Board
3.4	Gauss-Jordan method	1	Flipped Class
3.5	Tutorial	2	
3.6	Gauss-Jacobi method	1	Black Board
3.7	Gauss-Seidel method	2	Black Board
3.8	Eigen value of a matrix by Power method	1	Black Board
3.9	Tutorial	2	
4.	**Interpolation and Numerical Integration**		
4.1	Lagrange's divided difference interpolation	2	Black Board
4.2	Newton's divided difference interpolation	1	Black Board
4.3	Newton's forward and backward interpolations	2	Black Board
4.4	Tutorial	2	
4.5	Two and three point Gaussian quadrature	1	Flipped Class
4.6	Trapezoidal and Simpson's 1/3 and 3/8 rules	2	Black Board
4.7	Tutorial	2	

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5.	**Numerical Solution of Ordinary Differential Equations**		
5.1	Taylor series method	2	Black Board
5.2	Euler's method	1	Black Board
5.3	Modified Euler's method	1	Flipped Class
5.4	Tutorial	2	
5.5	Runge-Kutta method	2	Black Board
5.6	Milne's predictor and corrector method	1	Black Board
5.7	Adam's predictor and corrector method	1	Black Board
5.8	Tutorial	2	
	Total	60	

List of MATLAB Programs:

1. Generate the Fourier series of f(x) in (- π, π) and (- l, l), plot and visualize.
2. Compute the Fourier transform of f(x), plot and visualize.
3. Determine the solution of Non-linear equations using Iteration methods.
4. Illustrate Gauss-Jacobi and Gauss-Seidal method for system of linear equations.
5. Compute Newton's forward and backward interpolation method.
6. Demonstrate Trapezoidal and Simpson's rule.
7. Determine the solution of first order ODE using Fourth order Runge-kutta method.
8. Compute the solution of ODE using Milne's and Adam's Predictor and Corrector method.

Course Designers

5. Mr.G.Mohan - mohang@ksrct.ac.in
6. Ms.K.Geetha - geethak@ksrct.ac.in

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60 BT 301	BIOCHEMISTRY

Category	L	T	P	Credit
CS	3	0	0	3

Objective

- To learn the basic chemical structure and biological functions of biomolecules
- To impart knowledge on role of biomolecules for orderly structures of the cells/tissues
- To illuminate the metabolism of essential biomolecules that are indispensable for life
- To dissipate the knowledge on formations of specialized products from biomolecules
- To learn the principles of bioenergetics and redox reactions of the cell

Prerequisite

Basic knowledge on bioorganic chemistry and cell structure is needed.

Course Outcomes

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

CO1	identify the structure of carbohydrates and understand their classification, synthesis, essentialChemical characteristics that make them indispensable for life.	Apply
CO2	explore the structure, classification, biological functions of lipids and their metabolism	Apply
CO3	organize the structure and classification of amino acids, proteins, vitamins and its vital functions in the human body.	Apply
CO4	Experiment with the metabolism of the essential building blocks of life and its conversion to specialized products.	Apply
CO5	Justify the purpose of electron transport chain and how cellular ATP:ADP ratio regulates the rare of ATP production by oxidative phosphorylation	Apply

Mapping with Programme Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3			2				1	1		2	3	3
CO2	3	3							2	2		2	2	2
CO3		3	2	3	2		2		2	2		3	3	3
CO4	2		2	3			2		2	2		2	2	2
CO5		1	2	3	2				2	2		2	3	3
3- Strong; 2-Medium; 1-Some														

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	20	20	30	30
Understand (Un)	20	20	30	30
Apply (Ap)	20	20	40	40
Analyze (An)	0	0	0	0
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

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K.S.Rangasamy College of Technology – Autonomous R2022								
60 BT 301 - Biochemistry								
B.Tech. Biotechnology								
Semester	Hours/Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

CARBOHYDRATES * Carbohydrates: Basic chemical structure, Classification - Monosaccharide, Disaccharides, Polysaccharides, structure and function - Anaerobic pathway of glucose metabolism: Glycolysis - Aerobic pathway of glucose metabolism: Citric acid cycle - Alternate pathways of carbohydrate metabolism: Pentose phosphate pathway - Synthesis of carbohydrates from various sources: Gluconeogenesis	**[9]**
LIPIDS * Lipids: structure and function of fatty acids and lipids, classification, major lipid subclasses - phospholipids, glycolipids, sphingolipids and steroids - Lipoproteins: Types and functions - Lipid metabolism: Biosynthesis of Fatty acid, Oxidation of fattyacids - Beta oxidation, Other types of fatty acid oxidation - Alpha and omega oxidation - Biosynthesis of cholesterol.	**[9]**
PROTEINS AND VITAMINS * **Amino acids:** Structure and Classification. **Proteins:** Structure and Classification: Primary, Secondary, Tertiary and Quaternary structure. Properties - Denaturation and Renaturation. Oxidative degradation of amino acids: Transamination, oxidative deamination, decarboxylation, Biosynthesis of urea, conversion of amino acids in to specialized products: DOPA, Dopamine, Epinephrine and Norepinephrine. **Vitamins:** Classification, sources, functions and deficiency diseases.	**[9]**
NUCLEIC ACIDS * Nucleic acids: Structure of nitrogenous bases: purines and pyrimidines, nucleosides, nucleotides, formation of phosphodiester bonds - Structure of DNA and RNA - Biosynthesis of Purine and pyrimidine nucleotides: Denovo and salvage pathway - Purine and pyramidine degradation	**[9]**
BIOENERGETICS * Electrochemical potential and redox reaction, Mitochondrial electron transport chain: electron carriers, sites of ATP production, inhibitors. Oxidative phosphorylation: structure of ATPase complex, chemiosmotic theory, uncouplers and inhibitors of oxidative phosphorylation	**[5]**
Total Hours	**45**

Reference(s):

1.	Koolman J. and Roehm K.H. Color Atlas of Biochemistry, Georg ThiemeVerlag publishers, 2nd Edition, 2005.
2.	Berg Jeremy M.; John L. Tymoczko; Lubert Stryer, "Biochemistry", W. H. Freeman and Co., New York, USA, 7th edition,2010.
3.	Voet Donald and Judy G Voet, "Biochemistry", 4th edition, John Wiley & Sons Inc., 2012.
4.	Denise R. Ferrier, "Biochemistry-Lippincott Illustrated Reviews Series"7th edition, Wolters Kluwer Law & Business, 2017.

*SDG 3 - Ensure healthy lives and promote well-being for all at all age

Course Contents and Lecture Schedule

S.No	Topic	No.of Hours	Mode of content Delivery
1	**CARBOHYDRATES**		
1.1	Carbohydrates: Basic chemical structure.	1	Board
1.2	Classification – Monosaccharide	1	Board/CM
1.3	Disaccharides, Polysaccharides, structure and function	2	Board/CM

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1.4	Anaerobic pathway of glucose metabolism: Glycolysis.	1	PPT/Board
1.5	Aerobic pathway of glucose metabolism: Citric acid cycle.	1	PPT/Board
1.6	Alternate pathways of carbohydrate metabolism: Pentose phosphate pathway.	1	PPT
1.7	Synthesis of carbohydrates from various sources: Gluconeogenesis.	1	PPT/TPS
2	**LIPIDS**		
2.1	Lipids: structure and function of fatty acids and lipids,	1	Board
2.2	classification, major lipid subclasses phospholipids, glycolipids, sphingolipids and steroids.	1	PPT/CM
2.3	- Lipoproteins: Types and functions	1	PPT/CM
2.4	Lipid metabolism: Biosynthesis of Fatty acid,	1	PPTlBoard
2.5	Oxidation of fattyacids - Beta oxidation,	1	PPT
2.6	Other types of fatty acid oxidation - Alpha and omega oxidation	1	PPT/FP
2.7	Biosynthesis of cholesterol.	1	PPT
3	**PROTEINS AND VITAMINS**		
3.1	**Amino acids:** Structure and Classification.	1	PPTlBoard
3.2	**Proteins:** Structure and Classification:	1	PPT/CM
3.3	Primary, Secondary, Tertiary and Quaternary structure..	1	PPT
3.4	Properties - Denaturation and Renaturation.	1	Board
3.5	Oxidative degradation of amino acids: Transamination, oxidative deamination, decarboxylation,	1	PPTlBoard
3.6	Biosynthesis of urea, conversion of amino acids in to specialized products: DOPA, Dopamine, Epinephrine and Norepinephrine.	1	PPT
3.7	**Vitamins:** Classification, sources, functions and deficiency diseases		CM/TPS
4	**NUCLEIC ACIDS**		
4.1	Nucleic acids: Structure of nitrogenous bases: purines and pyrimidines,	1	Board/TPS
4.2	nucleosides, nucleotides, formation of phosphodiesterbonds -	1	TPS
4.3	Structure of DNA and RNA	1	TPS/CM
4.4	Biosynthesis of Purine and pyrimidine nucleotides- Denovo pathway	2	PPT
4.5	Biosynthesis of Purine and pyrimidine nucleotides- salvage pathway	1	PPTlBoard
4.6	Purine and pyramidine degradation	1	PPT
5	**BIOENERGETICS**		
5.1	Electrochemical potential and redox reaction	2	PPT/Board
5.2	Mitochondrial electron transport chain: electron carriers, sites of ATP production,inhibitors.	2	PPT/CM
5.3	Oxidative phosphorylation: structure of ATPase complex,	1	PPT/Video
5.4	chemiosmotic theory, uncouplers	1	PPT/Video
5.5	inhibitors of oxidative phosphorylation	1	PPT/Video
	Total	**45**	

Course Designer

1. Dr.S.Sidhra – sidhra@ksrct.ac.in

Passed in BoS Meeting held on 21/11/2023
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60 BT 302	MICROBIOLOGY

Category	L	T	P	Credit
PC	3	0	0	3

Objective

- To understand the basic and history of microbiology
- To impart the knowledge about the microorganisms and its classifications
- To understand the cellular organization of microbes and its identification system
- To study the nutritional requirements for the growth of microbes
- To learn about the basics of microbial growth, mode of infection and its control

Prerequisite

NIL.

Course Outcomes

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

CO1	Develop the knowledge about history, contributions and various classification system in the field of microbiology.	Apply
CO2	Build the basics knowledge about microscopy techniques and its identification using different staining methods	Apply
CO3	Analyze the structural organization and multiplication of Microorganism	Analyze
CO4	Identify the nutritional requirements of microbial growth	Apply
CO5	Examine the various industrial application of microorganisms and role in bioremediation justify the different processes of sterilization, disinfection and action mechanism of antimicrobial agents	Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	3	3	2	3	2	3	3	3	3	3
CO2	3	3	2	2	2	2	2	3	2	2	1	3	2	2
CO3	2	3	3	2	3	3	2	3	3	3	1	2	3	3
CO4	3	3	3	3	2	3	2	2	2	1	1	3	2	2
CO5	3	3	2	2	3	2	2	3	3	3	2	2	3	3

3- Strong; 2-Medium; 1-Some

Assessment

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	20	20	20	20
Understand (Un)	20	20	20	20
Apply (Ap)	20	20	40	40
Analyze (An)	0	0	20	20
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

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K.S.Rangasamy College of Technology – Autonomous R2022								
60 BT 302 - Microbiology								
B.Tech. Biotechnology								
Semester	Hours/Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

INTRODUCTION TO MICROBIOLOGY History and scope of microbiology - basic concepts, spontaneous generation, contributions of Leeuwenhoek, Louis Pasteur, Robert Koch, Elie Metchnikoff and Fleming - Classification systems - phenetic, numerical, phylogenetic, major characteristicsused in taxonomy, Bergey's manual of determinative bacteriology.	**[9]**
MICROSCOPY AND IDENTIFICATION OF MICROBES Microscopy-Simple and compound microscope, Phase contrast, Dark field, Fluorescent, Electron microscope, Identification of bacteria - Stain and staining techniques - Simple, Differential (Gram's, spore and AFB) and special (capsule staining, flagellar staining)– fungal staining.	**[9]**
STRUCTURAL ORGANIZATION AND MULTIPLICATION OF MICROBES Morphology and reproduction – Bacteria, Actinomycetes, Archeabacteria, viruses - bacteriophage (lytic and lysogeny), algae, microalgae, fungi, yeast, lichens, protozoan.	**[9]**
MICROBIAL NUTRITION AND GROWTH Nutritional requirements and classification of bacteria, algae and fungi - Media preparation – solid, liquid, and semisolid, Types of media- Selective, Enriched, Basal, Simple, Complex and Synthetic media, Pure culture techniques - anaerobic culture techniques - Kinetics of growth - generation time, mean generation time (g) and mean growth rate constant (k) - calculations- Influence of environmental factors on microbial growth - pH, temperature, pressure, oxygen and salt-measurement of microbial growth - cell mass and cell numbers.	**[9]**
CONTROL OF MICROORGANISMS * Sterilization and disinfection - Physical methods and Chemical methods; assessmentof chemical disinfectant - phenol co-efficient test, sterility testing- preservation and maintenance of microorganisms. Mechanism and mode of actions of anti-bacterial, anti-fungal and anti-viral agents - drug resistance ─ antibiotic sensitivity test.	**[5]**
Total Hours	**45**

Textbook(s):	
1.	Prescott, L.M., Harley, J.P. and Klein, D.A. "Microbiology", 7th Edition, Tata McGraw-Hill Publications, New Delhi, India, 2010.
2.	Pelczar, M.J., Chan, E.C.S. and Krieg, M.R. "Microbiology: An application Based Approach". Tata McGraw- Hill Publications, New Delhi, India, 2005.
Reference(s):	
1.	Black, J.G. "Microbiology: Principles and Explorations". 6th Edition. John Wiley and Sons, Inc, Singapore, 2004.
2.	Kamal, Rao, G.P. and Modi, D.R. "Concepts of Microbiology". International Book Distributing Co., Lucknow, India, 2005.
3.	Gerard J. Tortora Berdell R. Funke Christine L. Case Derek Weber Warner Bair, "Microbiology: An Introduction", 4th edition, Pearson Education (US), 2019.
4.	Surinder Kumar, " Essentials of Microbiology", First edition, Jaypee Brothers Medical Publishers (P) Ltd, New Delhi, 2016

*SDG 3 - Ensure healthy lives and promote well-being for all at all age

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Course Contents and Lecture Schedule

S.No	Topic	No.of Hours	Mode of content Delivery
1	**INTRODUCTION TO MICROBIOLOGY**		
1.1	History and scope of microbiology - basic concepts	1	PPT
1.2	Spontaneous generation thoery	1	PPT
1.3	Contributions of Leeuwenhoek Louis Pasteur, Robert Koch in microbiology	2	PPT
1.4	contributions of Elie Metchnikoff and Fleming in the field of microbiology	2	PPT
1.5	Classification systems - phenetic, numerical, phylogenetic, major characteristics used in taxonomy	2	Board
1.6	Bergey's manual of determinative bacteriology	1	Board
2	**MICROSCOPY AND IDENTIFICATION OF MICROBES**		
2.1	Microscopy-Simple and compound microscope	1	PPT
2.2	Phase contrast, Dark field, Fluorescent, Electron microscope	2	PPT
2.3	Identification of bacteria - Stain and staining techniques	2	Flipped Class
2.4	Simple, Differential (Gram's, spore and AFB) and special (capsule staining, flagellar staining)	3	PPT
2.5	fungal staining	1	PPT
3	**STRUCTURAL ORGANIZATION AND MULTIPLICATION OF MICROBES**		
3.1	Morphology and reproduction – Bacteria, Actinomycetes, Archeabacteria	2	PPT
3.2	Morphology and reproduction viruses - bacteriophage (lytic and lysogeny)	2	PPT
3.3	Morphology and reproduction - algae, microalgae	2	PPT
3.4	Morphology and reproduction - fungi, yeast, lichens, protozoan	2	PPT
3.5	Morphology and reproduction - lichens, protozoan	2	PPT
4	**MICROBIAL NUTRITION AND GROWTH**		
4.1	Nutritional requirements and classification of bacteria, algae and fungi	1	Board
4.2	Media preparation – solid, liquid, and semisolid	1	Board
4.3	Types of media- Selective, Enriched, Basal, Simple, Complex and Synthetic media	1	Board
4.4	Pure culture techniques - anaerobic culture techniques	1	Board
4.5	Kinetics of growth - generation time, mean generation time (g) and mean growth rate constant (k) – calculations		Board
4.6	Influence of environmental factors on microbial growth - pH, temperature, pressure, oxygen and salt	1	Board
4.7	measurement of microbial growth - cell mass and cell numbers	1	Board
5	**CONTROL OF MICROORGANISMS**		
5.1	Sterilization and disinfection	1	Flipped Class
5.2	Physical methods and Chemical methods	2	PPT
5.3	Assessmentof chemical disinfectant- phenol co-efficient test, sterility testing	2	PPT
5.4	Preservation and maintenance of microorganisms	1	PPT
5.5	Mechanism and mode of actions of anti-bacterial, anti-fungal	2	PPT
5.6	Anti-viral agents - drug resistance	2	PPT
5.7	Antibiotic sensitivity test	1	PPT
	Total	**45**	

Course Designer

1. Dr.Swathy J S - swathy@ksrct.ac.in

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BoS Chairman Signature

60 BT 303	CELL BIOLOGY AND GENETICS

Category	L	T	P	Credit
PC	3	0	0	3

Objective

- To build the knowledge on cell structure and functions of prokaryotes and eukaryotes at Molecular level
- To provide an insight on the process of eukaryotic cell division, regulation of cellular processes via signaling molecules and cell cycle regulation
- To impart the concept of Mendelian genetics and gene interactions
- To learn structure of chromosomes, Ploidisim and concept of mutation in genetics
- To understand the concepts in population genetics and its application for species analysis

Prerequisite

Basic biology

Course Outcomes

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

CO1	describe about cell organelles and transport of molecules across membrane	Apply
CO2	discuss the structure and functions of prokaryotic and eukaryotic cells and cellular components	Apply
CO3	explain the concept of mendelism and chromosomal theory	Remember
CO4	describe in techniques in cytogenetics and types of mutations with the concept of cancer	Apply
CO5	justify the importance of population genetics and evolution	Apply

Mapping with Programme Outcomes

COs	PO 1	PO2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3									3	3
CO2	3	2	2	2	2	2		1					2	2
CO3	2	2	1	1	2	2	2	1	3		3	2	3	3
CO4	2	2	2	3	2	1	1	3	3			2	2	2
CO5	3	3	1	1	1	2	1	1		3	2	3	3	3
3- Strong; 2-Medium; 1-Some														

Assessment pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	20	20	30	30
Understand (Un)	20	20	30	30
Apply (Ap)	20	20	40	40
Analyze (An)	0	0	0	0
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

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BoS Chairman Signature

K.S.Rangasamy College of Technology – Autonomous R2022								
60 BT 303 - Cell Biology and Genetics								
B.Tech. Biotechnology								
Semester	Hours/Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	0	0	45	3	40	60	100

CELL AND CELL ORGANELLES Cell and cell organelles; cell membranes (chemical composition, organization and fluidity), Plant cell wall, Endoplasmic Reticulum, Golgi complex and their role in protein sorting and post translation modifications, Vesicular Transport in Eukaryotic cells, Lysosomes, Plastids (chloroplasts and vacuoles), Nucleus: structure of nuclear pore and nuclear-cytosol transport, Mitochondria and chloroplast, cell permeability - concentration gradient and partition coefficient, transport of small molecules - active, passive, ion channels and facilitated diffusions.	[9]
TRANSPORT ACROSS CELL MEMBRANES AND CELL CYCLE The Cell membrane- composed of proteins, lipids and carbohydrates, membrane proteins, Molecular models of cell membrane, cell permeability and cell division: different stages of Mitosis and Meiosis, Cell cycle; Molecules that control cell cycle.	[9]
MENDELISM AND THE CHROMOSOMAL THEORY Mendel's principles: Mendel's experiments, segregation, Gene interactions, supplementary genes - Comb patterns in fowls, Complementary genes - Flower colour in sweet peas, Epistasis- Inhibitory and coloured genes in fowls, simple problems. Identification of genetic material, classical experiments- Hershey & Chase, Avery, McLeod etc., Multiple alleles and groups antigens, Independent Assortments (Test cross and back cross), Sex determination, Dosage compensation, sex linkage and pedigree analysis.	[9]
CYTOGENETICS AND MUTATIONS * Variation in chromosomal structure: deletion, inversion, translocation, duplication. variation in chromosomal numbers: aneuploidy, euploidy, polyploidy. Mutations: types of mutations, mutagenesis, Ionizing and non-ionizing radiation, Ames test, Cancer biology: Cancer and its types	[9]
POPULATION GENETICS AND EVOLUTION Hardy-Weinberg equilibrium, Extensions of Hardy- Weinberg equilibrium, non-random mating, population analysis, Models for population genetics. Mutation and Migration size. Natural selection. Evolution: Darwinian evolution, Speciation, Genetic variation and Sociobiology.	[9]
Total Hours	45

Textbook(s):

1.	Dr. Ajoy Paul ,Textbook Of Genetics ,ISBN: 978-93-84294-11-3 Pages: 1298 Second Edition: 2018
2.	Phillip Sheeler and Donald E. Bianchi, Cell and Molecular Biology, 3ed Paperback – 1, January 2009

Reference(s):

1.	Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., and Walter, P, "Molecular Biology of the Cell", Garland Science., New York, 2002
2.	Benjamin Lewin, "Gene IX", Oxford University Press, New Delhi, India, 2000.
3.	Jacobs M., "Cell And Molecular Biology" Vol.1., CBS Publishers and Distributors, 2016
4.	Vyas S.P. and Mehta A., "Cell And Molecular Biology" CBS Publishers and Distributors, 2020

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Course Contents and Lecture Schedule

S.No	Topic	No.of Hours	Mode of content Delivery
1	**CELL AND CELL ORGANELLES**		
1.1	Cell and cell organelles	2	BB
1.2	Cell membranes (chemical composition, organization and fluidity), Plant cell wall	1	PPT
1.3	Endoplasmic Reticulum, Golgi complex and their role in protein sorting and post translation modifications	1	PPT
1.4	Vesicular Transport in Eukaryotic cells, Lysosomes, Plastids (chloroplasts and vacuoles), Nucleus: structure of nuclear pore and nuclear-cytosol transport	1	BB
1.5	Mitochondria and chloroplast, cell permeability - concentration gradient and partition coefficient	2	Flipped Class
1.6	transport of smallmolecules - active, passive, ion channels and facilitated diffusions.	2	PPT
2	**TRANSPORT ACROSS CELL MEMBRANES AND CELL CYCLE**		
2.1	The Cell membrane- composed of proteins	1	PPT
2.2	Lipids and carbohydrates	2	Flipped Class
2.3	Membrane proteins, Molecular models of cell membrane, cell permeability	2	PPT
2.4	Cell division: different stages of Mitosis and Meiosis,	3	GD/ quiz
2.5	Cell cycle; Molecules that control cell cycle.	1	PPT
3	**MENDELISM AND THE CHROMOSOMAL THEORY**		
3.1	Mendel's principles: Mendel's experiments, segregation, Gene interactions.	2	BB
3.2	supplementary genes - Comb patterns in fowls, Complementary genes - Flower color in sweet peas	2	PPT
3.3	Epistasis- Inhibitory and colored genes in fowls, simple problems. Identification of genetic material,	2	PPT
3.4	classical experiments- Hershey & Chase, Avery, McLeod etc., Multiple alleles and groups antigens, Independent Assortments (Test cross and back cross),	2	PPT
3.5	Sex determination, Dosage compensation, sex linkage and pedigree analysis	1	PPT
4	**CYTOGENETICS AND MUTATIONS**		
4.1	Variation in chromosomal structure	2	BB
4.2	deletion, inversion, translocation, duplication Ionizing	2	PPT
4.3	non-ionizing radiation in Mutation	2	BB
4.4	variation in chromosomal numbers: aneuploidy, euploidy, polyploidy.	1	GD/ Role Play
4.5	Mutations: types of mutations, mutagenesis,	1	Seminar
4.6	Ames test	1	BB
4.7	Cancer biology. Cancer and its types	1	PPT
5	**POPULATION GENETICS AND EVOLUTION**		
5.1	Hardy-Weinberg equilibrium, Extensions of Hardy- Weinberg equilibrium,	2	BB
5.2	non-random mating, population analysis, Models for population genetics	1	BB
5.3	Mutation and Migration size	1	PPT
5.4	Natural selection Evolution: Darwinian evolution	1	PPT

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5.5	Speciation	1	Seminar
5.6	Genetic variation	1	BB
5.7	Sociobiology	1	PPT
	Total	**45**	

Course Designer

1. Dr. J. Philip Robinson - philip@ksrct.ac.in

60 BT 304	**PRINCIPLES OF CHEMICAL ENGINEERING**	Category	L	T	P	Credit
		PC	3	1	0	4

Objective

- To impart basic knowledge in unit conversion, and basic chemical calculations.
- To understand the applications of material balance calculations.
- To impart the basics of energy balance calculations.
- To understand the fluid flow under various conditions
- To know mechanical operations and flow through columns.

Prerequisite

NIL.

Course Outcomes

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

CO1	Review the basis of unit conversion, unit operations and unit processes	Understand
CO2	Execute material balance calculations with and without chemical reactions	Apply
CO3	Interpret energy balance calculations and enthalpy changes accompanying chemical reactions	Analyze
CO4	Understand the fluid behaviour, types and multiphase flow concept	Apply
CO5	Demonstrate size reduction equipment and principle of packed and fluidized columns	Understand

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3		2						3	3	3	3
CO2	3	3	3		2						2	3	3	3
CO3	3	3	2	3	2						2	2	3	2
CO4	3	3	2	2							2	3	2	3
CO5	3	3	2	2								3	3	3
3- Strong; 2-Medium; 1-Some														

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Assessment pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Sem Examination (Marks)
	1	2		
Remember (Re)	10	10	10	10
Understand (Un)	20	10	30	30
Apply (Ap)	20	40	40	40
Analyze (An)	10	0	20	20
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

K. S. Rangasamy College of Technology – Autonomous R2022

60 BT 304 - Principles of Chemical Engineering

B.Tech. Biotechnology

Semester	Hours/Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	3	1	0	45	4	40	60	100

Fundamentals of Chemical Engineering Over view of process industries, units and dimensions, basic laws, unit conversion, methods of expressing composition ofmixtures and solutions, average molecular weight of gas mixture, unit operations and unit processes.	**[9]**
Material Balance calculations Guidelines for material balance calculations - material balance with and without chemical reactions - stoichiometry of microbialgrowth and product formation - Recycling and bypass operations.	**[9]**
Energy Balance calculations* Basics energy balance calculations, first law of thermodynamics, sensible and latent heat, heat capacities, mean molal heat capacities, enthalpy changes accompanying chemical reactions, adiabatic process, heat of solution and mixing.	**[9]**
Flow of Fluids Nature of fluids, classification of fluids; concept of viscosity, laminar and turbulent flow, equation of continuity, Bernoulli's equation and its applications, friction factor, multiphase flow.	**[9]**
Mechanical Operations and flow through packed and fluidized bed Laws of size reduction; differential and cumulative size analysis; size reduction equipment –Jaw crusher, roll crusher, ball mill, hammer mill. Packed bed: flow through porous media- Erguns equation, Fluidization: principle; types and applications.	**[9]**
Total Hours (45+15)	**60**

Reference(s):

1.	Bhatt, B.I., Vora S.M., "Stoichiometry", 4th Edition, Tata McGraw-Hill Publication, New Delhi, 2004.
2.	McCabe, W.L., Smith, J.C and Harriot, P., "Unit Operations In Chemical Engineering", 7th Edition, McGraw – HillInc., New Delhi, 2004.
3.	Salil K. Ghosal, Shyamal K. Sanyal and Siddhartha Datta, "Introduction to Chemical Engineering", Tata McGraw – Hill Publication, New Delhi, 2011.

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4.	Gavhane K.A.," Introduction to Process Calculation", Nirali prakashan Publication, New Delhi, 2008.
5.	Gavhane K.A.,"Unit operations-I", Nirali prakashan Publication, 19th Edition, New Delhi, 2010.
6.	Geankoplis C.J., "Transport Processes and Unit Operations", Prentice Hall India, New Delhi, 2002.

*SDG 7: Affordable and Clean Energy

Course Contents and Lecture Schedule

S. No	Topic	No. of Hours	Mode of content Delivery
1	**Unit-I Fundamentals of Chemical Engineering**		
1.1	Over view of process industries	1	Board
1.2	Units and dimensions	1	Board
1.3	Unit conversion	1	PPT
1.4	Methods of expressing composition of mixtures and solutions	1	Flipped Class
1.5	Calculations	2	Board
1.6	Basic laws	1	PPT
1.7	Average molecular weight of gas mixture	1	Video/Board
1.8	Unit operations and unit processes	1	Board
2	**Unit II Material Balance calculations**		
2.1	Guidelines for material balance calculations	1	Board
2.2	Material balance without chemical reactions	2	Flipped Class
2.3	Calculations material balance without chemical reactions	1	Board
2.4	Material balance with chemical reactions	1	Board
2.5	Calculations material balance with chemical reactions	2	Board
2.6	Stoichiometry of microbial growth and product formation	1	Video/PPT
2.7	Recycling and bypass operations	1	Board
3	**Unit III Energy Balance calculations**		
3.1	Basic energy balance calculations	1	Board
3.2	First law of thermodynamics & Sensible and latent heat	1	Board
3.3	Heat capacities & Mean molal heat capacities	1	Board
3.4	Enthalpy changes accompanying chemical reactions	2	Video/Board
3.5	Problems on heat capacities and energy balance calculations	2	Board
3.6	Adiabatic processes	1	Board
3.7	Heat of solution and mixing	1	Board
4	**Unit IV Flow of Fluids**		
4.1	Nature of fluids: classification of fluids	1	Board
4.2	Concept of viscosity	1	Board
4.3	Laminar and turbulent flow	1	Video/GD
4.4	Equation of continuity	1	Board
4.5	Bernoulli's equation and applications	1	Flipped Class/Board
4.6	Friction factor	1	Board
4.7	Calculations	2	Board
4.8	Multiphase flow	1	Board

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5	**Unit –V Mechanical Operations and flow through packed and fluidized bed**		
5.1	Laws of size reduction	1	Board
5.2	Differential and cumulative size analysis	1	PPT
5.3	Size reduction equipment –Jaw crusher, roll crusher, ball mill, hammer mill	1	Flipped Class
5.4	Packed bed: Flow through porous media pressure drop calculations	1	Video/Board
5.5	Packed bed: Ergun's equation	1	Board
5.6	Pressure drop calculations	1	Board
5.7	Fluidization: principle and types	1	Video
5.8	Calculations	2	Board

Course Designer

1. Dr. S. Poornima - spoornima@ksrct.ac.in

60 BT 305	Molecular Biology	Category	L	T	P	Credit
		PC	3	0	0	3

Objective(s)

- Understand the fundamental chemistry and structure of nucleic acids.
- Explore DNA replication, transcription, and translation in both prokaryotes and eukaryotes.
- Analyze mechanisms of DNA mutation and repair.
- Understand regulation of gene expression including operon concepts.
- Apply knowledge to problem-solving scenarios in molecular biology.

Prerequisite

Chemistry, Biochemistry, Cell Biology

Course Outcomes

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

CO1	Interpret the chemistry and structure of nucleic acids, including DNA and RNA, and their role in genetic information storage.	Understand, Apply
CO2	Explain the process of DNA replication in prokaryotes and eukaryotes, and the functions of DNA polymerases.	Understand, Apply, Aanalyze
CO3	Describe the transcription process and its regulation in prokaryotes and eukaryotes.	Understand, Apply, Aanalyze
CO4	Interpret the genetic code and understand protein synthesis in both prokaryotic and eukaryotic ribosomes.	Understand, Apply, Analyze
CO5	Evaluate gene expression regulation mechanisms in prokaryotes and eukaryotes, including small noncoding RNAs and epigenetic modifications.	Understand, Apply, Analyze

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Mapping with Programme Outcomes

COURSE NAME	CO	PO											PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
Molecular Biology	CO1	3	3			1				2				1	2
	CO2	3	3		3	1				2		3		1	2
	CO3	3	3		3	1				2		3		2	2
	CO4	3	3		3	1				2		3		2	2
	CO5	3	3		3	1				2		3		2	2

Note: 3 – Strong Contribution; 2 – Average Contribution; 1 – Some Contribution

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Semester Examination (Marks)
	1	2	
Remember	10	10	10
Understand	10	10	20
Apply	20	20	40
Analyze	20	20	30
Evaluate	0	0	0
Create	0	0	0

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K.S.Rangasamy College of Technology – Autonomous R2022								
60 BT 305 – Molecular Biology								
B.Tech Biotechnology								
Semester	**Hours/Week**			**Total hrs.**	**Credit**	**Maximum Marks**		
	L	**T**	**P**		**C**	**CA**	**ES**	**Total**
III	3	0	0	45	3	40	60	100

Chemistry and Structure of Nucleic Acids Central dogma of molecular biology, basics of nucleic acid chemistry: nucleosides, nucleotides, and nucleic Acids, Base pairing rules, Hydrogen bonding and Base stacking in DNA and RNA, Primary structure of nucleic acids: Sugar-Phosphate backbone and base sequence, Secondary and Tertiary structures: DNA double helix, Supercoiling, Quadruplex Structures, and RNA Structures. Structural organization of chromosomes: Nucleosome, Euchromatin, Chromatin and Heterochromatin.	[9]
DNA Replication and Repair * DNA replication models: Semiconservative, conservative, and dispersive, DNA polymerases and their functions in replication, DNA replication origins and initiation, Molecular mechanisms of DNA replication in Prokaryotes and Eukaryotes, Telomeres and telomerase, Types of DNA mutations: point mutations, frameshift mutations, and indels, DNA repair pathways: Base excision repair, nucleotide excision repair, and mismatch repair. Problem Solving: Case Studies on DNA Replication and Repair.	[9]
Transcription * Structure and function of mRNA, rRNA and tRNA. Characteristics of promoter and enhancer sequences. RNA polymerase and its subunits in prokaryotes and eukaryotes, RNA synthesis: Initiation, elongation and termination, Termination of Transcription in Prokaryotes, Eukaryotic Transcription and its Regulation: Promoters, enhancers and transcription factors, 5' capping, 3' polyadenylation, and splicing in eukaryotic RNA processing, RNA editing and alternative splicing. Problem Solving: Designing Experiments in Transcription.	[9]
Translation * Introduction to Genetic code: Elucidation of genetic code, Codon degeneracy, Wobble hypothesis and its importance, Prokaryotic and eukaryotic ribosomes. Steps in translation: Initiation, Elongation and termination of protein synthesis in prokaryotes and eukaryotes. Inhibitors of protein synthesis. Posttranslational modifications and its importance. Problem Solving: Deciphering the Genetic Code and Protein Synthesis.	[9]
Regulation of Gene Expression Operon Concepts in Prokaryotes, Lac Operon, Trp Operon, and ara Operon, Role of small noncoding RNAs: miRNAs and siRNAs, Riboswitches: RNA-based genetic regulation, Epigenetic modifications and their role in gene expression control, DNA methylation, histone modifications, and chromatin remodeling.Problem Solving: Case Studies in Gene Expression Regulation.	[9]
Total Hours	**45**

Reference(s):

1. Watson, J. D. et al. (2017) Molecular Biology of Gene. 7th edition. Pearson.
2. Gerald Karp. Cell and Molecular Biology: Concepts and Experiments, 5th Edition. Wiley Publication (2008).
3. Krebs, J. E., Goldstein, E. S. and Kilpatrick, S. T. (2018) Lewin's GENES XII. Jones and Bartlett Learning.
4. Weaver, R. (2011) Molecular Biology. 5th edition. McGraw-Hill Education

*SDG 3: Good Health and Well-being

Course Content and Lecture Schedule

S. No.	Topics	No. of hours
1.0	**Chemistry and Structure of Nucleic Acids**	
1.1	Central dogma of molecular biology, basics of nucleic acid chemistry: nucleosides, nucleotides, and nucleic Acids	1
1.2	Base pairing rules, Hydrogen bonding and Base stacking in DNA and RNA	1
1.3	Primary structure of nucleic acids: Sugar-Phosphate backbone and base sequence	1

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

1.4	Secondary and Tertiary structures: DNA double helix, Supercoiling, Quadruplex Structures	1
1.5	RNA Structures	1
1.6	Structural organization of chromosomes	1
1.7	Nucleosome, Euchromatin, Chromatin and Heterochromatin.	1
1.8	Problem Solving: Analyzing the Structure of Nucleic Acids, Predicting DNA secondary structures and their effects on gene expression.	2
2.0	**DNA Replication and Repair**	
2.1	DNA replication models: Semiconservative, conservative, and dispersive	1
2.2	DNA polymerases and their functions in replication	1
2.3	DNA replication origins and initiation, Telomeres and telomerase	1
2.4	Molecular mechanisms of DNA replication in Prokaryotes and Eukaryotes	1
2.5	Types of DNA mutations: point mutations, frameshift mutations, and indels	1
2.6	DNA repair pathways: Base excision repair	1
2.7	nucleotide excision repair, and mismatch repair	1
2.8	Problem Solving: Case Studies on DNA Replication and Repair	2
3.0	**Transcription**	
3.1	Structure and function of mRNA, rRNA and tRNA. Characteristics of promoter and enhancer sequences	1
3.2	Termination of Transcription in Prokaryotes	1
3.3	RNA polymerase and its subunits in prokaryotes and eukaryotes	1
3.4	RNA synthesis: Initiation, elongation and termination	1
3.5	Transcription initiation: Promoters and transcription factors	1
3.6	Eukaryotic Transcription and its Regulation: Promoters, enhancers and transcription factors	1
3.7	RNA capping, Polyadenylation	1
3.8	Splicing in eukaryotic RNA processing, RNA editing and alternative splicing	1
3.9	Problem Solving: Designing Experiments in Transcription	1
4.0	**Translation**	
4.1	Introduction to Genetic code: Elucidation of genetic code	1
4.2	Codon degeneracy, Wobble hypothesis and its importance	1
4.3	Prokaryotic and eukaryotic ribosomes	1
4.4	Initiation, Elongation and termination of protein synthesis in prokaryotes	1
4.5	Initiation, Elongation and termination of protein synthesis in Eukaryotes	1
4.6	Inhibitors of protein synthesis	1
4.7	Posttranslational modifications and its importance	1
4.8	Problem Solving: Deciphering the Genetic Code and Protein Synthesis	2
5.0	**Regulation of Gene Expression**	
5.1	Operon Concepts in Prokaryotes, Lac Operon	1
5.2	Trp Operon, and ara Operon	1
5.3	Role of small noncoding RNAs: miRNAs and siRNAs	1
5.4	Riboswitches: RNA-based genetic regulation	1
5.5	Epigenetic modifications and their role in gene expression control	1
5.6	DNA methylation, histone modifications	1
5.7	Chromatin remodeling	1
5.8	Problem Solving: Case Studies in Gene Expression Regulation	2
	Total	**45**

Course Designer

Dr.B.Kalpana - kalpana@ksrct.ac.in

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

60 GE 002	**Tamils and Technology** (Common to all Branches)

Category	L	T	P	Credit
GE	1	0	0	1

Objectives:

- To learn weaving, ceramic and construction technology of Tamils.
- To understand the agriculture, irrigation and manufacturing technology of Tamils.
- To realize the development of scientific Tamil and Tamil computing.

Prerequisite:

Nil

Course Outcomes:

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

CO1	Understand the weaving and ceramic technology of ancient Tamil people nature.	Understand
CO2	Comprehend the construction technology, building materials in sangam period and case studies.	Understand
CO3	Infer the metal process, coin and beads manufacturing with relevant archeological evidence.	Understand
CO4	Realize the agriculture methods, irrigation technology and pearl diving.	Understand
CO5	Apply the knowledge of scientific Tamil and Tamil computing.	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1							3	3		2		3	3	3
CO2							3	3		2		3	3	3
CO3							3	3		2		3	3	2
CO4							3	3		2		3	2	3
CO5							3	3		2		3	3	3

3- Strong; 2-Medium; 1-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Examination (Marks)
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	40
Analyze	10	10	30
Evaluate	-	-	-
Create	-	-	-

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

Syllabus

K. S. Rangasamy College of Technology – Autonomous R2022								
60 GE 002 – Tamils and Technology (Common to all Branches)								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	1	0	0	15	1	100	-	100

WEAVING AND CERAMIC TECHNOLOGY Weaving Industry during Sangam Age – Ceramic Technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.	3
DESIGN AND CONSTRUCTION TECHNOLOGY 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.	3
MANUFACTURING TECHNOLOGY 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	3
AGRICULTURE AND IRRIGATION TECHNOLOGY 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	3
SCIENTIFIC TAMIL & TAMIL COMPUTING 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.	3
Total Hours	**15**

Text Book(s):

1.	தமிழக வரலாறு - மக்களும் பண்பாடும் கே. கே . பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2.	கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3.	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு).
4.	பொருநை - ஆற்றங்கரை நாகரீகம் (தொல்லியல் துறை 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,
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

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

60 GE 002	**தமிழரும் தொழில்நுட்பமும்** (அனைத்து துறைகளுக்கும் பொதுவானது)

Category	L	T	P	Credit
GE	1	0	0	1

பாடத்தின் நோக்கங்கள்:

- தமிழர்களின் சங்ககால நெசவு, பனை வனைதல் மற்றும் கட்டிட தொழில் நுட்பம் குறித்து அறிதல்.
- தமிழர்களின் சங்ககால வேளாண்மை, நீர்ப்பாசனம் மற்றும் உற்பத்தி முறைகள் குறித்த கற்றல்.
- நவீன அறிவியல் தமிழ் மற்றும் கணித்தமிழ் குறித்த புரிதல்.

முன்கூட்டிய துறைசார் அறிவு:

தேவை இல்லை

பாடம் கற்றதின் விளைவுகள்:

பாடத்தை வெற்றிகரமாக கற்று முடித்த பின்பு, மாணவர்களால் முடியும் விளைவுகள்

CO1	சங்ககாலத் தமிழர்களின் நெசவு மற்றும் பானை வனைதல் தொழில்நுட்பம் குறித்த கற்றுணர்தல்	புரிதல்
CO2	சங்ககாலத் தமிழர்களின் கட்டிட தொழில்நுட்பம் கட்டுமானப் பொருட்கள் மற்றும் அவற்றை விளக்கும் தளங்கள் குறித்த அறிவு.	புரிதல்
CO3	சங்ககாலத் தமிழர்களின் உலோகத் தொழில், நாணயங்கள் மற்றும் மணிகள் சார்ந்த தொல்லியல் சான்றுகள் பற்றிய அறிவு.	புரிதல்
CO4	சங்ககாலத் தமிழர்களின் வேளாண்மை, நீர்ப்பாசன முறைகள் மற்றும் முத்து குளித்தல் குறித்த தெளிவு.	புரிதல்
CO5	நவீன அறிவியல் தமிழ் மற்றும் கணித்தமிழ் குறித்த புரிந்துகொள்ளலும் மற்றும் பயன்படுத்துதலும்.	பகுப்பாய்வு

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1							3	3		2		3	3	3
CO2							3	3		2		3	3	3
CO3							3	3		2		3	3	2
CO4							3	3		2		3	2	3
CO5							3	3		2		3	3	3
		3- Strong; 2-Medium; 1-Low												

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Examination (Marks)
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	40
Analyze	10	10	30
Evaluate	-	-	-
Create	-	-	-

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

Syllabus

K. S. Rangasamy College of Technology – Autonomous (R2022)								
60 GE 002 – ***தமிழரும் தொழில்நுட்பமும்***								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	1	0	0	15	1	100	-	100

***நெசவு மற்றும் பானைத் தொழில்நுட்பம்*:** *சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.*	3
***வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்*:** *சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமானப் பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கல் - நாயக்கர் காலக் கோயில்கள் – மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக் கலை.*	3
***உற்பத்தித் தொழில் நுட்பம்*:** *கப்பல் கட்டும் கலை – உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள் , கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத் துண்டுகள் - தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.*	3
***வேளாண்மை மற்றும் நீர்பாசனத் தொழில் நுட்பம்*:** *அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்கான வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.*	3
அறிவியல் தமிழ் மற்றும் கணித்தமிழ் *அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.*	3
Total Hours	**15**

Text Book(s):

1.	*தமிழக வரலாறு - மக்களும் பண்பாடும் கே. கே . பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).*
2.	*கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).*
3.	*கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு).*
4.	*பொருநை - ஆற்றங்கரை நாகரீகம் (தொல்லியல் துறை 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) (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.

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

60 BT 3P1	BIOCHEMISTRY LABORATORY

Category	L	T	P	Credit
PC	0	0	4	2

Objective

- To learn the fundamental approaches for experimental investigation.
- To learn the theoretical foundations for the methods used for biochemical analysis.
- To determine the characteristics features of various molecules with reference to its analytical characters.
- To evaluate and estimate the biological molecules through various methods.
- To analyze the level of various elements through suitable standards.

Prerequisite

Nil

Course Outcomes

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

CO1	describe the calibration of glass-wares and understand the preparation of solutions.	Apply
CO2	standardize the pH meter and preparation of buffer solutions.	Apply
CO3	elucidate the fundamental analysis of carbohydrates and lipids qualitatively and quantitatively	Apply
CO4	examine and interpret the results by determining the amount of glycine and ascorbic acid	Apply
CO5	estimate the amount of carbohydrate, protein, cholesterol, creatinine, urea and uric acid quantitatively	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			2	3							2		3	3
CO2			2	3							2		3	3
CO3			2	3						2	2		3	2
CO4			2	3						2	2		2	3
CO5			2	3						2	2		3	3
3- Strong; 2-Medium; 1-Low														

List of Experiments*

1. Calibration of glass wares- pipettes and volumetric flasks
2. Preparation of solutions:1) percentage solutions, 2) molar solutions, 3) normal solutions
3. Standardization of pH meter and preparation of buffer of a given pH and molarity
4. Qualitative analysis of Carbohydrates- Monosaccharides (Determination of reducing property, differentiation of aldoses and ketoses, Osazone formation).
5. Qualitative analysis of Carbohydrates- Disaccharides and Polysacccharides (hydrolysis of glycosidic bond and osazone formation)
6. Qualitative analysis of Lipids - Determination of Acid number of an edible oil (coconut oil).
7. Qualitative analysis of Lipids – Determination of Iodine number of an edible oil (Sunflower oil).

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8. Estimation of ascorbic acid by dye method (Titrimetry)
9. Estimation of amino acid (glycine) by Sorenson's Formal titration method.
10. Determination of total Carbohydrate content by Anthrone's method.
11. Estimation of protein by Lowry's method
12. Estimation of cholesterol by Zak'smethod
13. Estimation of creatinine by Jaff'smethod
14. Determination of urea in the urine sample by Dam method
15. Evaluation of uric acid by Caraway's method

*SDG 3: Good Health and Well-being

-Course Designers

1. Dr.S.Sidhra – sidhra@ksrct.ac.in
2. Dr. K.Syed Zameer Ahmed – syedzameerahmed@ksrct.ac.in

60 BT 3P2	MICROBIOLOGY LABORATORY

Category	L	T	P	Credit
PC	0	0	4	2

Objective

- To understand the growth and development of microbes through various culturing methods
- To observe the differences in staining reactions in bacteria and fungi
- To learn the culture conditions of anaerobic microbes
- To understand the concept of quality analysis of water and milk samples.
- To identify the effective method to control microbes

Prerequisite

Nil

Course Outcomes

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

CO1	perform the aseptic methods to be followed in laboratory and preparation of liquid and solid media and cultivation of microorganisms	Apply
CO2	interpret the differential staining techniques for identification of bacteria and fungi	Apply
CO3	demonstrate anaerobic microbe culture techniques	Apply
CO4	analysis for physiological identification of microorganisms	Apply
CO5	examine the quality of water and milk, and carry out the antibiotic sensitivity test	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	2	1	2	3	2	3	2	3	3	3
CO2	2	3	2	2	2	2	3	1	2	2	2		3	3
CO3													3	2
CO4													2	3
CO5													3	3

3- Strong; 2-Medium; 1-Low

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List of Experiments*

1. Laboratory Precautions, principles of aseptic techniques
2. Preparation of Liquid and solid nutrient media
3. Preparation and observation of bacteria by using various selective media
4. Cultivation of microorganisms - Pour plate, spread plate and streak plate
5. Gram's staining - Gram positive and Gram-negative bacteria
6. Fungal staining - Lacto phenol cotton blue staining of Mold
7. Determination of Microbial growth-viable count and turbidity method
8. Cultivation of anaerobic bacteria
9. Physiological characterization of microbes - Carbohydrate fermentation test and catalase test
10. Starch and casein hydrolysis test
11. IMViC test for Coliform bacteria
12. Enumeration of Bacteria, fungi and Actinomycetes (Design experiment)
13. Rapid detection of bacteriological quality of water - Most Probable Number test
14. Quality analysis of Milk samples - Methylene Blue Reduction Test
15. Antibiotic resistance / sensitivity test

*SDG 3: Good Health and Well-being

-Course Designers

1. Dr. Swathy J S– swathy@ksrct.ac.in

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60 CG 0P2	CAREER SKILL DEVELOPMENT II

Category	L	T	P	Credit
CGC	0	0	2	0

Objective

- To help learners improve their vocabulary and enable them to use words appropriately in different academic and professional contexts.
- To help learners develop strategies that could be adopted while reading texts.
- To help learners acquire the ability to speak and write effectively in English in real life and career related situations.
- Improve listening, observational skills, and problem-solving capabilities
- Develop message generating and delivery skills

Prerequisite

Basic knowledge of reading and writing in English.

Course Outcomes

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

CO1	Compare and contrast products and ideas in technical texts.	Analyze
CO2	Identify cause and effects in events, industrial processes through technical texts	Analyze
CO3	Analyze problems in order to arrive at feasible solutions and communicate them orally and in the written format.	Analyze
CO4	Report events and the processes of technical and industrial nature.	Apply
CO5	Articulate their opinions in a planned and logical manner, and draft effective résumés in context of job search.	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								2	3	3	2	3	3	3
CO2								2	3	3	2	3	3	3
CO3								2	3	3	2	3	3	2
CO4								2	3	3	2	3	2	3
CO5								2	3	3	2	3	3	3
3- Strong; 2-Medium; 1-Some														

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K.S.Rangasamy College of Technology – Autonomous R2022								
60 CG 0P2- Career Skill Development II								
Common to All Branches								
Semester	Hours/Week			Total Hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III	0	0	2	25	0	100	00	100

Listening Evaluative Listening: Advertisements, Product Descriptions, - Audio / video; filling a graphic organiser (choosing a product or service by comparison) - Listening to longer technical talks and completing– gap filling exercises. Listening technical information from podcasts – Listening to process/event descriptions to identify cause & effects, documentaries depicting a technical problem and suggesting solutions - Listening to TED Talks	**[5]**
Speaking Marketing a product, persuasive speech techniques - Describing and discussing the reasons of accidents or disasters based on news reports, Group Discussion (based on case studies), presenting oral reports, Mini presentations on select topics with visual aids, participating in role plays, virtual interviews	**[5]**
Reading Reading advertisements, user manuals and brochures - longer technical texts– cause and effect essays, and letters / emails of complaint - Case Studies, excerpts from literary texts, news reports etc. - Company profiles, Statement of Purpose (SoPs)	**[5]**
Writing Professional emails, Email etiquette - compare and contrast essay - Writing responses to complaints Precis writing, Summarizing and Plagiarism- Job / Internship application – Cover letter & Résumé	**[5]**
Verbal Ability II Reading Comprehension (Inferential fillups) – Spotting Errors – Verbal Analogies – Theme Detection – Change of Voice – Change of Speech – One word substitution	**[5]**
Total Hours	**25**

Reference(s):

1.	*'English for Engineers & Technologists'* Orient Blackswan Private Ltd. Department of English, Anna University, 2020
2.	Norman Lewis, *'Word Power Made Easy - The Complete Handbook for Building a Superior Vocabulary Book'*, Penguin Random House India, 2020
3.	Raman. Meenakshi, Sharma. Sangeeta, 'Professional English'. Oxford University Press. New Delhi. 2019
4.	Arthur Brookes and Peter Grundy,' Beginning to Write: Writing Activities for Elementary and Intermediate Learners', Cambridge University Press, New York, 2003

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Course Contents and Lecture Schedule

S.No	Topic	No.of Hours
1	**Listening**	
1.1	Evaluative Listening: Advertisements, Product Descriptions	1
1.2	Listening to longer technical talks and completing– gap filling exercises.	1
1.3	Listening technical information from podcasts	1
1.4	Listening to process/event descriptions to identify cause & effects and documentaries depicting a technical problem and suggesting solutions	1
1.5	Listening to TED Talks	1
2	**Speaking**	
2.1	Marketing a product, persuasive speech techniques	1
2.2	Describing and discussing the reasons of accidents or disasters based on news reports,	1
2.3	Group Discussion (based on case studies)	1
2.4	Presenting oral reports, Mini presentations on select topics with visual aids	1
2.5	participating in role plays and virtual interviews	1
3	**Reading**	
3.1	Reading advertisements, user manuals and brochures	1
3.2	Reading - longer technical texts– cause and effect essays, and letters / emails of complaint	1
3.3	Case Studies, excerpts from literary texts, news reports etc.	1
3.4	Company profiles	1
3.5	Statement of Purpose (SoPs)	1
4	**Writing**	
4.1	Professional emails, Email etiquette	1
4.2	Compare and contrast essay	1
4.3	Writing responses to complaints	1
4.4	Precis writing, Summarizing and Plagiarism	1
4.5	Job / Internship application – Cover letter & Résumé	1
5	**Verbal Ability II**	
5.1	Reading Comprehension (Inferential fillups) and Theme Detection	1
5.2	Spotting Errors	1
5.3	Verbal Analogies	1
5.4	Change of Voice and Change of Speech	1
5.5	One word substitution	1
	Total	**25**

Course Designer

2. Dr.A.Palaniappan - palaniappan@ksrct.ac.in

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K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE - 637215
(An Autonomous Institution affiliated to Anna University)

B.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS
(For the candidates admitted from 2022-2023 onwards)

FOUTRH SEMESTER

S.No.	Course Code	Name of the Course	Duration of Internal Exam	Weightage of Marks			Minimum Marks for Pass in End Semester Exam	
				Continuous Assessment *	End Semester Exam **	Max. Marks	End Semester Exam	Total
THEORY								
1	60 MA 021	Probability and Statistics	2	40	60	100	45	100
2	60 BT 401	Genetic Engineering	2	40	60	100	45	100
3	60 BT 402	Protein and Enzyme Engineering	2	40	60	100	45	100
4	60 BT 403	Biochemical Thermodynamics	2	40	60	100	45	100
5	60 MY 002	Universal Human Values	2	100	-	100	-	100
6	60 BT E1	Open Elective – I	2	40	60	100	45	100
PRACTICAL								
7	60 BT 4P1	Molecular Biology and Genetic Engineering Laboratory	3	60	40	100	45	100
8	60 BT 4P2	Protein and Enzyme Engineering Laboratory	3	60	40	100	45	100
9	60 C 0P3	Career Skill Development – III	3	100	-	100	-	-
10	60 CG 0P6	Internship	-	100	-	100	-	100

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60 MA 021	Probability and Statistics

Category	L	T	P	Credit
BS	3	1	0	4

Objective

- To get exposed to the basic concepts of probability.
- To familiarize the concepts of correlation and regression.
- To familiarize various methods in hypothesis testing.
- To get exposed to the fundamentals of analysis of variance.
- To learn basics of descriptive statistics and control charts.

Prerequisite

Nil

Course Outcomes

At the end of the course, the students will be able to

CO1	Understand the basic concepts of probability.	Remember Understand Apply
CO2	Calculate coefficient of correlation and regression.	Remember Understand Apply
CO3	Apply Student's t test, F test and Chi-square test for testing the statistical hypothesis.	Remember Understand Apply
CO4	Apply the concepts of ANOVA to test the equality of means for more than two populations.	Remember Understand Apply
CO5	Compute measures of central tendency and measures of dispersion, and apply the concepts of control charts for decision making.	RememberUnderstand Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2							3	2		
CO2	3	3	2	2	2							3	2		
CO3	3	3	3	3	2							3	2		
CO4	3	3	3	3	2							3	2		
CO5	3	3	3	3	2							3	2		
3 – Strong; 2 – Medium; 1 – Some															

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		Model Exam (Marks)	End Semester Examination (Marks)
	1	2		
Remember (Re)	10	10	20	20
Understand (Un)	10	10	20	20
Apply (Ap)	40	40	60	60
Analyze (An)	0	0	0	0
Evaluate (Ev)	0	0	0	0
Create (Cr)	0	0	0	0
Total	60	60	100	100

Passed in BoS Meeting held on 21/11/2023
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BoS Chairman Signature

K.S.Rangasamy College of Technology – Autonomous R2022								
60 MA 021 - Probability and Statistics								
Common to Biotechnology and Food Technology								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	1	0	60	4	40	60	100

Probability and Random Variable Probability - Axioms of probability - Total probability - Conditional probability - Bayes theorem - Random variable - Discrete random variable - Probability mass function - Continuous random variable - Probability density function - Moment generating function.	**[9]**
Two Dimensional Random Variables Joint distribution - Marginal distribution - Conditional distribution - Covariance - Correlation - Rank Correlation - Regression.	**[9]**
Testing of Hypothesis Type I and Type II errors - Test of significance of small samples: Student's 't' test - Single mean - Difference of means - F- test - Chi-square test - Goodness of fit - Independence of attributes.	**[9]**
Design of Experiments Analysis of variance - One way classification - Completely randomized design - Two way classification - Randomized block design - Latin square design.	**[9]**
Statistics and Quality Control Measures of Central tendency: Mean, Median, Mode - Measures of Dispersion: Quartile deviation – Standard deviation - Coefficient of variation - Control charts: Mean ($\bar{X}$) chart and Range (R) chart - nP chart - C chart.	**[9]**
Total Hours: 45 + 15 (Tutorial)	**60**

Text book(s):

1.	Gupta S.C and Kapoor V.K., "Fundamentals of Mathematical Statistics", 12th Edition, Sultan Chand & Sons, New Delhi, 2020.
2.	Richard A Johnson, "Miller & Freund's Probability and Statistics for Engineers", 9th Edition, Pearson Education Limited, New Delhi, 2018.

Reference(s):

1.	Sheldon Ross, "A first course in Probability", 10th Edition, Pearson Education, New Delhi, 2019.
2.	Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, New Delhi, 2011.
3.	Veerarajan T., "Probability, Statistics and Random Process", 3rd Edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
4.	Lipschutz, Seymour, Schiller John. J., "Schaum's outlines – Introduction to Probability and Statistics", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 1998.

Course Contents and Lecture Schedule

S.No.	Topic	Number of Hours
1.	**Probability and Random Variable**	
1.1	Axioms of probability	1
1.2	Total probability	
1.3	Conditional probability	1
1.4	Bayes theorem	2
1.5	Tutorial	2
1.6	Discrete random variable - Probability mass function	2

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1.7	Continuous random variable - Probability density function	1
1.8	Moment generating function	1
1.9	Tutorial	2
2.	**Two Dimensional Random Variables**	
2.1	Joint distribution	1
2.2	Marginal distribution	1
2.3	Conditional distribution	1
2.4	Covariance	1
2.5	Tutorial	2
2.6	Correlation	2
2.7	Rank Correlation	1
2.8	Regression	1
2.9	Tutorial	2
3.	**Testing of Hypothesis**	
3.1	Student's 't' test – Single mean	1
3.2	Student's 't' test - Difference of means	2
3.3	F- test	2
3.4	Tutorial	2
3.5	Chi-square test -Goodness of fit	1
3.6	Chi-square test - Independence of attributes	2
3.7	Tutorial	2
4.	**Design of Experiments**	
4.1	Analysis of variance - One way classification	2
4.2	Analysis of variance - Completely randomized design	1
4.3	Analysis of variance - Two way classification	2
4.4	Tutorial	2
4.5	Analysis of variance - Randomized block design	1
4.6	Analysis of variance - Latin square	2
4.7	Tutorial	2
5.	**Statistics and Quality Control**	
5.1	Mean, Median, Mode	2
5.2	Quartile deviation	1
5.3	Standard deviation	1
5.4	Coefficient of variation	1
5.5	Tutorial	2
5.6	Mean (X) chart and Range (R) chart	1
5.7	nP chart	1
5.8	C chart	1
5.9	Tutorial	2
	Total	60

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Approved in Academic Council Meeting held on 23/12/2023

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List of MATLAB Programs:

1. Calculating the probability for one dimensional random variable
2. Computing Coefficient of Correlation
3. Plotting Lines of regression
4. Visualizing data and performing Testing of hypothesis
5. Visualizing data and performing Chi-square test
6. Visualizing data and performing Analysis of Variance
7. Computing Mean, Median and Mode
8. Plotting and visualizing control charts

Course Designers

3. Mr.G.Mohan - mohang@ksrct.ac.in
4. Ms.K.Geetha - geethak@ksrct.ac.in

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60 BT 401	**Genetic Engineering**

Category	L	T	P	Credit
PC	3	0	0	3

Objective

- To discuss the methods, tools and techniques involved in genome analysis, expression of cloned genes in different host system.
- To understand the production of recombinant proteins, mutation analysis and the importance of PCRin genome analysis.
- The student would learn about various aspects of Genetic Engineering, its application and ethical issues.
- To determine the strategies involved in gene cloning with the help of genomic libraries, cDNA libraries and other libraries.
- To discuss the production of useful molecules like cytokines, vaccines and antibiotics and define thesafety guidelines for recombinant.

Prerequisite

Molecular Biology and Biochemistry

Course Outcomes

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

CO1	Understand restriction and modification system and their role in genetic engineering	Understand
CO2	Know about the cloning vectors used in manipulation of genes.	Understand
CO3	Examine the strategies involved in gene cloning and methods involved in screening of cloned genes to identify the target gene.	Apply
CO4	Illustrate the PCR based techniques involved in genetic manipulation including mutagenesis and demonstrate various sequencing techniques	Apply
CO5	Comprehend the applications of rDNA technology and describe the role of knock out and RNA Interference technology in gene expression studies.	Analyze

Mapping with Programme Outcomes

COs	**PO1**	**PO2**	**PO 3**	**PO 4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	2	3			3		3	2	3	3	3
CO2	3	3	2	3		3	3	3		3		3	3	2
CO3	3	3	3	3				3	3		3	3	3	2
CO4	3	3	3	3	3	3	3			3		3	3	2
CO5	3	3	3	3		3			3		3	3	3	3
3- Strong; 2-Medium; 1-Some														

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests (Marks)**		**End Sem Examination (Marks)**
	1	**2**	
Remember (Re)	10	10	10
Understand (Un)	20	20	40
Apply (Ap)	20	10	30
Analyse (An)	10	20	20

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K.S.Rangasamy College of Technology – Autonomous R2022

60 BT 401 – Genetic Engineering

B.Tech. Biotechnology

Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	3	40	60	100

FUNDAMENTAL TECHNIQUES OF GENE MANIPULATION* Restriction enzymes: types and mechanisms, DNA modification enzymes - Alkaline phosphatase-Terminal deoxynucleotidal transferase- polynucleotide kinase- DNA Methyltransferases (DNMTs)-DNA Polymerases, S1 nuclease , Restriction mapping, Design of linkers and adapters, Joining of DNA molecules, Basics of cloning.	**[9]**
BIOLOGY OF CLONING VECTORS Characteristics of cloning vectors, Types of vectors, Selectable markers, and Experimental applications of vectors: Plasmids- pBR322, pUC, λ vectors, cosmids, M13 vectors, Phagemids, Artificial Chromosomes: YAC, PAC, BAC, HAC, Expression vectors, Insect, Yeast and Mammalian vectors.	**[9]**
GENE CLONING STRATEGIES ANDSCREENING Cloning of genes: Genomic libraries, cDNA libraries, Directional cDNA cloning, PCR based libraries-RACE, Subtraction libraries, Screening: Nucleic acid probe hybridization, Immuno screening and Functional screening.	**[9]**
AMPLIFICATION AND SEQUENCING OF DNA PCR: Mechanism, Types- Nested, Hot start, colony PCR, Taqman assay, Molecular beacons, Site directed mutagenesis: primer extension - Strand selection -Cassette mutagenesis - PCR based, Methods of nucleic acid sequencing: Sanger'smethod, Automated sequencing. Next Generation sequencing method: Illumina and Ion Torrent.	**[9]**
APPLICATIONS OF RDNA TECHNOLOGY Differential display, Microarrays, FISH, Knock-out analysis, Antisense and RNA interference, Yeast two hybrid system, RAPD, RFLP, VNTRs and SSR; Production of useful molecules: cytokines, vaccines and antibodies, improving agronomictraits. Safety guidelines for recombine ant DNA technology.	**[9]**
Total Hours	**45**

Text book(s):

1. Smita Rastogi and Neelam Pathak, "Genetic Engineering", Oxford Publication, 2010.
2. Ragagopal K., "Recombinant DNA Technology and Genetic Engineering", Tata McGraw Hill Education Private Ltd.,2012.

Reference(s):

1. Primrose S.B. &Twyman R.M., "Principles of Gene Manipulation and Genomics", 7th Edition, Blackwell Publishing,2006.
2. Richard J. Reece., "Analysis of Genes and Genomes", John Wiley and Sons Ltd., Singapore, 2004.
3. Desmond S.T. Nicholl, "An Introduction to Genetic Engineering", Third Edition Cambridge University Press NewYork, 2008.
4. Gyana Ranjan Rout, K,V, Peter, " Genetic Engineering of Horticultural crops" Academic Press An imprint of Elsevier, 2018.

*SDG 3: Good Health and Well-being

Course Contents and Lecture Schedule

Passed in BoS Meeting held on 21/11/2023
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S.No	Topic	No.of Hours
1	**FUNDAMENTAL TECHNIQUES OF GENE MANIPULATION**	
1.1	Restriction enzymes: types and mechanisms	1
1.2	DNA modification enzymes - Alkaline phosphatase- Terminal deoxynucleotidal transferase- polynucleotide kinase	2
1.3	DNA Methyltransferases (DNMTs)- DNA Polymerases, S1 nuclease	2
1.4	Restriction mapping	1
1.5	Design of linkers and adapters	1
1.6	Joining of DNA molecules	1
1.7	Basics of cloning	1
2	**BIOLOGY OF CLONING VECTORS**	
2.1	Characteristics of cloning vectors	1
2.2	Types of vectors, Selectable markers	1
2.3	Experimental applications of vectors: Plasmids- pBR322,	1
2.4	pUC, λ vectors, cosmids, M13 vectors	1
2.5	Phagemids	1
2.6	Artificial Chromosomes: YAC, PAC, BAC, HAC	1
2.7	Expression vectors	1
2.8	Insect, Yeast and Mammalian vectors.	2
3	**GENE CLONING STRATEGIES ANDSCREENING**	
3.1	Cloning of genes: Genomic libraries,	1
3.2	cDNA libraries, Directional cDNA cloning	1
3.3	PCR based libraries-RACE	2
3.4	Subtraction libraries	1
3.5	Screening: Nucleic acid probe hybridization	2
3.6	Immuno screening and Functional screening	2
4	**AMPLIFICATION AND SEQUENCING OF DNA**	
4.1	PCR: Mechanism, Types- Nested,	1
4.2	Hot start, colony PCR, Taqman assay	1
4.3	Molecular beacons	1
4.4	Site directed mutagenesis: primer extension -	1
4.5	Strand selection -Cassette mutagenesis - PCR based	1
4.6	Methods of nucleic acid sequencing: Sanger'smethod	1
4.7	Automated sequencing	1
4.8	Next Generation sequencing method: Illumina and Ion Torrent	2
5	**APPLICATIONS OF RDNA TECHNOLOGY**	
5.1	Differential display, Microarrays	1
5.2	FISH, Knock-out analysis	2
5.3	Antisense and RNA interference, Yeast two hybrid system	1
5.4	RAPD, RFLP	1
5.5	VNTRs and SSR	1
5.6	Production of useful molecules: cytokines, vaccines and antibodies	2
5.7	improving agronomictraits.	1
5.8	Safety guidelines for recombinant rDNA technology.	1
	Total	**45**

Course Designers

5. Dr.Swathy J S - swathy@ksrct.ac.in

Passed in BoS Meeting held on 21/11/2023
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BoS Chairman Signature

60 BT 402	Protein and Enzyme Engineering

Category	L	T	P	Credit
EN	3	0	0	3

Objective

- To impart concept on Protein engineering and Enzyme Engineering.
- To learn basic principles in Enzyme kinetics and catalysis
- To evaluate the Production and purification of Proteins and Enzymes
- To comprehend the various methods of protein and enzyme engineering
- To analyze the application of proteins and enzymes in various industries

Prerequisite

Basic knowledge on Chemistry, Cell Biology and Biochemistry is needed to understand this course.

Course Outcomes

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

CO1	Demonstrate the basic, types and structural confirmation of proteins and enzymes	Understand
CO2	Examine the concepts of enzyme activity and its catalysis	Apply
CO3	Illustrate the protein/ enzyme purification methods and factors affecting immobilization	Apply
CO4	Infer the strategies for protein/ enzyme engineering and rational enzyme design.	Analyze
CO5	Examine the design of enzyme electrodes and applications of protein/ enzyme in various domain	Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											1
CO2	2	3		1								1
CO3	3	2	2									
CO4			3	1								
CO5			3	1	2							
3- Strong; 2-Medium; 1-Some												

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember (Re)	10	10	10
Understand (Un)	20	20	40
Apply (Ap)	20	10	30
Analyse (An)	10	20	20

Passed in BoS Meeting held on 21/11/2023
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K.S.Rangasamy College of Technology – Autonomous R2022								
60 BT 402 - Protein and Enzyme Engineering								
Common to All Branches								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	0	0	45	3	40	60	100

Introduction to Proteins and Enzymes Introduction to proteins - Structural characterization and determination - Ramachandran Plot.Enzymes: definition, nomenclature and classification of enzymes ,Holoenzymes, Apoenzymes, Metalloenzymes, and Ribozyme, Factors affecting enzyme activity, Regulation of enzyme activity-Allosteric Regulation, Enzyme Inhibition (Competitive,Noncompetitive and Uncompetitivve Inhibition)	**[9]**
Enzyme kinetics and catalysis Concept of active site -Mechanism of enzyme action - specificity of enzyme action -: Michaelis Menton equation and its Transformations, turn over number, Analytical problems in turn over number, transformations of MM equations. Catalysis- Acid base catalysis, Covalent catalysis, Mechanism of action of lyzosymes.	**[9]**
Production and purification of Proteins and Enzymes Production and Purification of enzyme from plant, animal and microbial source: extraction, precipitation, dialysis, Ion exchange chromatography, Hydrophobic interaction chromatography, Gel filtration chromatography. Types of Enzyme immobilization.	**[9]**
Strategies for protein and enzyme engineering Protein engineering cycle, protein splicing, random and site directed mutagenesis, peptidomimetics, *in vitro* protein evolution (DNA shuffling, Error prone PCR), cell surface display technology - Rational enzyme Design: Reshaping enzyme specificity, reengineering catalytic mechanisms, engineering by molecular assembling.	**[9]**
Application of Proteins and Enzymes* Importance of recombinant enzymes and proteins, Industrial applications of enzymes, design of enzyme electrodes - Case studies on protein engineering applications in food, detergent, environment and health care industries.	**[9]**
Total Hours	**45**

Text book(s):

1. Palmer, T. and Bonner, P., “Enzymes: Biochemistry, Biotechnology and Clinical chemistry”, Affiliated East - West Press Pvt. Ltd., New Delhi, India, 2008.
2. Devasena T., “Enzymlogy”, Second Edition, Oxford University Press, New Delhi, India, 2014.

Reference(s):

1. Branden, C. and Tooze, J., “Introduction to Protein structure”, Second Edition, Garland Publishing, New York, US, 1999.
2. Moody, P.C.E. and Wilkinson, A.J., “Protein Engineering”, IRL Press, Oxford, UK, 1990.

***SDG 9: Industry, Innovation, and Infrastructure**

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Course Contents and Lecture Schedule

S.No	Topic	No.of Hours
1	**Introduction to Proteins and Enzymes**	
1.1	Introduction to proteins	1
1.2	Structural characterization and determination - Ramachandran Plot	1
1.3	Enzymes: definition, nomenclature	1
1.4	Classification of enzymes	1
1.5	Holoenzymes, Apoenzymes, Metalloenzymes, and Ribozyme,	1
1.6	Factors affecting enzyme activity	1
1.7	Regulation of enzyme activity	1
1.8	Allosteric Regulation	1
1.9	Enzyme Inhibition (Competitive, Noncompetitive and Uncompetitivve Inhibition)	1
2	**Enzyme kinetics and catalysis**	
2.1	Concept of active site	1
2.2	Mechanism of enzyme action	1
2.3	specificity of enzyme action	1
2.4	Michaelis Menton equation and its Transformations	1
2.5	turn over number, Analytical problems in turn over number,	1
2.6	transformations of MM equations.	1
2.7	Catalysis- Acid base catalysis,	1
2.8	Covalent catalysis,.	1
2.9	Mechanism of action of lyzosymes	1
3	**Production and purification of Proteins and Enzymes**	
3.1	Production and Purification of enzyme from plant,	2
3.2	animal and microbial source:	1
3.3	extraction, precipitation,	1
3.4	dialysis, Ion exchange chromatography,	1
3.5	Hydrophobic interaction chromatography,	1
3.6	Gel filtration chromatography.	1
3.7	Types of Enzyme immobilization	2
4	**Strategies for protein and enzyme engineering**	
4.1	Protein engineering cycle	1
4.2	protein splicing,	1
4.3	random and site directed mutagenesis,	1
4.4	peptidomimetics,	1
4.5	*in vitro* protein evolution (DNA shuffling, Error prone PCR mechanisms, engineering by molecular assembling.	1
4.6	cell surface display technology -	1
4.7	Rational enzyme Design:	1

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4.8	Reshaping enzyme specificity,	1
4.9	reengineering catalytic	1
5	**Application of Proteins and Enzymes**	
5.1	Importance of recombinant enzymes and proteins	2
5.2	Industrial applications of enzymes,.	2
5.3	design of enzyme electrodes	1
5.4	Case studies on protein engineering	1
5.5	applications in food, detergent,	1
5.6	environment and health care industries	2
	Total	**60**

Course Designers

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Passed in BoS Meeting held on 21/11/2023
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60 BT 403	Biochemical Thermodynamics

Category	L	T	P	Credit
PC	3	1	0	4

Objective (s)

- To learn about basic thermodynamic relations and properties of fluids
- To understand partial molar properties and property change of mixing
- To understand the concept of phase equilibria
- To know the application of chemical reaction equilibrium
- To apply the thermodynamics concepts in bioengineering

Prerequisite

Basic knowledge of Engineering Mathematics and physics

Course Outcomes

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

CO1	Understand the basic laws of thermodynamics to predict the thermodynamic properties of pure fluids	Understand
CO2	Understand the various thermodynamic properties of solutions	Understand
CO3	Know the criteria of phase equilibria for single and multicomponent systems	Understand
CO4	Apply the concept of chemical reaction equilibria and equilibrium conversion	Apply
CO5	Apply the bioenergetics and thermodynamics of biochemical reactions	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1										2	3
CO2	2	3	1	1									3	2
CO3	3	1	2	1	1								3	2
CO4	2	3	1										2	3
CO5	3	2	1										2	3
3- Strong; 2-Medium; 1-Some														

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Sem Examination (Marks)
	1	2	
Remember	10	10	20
Understand	30	30	40
Apply	20	20	40
Analyze	-	-	-
Create	-	-	-

Passed in BoS Meeting held on 21/11/2023
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BoS Chairman Signature

K. S. Rangasamy College of Technology – Autonomous R2022								
60 BT 403- Biochemical Thermodynamics								
Common to All Branches								
Semester	Hours/Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
IV	3	1	0	60	4	40	60	100

Thermodynamic Properties of Pure Fluids Basic concepts and laws of thermodynamics - basics of entropy - volumetric properties of fluids - estimation of thermodynamic properties using equations of state, calculations involving actual property changes, Maxwell's relations and applications.	**[9]**
Solution Thermodynamics* Partial molar properties - concept of chemical potential and fugacity in solutions - activity - activity coefficients - effect of pressure and temperature - Gibbs-Duhem equations - property changes of mixing - heat effects of mixing in biological broths.	**[9]**
Phase equilibria Criteria for phase equilibria - phase equilibria in single and multicomponent systems - Duhem's theorem. V-L-E calculations for binary and multi component systems. Liquid-liquid equilibria and solid-liquid equilibria.	**[9]**
Chemical Reaction equilibria Chemical reaction equilibrium: evaluation of equilibrium constant, effect of temperature and pressure on equilibrium constant, equilibrium conversion for single and multiple reactions.	**[9]**
Biochemical Thermodynamics Thermodynamics and energetics of metabolic pathways, oxygen requirement and heat generation in aerobic growth, energy coupling (NADH and ATP), Thermodynamics of oxidation-reduction reactions. Case study.	**[9]**
Total Hours	**60**

Text book(s):	
1.	Smith J.M., Van Ness H.C., Abbot M.M. Chemical Engineering Thermodynamics, Sixth edition, McGraw-Hill, 2001.
2.	Narayanan K.V., "A Text Book of Chemical Engineering Thermodynamics", Second Edition, Prentice Hall of India, New Delhi, 2016.
Reference(s):	
1.	Gopinath Halder, "Introduction to Chemical Engineering Thermodynamics", PHI Learning Pvt. Ltd. New Delhi, 2009.
2.	Sandler S. I., Chemical, Biochemical and Engineering Thermodynamics, Fourth Edition, John Wiley & Sons Inc., 2006.
3.	Gavhane K.A, "Chemical Engineering thermodynamics-1", Nirali Prakasan Publications, Pune, 2013.
4.	Haynie D.T., "Biological Thermodynamics", Second Edition., Cambridge University Press, 2008.

***SDG 7: Affordable and Clean Energyth and Well-being**

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**Thermodynamic Properties of Pure Fluids**	
1.1	Basic concepts and laws of thermodynamics	1
1.2	Basics of entropy	1
1.3	Volumetric properties of fluids	1
1.4	Estimation of thermodynamic properties using equations of state	2
1.5	Calculations involving actual property changes	3
1.6	Maxwell's relations and applications	1
2	**Solution Thermodynamics**	
2.1	Partial molar properties	2
2.2	Concept of chemical potential and fugacity in solutions	1
2.3	Activity	1
2.4	Activity coefficients	1
2.5	Effect of pressure and temperature	1
2.6	Gibbs-Duhem equations	1
2.7	Property changes of mixing	1
2.8	Heat effects of mixing in biological broths	1
3	**Phase equilibria**	
3.1	Criteria for phase equilibria	1
3.2	Phase equilibria in single and multicomponent systems	1
3.3	Duhem's theorem	1
3.4	V-L-E calculations for binary and multi component systems	3
3.5	Liquid-liquid equilibria	2
3.6	Solid-liquid equilibria	1
4	**Chemical Reaction equilibria**	
4.1	Chemical reaction equilibrium	1
4.2	Evaluation of equilibrium constant	2
4.3	Effect of temperature and pressure on equilibrium constant	2
4.4	Equilibrium conversion for single reactions	2
4.5	Equilibrium conversion for multiple reactions	2
5	**Biochemical Thermodynamics**	
5.1	Thermodynamics and energetics of metabolic pathways	2
5.2	Oxygen requirement and heat generation in aerobic growth	2
5.3	Energy coupling (NADH and ATP)	1
5.4	Thermodynamics of oxidation-reduction reactions	2
5.5	Case study	2
	Total	**45**

Course Designers

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Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

60 MY 002	UNIVERSAL HUMAN VALUES	Category	L	T	P	Credit
		PC	2	1	0	3

- To identify the essential complementarily between 'values' and 'skills'
- To ensure core aspirations of all human beings.
- To acquire ethical human conduct, trustful and mutually fulfilling human behaviour
- To enrich interaction with Nature
- To achieve holistic perspective towards life and profession

Prerequisite

NIL

Course Outcomes

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

CO1	Understand the significance of value inputs in formal education and start applying them in their life and profession	Understand
CO2	Evaluate coexistence of the "I" with the body.	Analyze
CO3	Identify and evaluate the role of harmony in family, society and universal order.	Analyze
CO4	Classify and associate the holistic perception of harmony at all levels of	Analyze
CO5	Develop appropriate human conduct and management patterns to create harmony in professional and personal lives.	Create

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								3	2		2	3	2	3
CO2						3		3	3			3	3	2
CO3						3	3	3	3			3	3	2
CO4						3	3	3	3			3	2	3
CO5						3	3	3	3	3		3	2	3
3- Strong; 2-Medium; 1-Some														

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)			End Semester Examination (Marks)
	1	2	Model	
Remember	10	10	20	No End Semester Examination
Understand	10	10	20	
Apply	20	20	30	
Analyse	20	20	30	
Evaluate	0	0	0	
Create	0	0	0	

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BoS Chairman Signature

K. S. Rangasamy College of Technology – Autonomous R2022								
60 MY 002 - UNIVERSAL HUMAN VALUES								
Common to all Branches								
Semester	Hours / Week			Total hrs	Credit	Maximum Marks		
	L	T	P		C	CA	ES	Total
III/IV	2	1	0	45	3	50	50	100

Introduction to value Education Understanding value Education-Self exploration as the process for value education-Continuous Happiness and prosperity-the basic human aspirations-right understanding-relationship and physical facility – happiness and prosperity - current scenario – method to full fill the basic human aspirations	**[9]**
Harmony in the Human Being Understanding Human being as the Co-Existence of the self and the Body-Distinguishing between the needs of the self and the body-the body as an instrument of the self-understanding harmony in the self-harmony of the self with the body – programme to ensure self-regulation and health	**[9]**
Harmony in the Family and Society Harmony in the Family –the basic unit of human interaction-values in human- to - human relationship – 'Trust' the foundation value in relationship – 'Respect'- as the right evaluation-understanding harmony in the society –vision for the universal human order.	**[9]**
Harmony in the Nature/Existence Understanding harmony in the Nature-Interconnectedness, self-regulation and mutual fulfillment among the four orders of nature – realizing existence as co-existence at all levels –the holistic perception of harmony in existence.	**[9]**
Implications of the Holistic Understanding Natural Acceptance of human values- definitiveness of human conduct- a basis for humanistic education, humanistic constitution and universal human order- competence in professional ethics –holistic technologies, production systems and management models-typical case studies – strategies for transition towards value base life and profession	**[9]**
Total Hours	**45**

Text Book(s):	
1.	A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana,
Reference(s):	
1.	Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2.	Human Values, A.N. Tripathi, New Age International. Publishers, New Delhi, 2004.

Course Contents and Lecture Schedule

S. No	Topic	No. of Hours
1	**INTRODUCTION TO VALUE EDUCATION**	
1.1	Discussion on Present Education System and Skill Based Education	1

Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

1.2	Understanding Value Education	1
1.3	Self-exploration as the process for value education	1
1.4	Basic Human Aspirations - Continuous Happiness and Prosperity	1
1.5	Basic requirements to fulfill Human Aspirations - Right understanding, Relationship and Physical facility	1
1.6	Transformation from Animal Consciousness to Human Consciousness	1
1.7	Sources of Happiness and Prosperity – Harmony and Disharmony	1
1.8	Current Scenario and Role of Education	1
1.9	Outcome of Human Education and Method to fulfill the basic human aspirations	1
2	**HARMONY IN THE HUMAN BEING**	**2**
2.1	Understanding Human being - As Co-Existence of the self and the Body - The Needs of the Self and the Body	2.1
2.2	Understanding Human being - As Co-Existence of the self and the Body - The Activities and Response of the Self and the Body	2
2.3	The body as an instrument of the self	1
2.4	Understanding harmony in the self	1
2.5	Harmony of the self with the body	2
2.6	Programme to ensure self-regulation and health	1
2.7	My Participation (Value) regarding Self and my Body - Correct Appraisal of our Physical needs	1
3	**HARMONY IN THE FAMILY AND SOCIETY**	
3.1	Harmony in the Family - Understanding Values in Human Relationships	1
3.2	Family as the basic Unit of Human Interaction	1
3.3	Values in human Relationships	1
3.4	Trust - the foundation value in relationship	1
3.5	Respect as the right evaluation, the Basis for Respect, Assumed Bases for Respect today	1
3.6	Harmony from Family to World Family: Undivided Society	1
3.7	Extending Relationship from family to society, Identification of the Comprehensive Human Goal	1
3.8	Programs needed to achieve the Comprehensive Human Goal: The Five Dimensions of Human Endeavour	1
3.9	Harmony from Family Order to World Family Order – Universal Human Order	1
4	**HARMONY IN THE NATURE / EXISTENCE**	
4.1	The Four Orders in Nature	1
4.2	Participation of Human Being in Entire Nature	1
4.3	Natural Characteristics - Tendency of Human Living with Animal Consciousness / The Holistic Perception of Harmony in Existence	1
4.4	Present day Problems	1
4.5	Recyclability and self-regulation in Nature	1
4.6	Relationship of Mutual Fulfillment	1
4.7	An Introduction to space, Co-existence of Units in Space	1
4.8	Harmony in Existence – Understanding Existence as Co- Existence	1
4.9	Natural Characteristic of Human Living with Human Consciousness	1
5	**IMPLICATIONS OF THE HOLISTIC UNDERSTANDING**	

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5.1	Natural Acceptance of human values	1
5.2	Definitiveness of Ethical Human Conduct - Development of Human Consciousness	1
5.3	Identification of Comprehensive Human Goal	1
5.4	Basis for Humanistic Education and Humanistic Constitution	1
5.5	Ensuring Competence in professional Ethics	1
5.6	Issues in Professional Ethics-The Current Scenario	1
5.7	Holistic Technologies and Production Systems and management models -Typical Case Studies	2
5.8	Strategies for transition towards value based life and profession	1
	Total	45

Course Designers

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Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

60 BT 4P1	Molecular Biology and Genetic Engineering Laboratory

Category	L	T	P	Credit
PC	0	0	4	2

Objective

- To understand steps involved in the isolation of DNA form Bacteria, Fungi and Plant.
- To understand the concepts of plasmid DNA extraction and transformation
- To provide hands-on experience in performing basic recombinant DNA techniques
- To develop the ability to design, conduct, analyze and interpret data related to genetic engineering experiments
- To inculcate the research aptitude and technical skills to fulfill the need of both industry and research

Prerequisite

Molecular Biology, Genetic Engineering and Cell Biology

Course Outcomes

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

CO1	Apply the knowledge of DNA extraction to isolate DNA from different sources.	Apply
CO2	Analyse and interpret the data obtained from the agarose gel using graphical, UV spectrophotometricand software methods.	Analyze
CO3	Identify the correct restriction enzymes to digest the vector DNA thatgive cohesive ends, ligate it to make recombinant DNA and transform it with *E.coli* DH5 αcells	Apply
CO4	Perform PCR at appropriate concentration and operate the thermocycler to amplify the DNA	Analyze
CO5	Apply the knowledge of restriction digestion, ligation, transformation and PCR to design experiment ,confirm its presence either by PCR or by cloning and screening and interpret the data obtained from the results	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2		2	2	3	2	2	2	2	3
CO2	3	2	2	2		3	3	2	1		2	2	3	3
CO3	3	2	2	2	2		3	2	1		2	2	3	2
CO4	3	2	2	2		2		2	1	2		2	2	3
CO5	3	2	2	2		3	2	2	1		2	2	3	2
3- Strong; 2-Medium; 1-Some														

Analyse (An)	30	30	50
Create (Cr)	0	0	0

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List of Experiments

1. Isolation of genomic DNA from bacterial cells*
2. Isolation of genomic DNA from fungal cell
3. Isolation of DNA from Blood by high salt method
4. Quantification of DNA by UV spectrometer and agarose gel electrophoresis
5. Extraction of Plasmid DNA
6. Isolation of total RNA from prokaryotes
7. Extraction of DNA from Agarose gel
8. Restriction Enzyme Digestion of Vector and genomic DNA
9. Ligation of restricted DNA to construct DNA
10. Competent cell preparation- Calcium Chloride method
11. Transformation by heat-shock induction method
12. PCR- 16S rDNA amplification
13. Random Amplification of Polymorphic DNA
14. Isolate DNA from any five different sources, quantify it and interpret your result by comparing the data obtained
15. Make a recombinant DNA of your own gene of interest using the given vector and confirm it by the any oneof the following techniques: Transformation and blue-white screening, Colony PCR

*SDG 3: Good Health and Well-being

Course Designers

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Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

BoS Chairman Signature

60 BT 4P2	Protein and Enzyme Engineering Laboratory

Category	L	T	P	Credit
PC	0	0	4	2

Objective

- To impart basics of intra and extra cellular protein and enzyme extraction.
- To study the biochemical characterization of enzymes
- To learn the principle and procedure for enzyme and protein purifications.
- To know the specific activity and kinetics of enzymes.
- To learn about the fabrication of enzymesensors and their functions

Prerequisite

Basic knowledge of extraction and purification is needed

Course Outcomes

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

CO1	Demonstrate the extraction and production of intra cellular proteins	Understand
CO2	Identify the Kinetic characteristics and *specific activity* for the given enzyme	Apply
CO3	Construct the purification pattern for the given enzyme	Apply
CO4	Compare the kinetic characteristics of free and immobilized enzymes	Analyze
CO5	analyze the protein expression pattern and fabrication of enzyme sensors	Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2			3	2							1	3	3
CO2		2		3	1								3	2
CO3	1			2									2	3
CO4		1			1								3	3
CO5				2									2	3
3- Strong; 2-Medium; 1-Some														

Passed in BoS Meeting held on 21/11/2023
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BoS Chairman Signature

List of Experiments

1. Extraction and estimation of extra cellular proteins from bacteria and fungi*
2. Production and estimation of protease
3. Digestion of milk protein into amino acids with quantification
4. Effect of pH on Acid phosphatase activity
5. Effect of Temperature on Acid phosphatase activity
6. Kinetic characterization (K_m &V_{max}) of Acid phosphatase - LB plot
7. Identification of inhibition types of Acid phosphatase
8. Purification of protein by ion exchange chromatography
9. SDS PAGE analysis for partial purification of proteinsample
10. Identification of isozyme pattern of Peroxidase by Native-PAGEanalysis
11. Immobilization of enzymes using gel entrapment method
12. Comparative kinetic characterization of free and immobilized enzymes
13. Engineering the active site using chemical modification method
14. Western blot - Analysis of protein expression pattern
15. Fabrication of enzyme sensors and demonstration of their functions

*SDG 3: Good Health and Well-being

Course Designers

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Passed in BoS Meeting held on 21/11/2023
Approved in Academic Council Meeting held on 23/12/2023

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