



Learn Beyond

**KPR Institute of
Engineering and
Technology**

(Autonomous, Affiliated to Anna University)

CURRICULUM AND SYLLABI REGULATIONS – 2025

Department of
Biomedical Engineering

CONTROLLED COPY



I. Vision and Mission of the Institute

Vision

To become a premier institute of academic excellence by imparting technical, intellectual and professional skills to students for meeting the diverse needs of industry, society, the nation and the world at large

Mission

- Commitment to offer value-based education and enhancement of practical skills
- Continuous assessment of teaching and learning processes through scholarly activities
- Enriching research and innovation activities in collaboration with industry and institutes of repute
- Ensuring the academic processes to uphold culture, ethics and social responsibilities

II. Vision and Mission of the Department

Vision

To be a centre of excellence for dissemination of knowledge, research and development in biomedical engineering to serve

Mission

The mission of the department is to

- Impart value-based education in biomedical engineering using modern equipment and tools
- Build an integrated team of biomedical engineers to foster technologies through research, development and innovation
- Provide healthcare industries with solutions imbibed through lifelong learning with ethics and moral values

III. Program Educational Objectives (PEOs)

The Program Educational Objectives (PEOs) of the BIOMEDICAL ENGINEERING (BM) represent major accomplishments that the graduates are expected to achieve after three to five years of graduation.

PEO1: Apply the knowledge gained from biomedical engineering to help solve the technological problems in industries.

PEO2: Design and develop healthcare products and processes through continuous skill upgradation and research.

PEO3: Demonstrate professional and ethical standards of behavior and commit to lifelong learning to meet the needs of society.

IV. Program Outcomes (POs)

Graduates of the BIOMEDICAL ENGINEERING will be able to

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions (WK8)

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems (WK2 and WK6)

B.E. - BM - R2025 - CBCS

- PO6:** The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment (WK1, WK5, and WK7)
- PO7:** Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws (WK9)
- PO8:** Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/ multi-disciplinary teams
- PO9:** Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
- PO10:** Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments
- PO11:** Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change (WK8)

Knowledge and Attitude Profile (WK)

- WK1:** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences
- WK2:** Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline
- WK3:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline
- WK4:** Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline
- WK5:** Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area
- WK6:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline
- WK7:** Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development
- WK8:** Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues
- WK9:** Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes

V. Program Specific Outcomes (PSOs)

Graduates of the BIOMEDICAL ENGINEERING will be able to

- PSO1:** Design and evaluate medical solutions using biosensors, biomaterials, biomechanics, and diagnostic and therapeutic equipment for the healthcare industries.
- PSO2:** Identify, analyze, solve and develop algorithms for addressing healthcare problems using the software skills acquired through bio-signal and image processing advancements.

VI. PEO / PO Mapping

Following three levels of correlation should be used:


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1: Low

2: Medium

3: High

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
PEO 1	3	3	3	2	2	1	1	1	1	2	2	3	3
PEO 2	3	3	3	2	2	2	2	2	2	2	2	3	3
PEO 3	1	1	1	1	1	2	2	3	3	3	2	1	1

VII. Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Sem	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
I	English Proficiency I	-	-	-	-	-	-	-	✓	✓	-	✓	-	-
	Calculus and Differential Equations	✓	✓	-	✓	✓	-	-	-	-	-	-	-	✓
	Engineering Physics	✓	✓	✓	✓	-	-	-	-	-	-	-	✓	-
	Applied Chemistry for Electronics Engineers	✓	✓	✓	✓	-	-	-	✓	✓	-	✓	✓	-
	Problem Solving using C Programming	✓	✓	✓	✓	✓	-	-	-	-	-	✓	-	✓
	Digital Technologies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	-
	Electronic Devices and Circuits	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	-
	Chinese for Engineers - I	-	-	-	-	-	-	-	✓	✓	-	✓	-	-
	French for Engineers - I	-	-	-	-	-	-	-	✓	✓	-	✓	-	-
	Japanese for Engineers - I	-	-	-	-	-	-	-	✓	✓	-	✓	-	-
	Hindi for Engineers - I	-	-	-	-	-	-	-	✓	✓	-	✓	-	-
	German for Engineers - I	-	-	-	-	-	-	-	✓	✓	-	✓	-	-
	Biomedical Engineering Essentials	✓	✓	✓	✓	-	✓	-	-	✓	✓	✓	✓	-
	Induction Program - Universal Human Values I	-	-	-	-	-	✓	✓	✓	-	-	✓	-	-
	Heritage of Tamils	-	-	-	-	-	-	✓	✓	-	✓	-	-	-
	Design Thinking	✓	✓	✓	✓	-	-	-	-	✓	✓	✓	-	-
	Biology for Engineers	✓	✓	✓	✓	-	-	-	✓	✓	✓	✓	✓	-
	Computer Fundamentals and Coding Essentials	✓	✓	✓	✓	✓	✓	-	-	-	-	✓	-	-
II	English Proficiency II	-	-	-	-	-	-	-	✓	✓	-	✓	-	-
	Linear Algebra and Complex Variables	✓	✓	✓	✓	✓	-	-	-	-	-	✓	-	✓
	Medical Physics	✓	✓	✓	✓	-	-	-	-	-	-	-	✓	-
	Environmental Science and Sustainability	✓	✓	✓	✓	-	-	✓	✓	✓	-	✓	-	-
	Computational Problem Solving using Python	✓	✓	✓	✓	✓	-	-	-	-	-	✓	-	✓
	Basics of Mechanical Engineering	✓	✓	-	-	✓	✓	-	✓	✓	-	-	-	-
	Basics of Electrical Engineering	✓	✓	-	-	-	-	-	-	-	-	✓	-	-
	Basics of Electronics Engineering	✓	✓	✓	✓	✓	-	-	✓	✓	-	✓	-	-
	Basics of Civil Engineering	✓	✓	✓	-	-	-	-	-	-	-	✓	-	-

Sem	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
	Analog Electronics for Biomedical Applications	✓	✓	✓	✓	-	-	-	-	✓	✓	✓	✓	-
	Chinese for Engineers - II	-	-	-	-	-	-	-	✓	✓	-	✓	-	-
	Hindi for Engineers - II	-	-	-	-	-	-	-	✓	✓	-	✓	-	-
	French for Engineers - II	-	-	-	-	-	-	-	✓	✓	-	✓	-	-
	Japanese for Engineers - II	-	-	-	-	-	-	-	✓	✓	-	✓	-	-
	German for Engineers - II	-	-	-	-	-	-	-	✓	✓	-	✓	-	-
	Universal Human Values II	-	-	-	-	-	-	-	✓	✓	-	✓	-	-
	Tamils and Technology	-	-	-	-	-	-	✓	✓	-	✓	-	-	-
	Design Thinking	✓	✓	✓	✓	-	-	-	-	✓	✓	✓	-	-
	Biology for Engineers	✓	✓	✓	✓	-	-	-	✓	✓	✓	✓	✓	-
	Computer Fundamentals and Coding Essentials	✓	✓	✓	✓	✓	✓	-	-	-	-	✓	-	-
III	Probability and Statistics	✓	✓	-	-	✓	-	-	-	-	-	-	-	✓
	Human Anatomy and Physiology	✓	✓	✓	✓	✓	✓	-	-	-	-	-	✓	-
	Biomedical Sensors and Instrumentation	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	-
	Digital System Design	✓	✓	✓	-	-	-	-	-	-	-	✓	✓	-
	Data Structures and Algorithms	✓	✓	✓	✓	✓	-	-	-	-	-	-	-	✓
	Biomaterials	✓	✓	✓	✓	✓	-	-	-	✓	-	✓	✓	-
	Human Anatomy and Physiology Laboratory	✓	✓	✓	✓	-	-	-	-	-	-	-	✓	-
	Biomedical Sensors and Instrumentation Laboratory	✓	✓	✓	✓	✓	-	✓	✓	✓	-	-	✓	-
	Digital System Design Laboratory	✓	✓	✓	✓	-	-	✓	✓	✓	-	✓	✓	-
	Essence of Indian Traditional Knowledge	-	✓	-	✓	-	-	✓	-	-	-	-	-	-
	Professional Skill Development - I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	-
IV	Stochastic Processes in Engineering Systems	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
	Microbiology and Pathology	✓	✓	✓	✓	-	-	-	-	-	✓	-	✓	-
	Hospital Administration	✓	✓	✓	✓	-	✓	✓	-	-	✓	✓	✓	-
	Object Oriented Programming Using Java	✓	✓	✓	✓	-	-	-	-	-	-	✓	-	✓
	Biophysical Signals and Systems	✓	✓	✓	✓	-	-	-	-	-	-	-	-	✓
	Microbiology and Pathology Laboratory	✓	✓	✓	✓	✓	-	-	-	✓	✓	-	✓	✓
	Object Oriented Programming Using Java Laboratory	✓	✓	✓	✓	-	-	-	-	-	-	✓	-	✓
	Indian Constitution	-	-	-	-	-	✓	✓	✓	-	-	-	-	-
	Professional Skill Development - II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	-

BIOMEDICAL ENGINEERING
Regulations 2025
For the students admitted from 2025 onwards
CHOICE BASED CREDIT SYSTEM
CURRICULUM FOR I - VIII SEMESTERS

**SEMESTER I**

No	Course Code	Title	Category	Type	L	T	P	J	C
1	U25ENG01	English Proficiency I	HSMC	L	-	-	2	-	1
2	U25MA101	Calculus and Differential Equations	BSC	TwL	2	-	2	-	3
3	U25PH101	Engineering Physics	BSC	TwL	2	-	2	-	3
4	U25CY102	Applied Chemistry for Electronics Engineers	BSC	TwL	2	-	2	-	3
5	U25CSG01	Problem Solving using C Programming	ESC	TwL	2	-	2	-	3
6	U25CSG03	Digital Technologies	ESC	T	1	-	-	-	1
7	U25BM101	Electronic Devices and Circuits	PCC	TwL	2	-	2	-	3
8	U25LEG01	German for Engineers - I	HSMC	TwL	1	-	2	-	2
	U25LEG02	Japanese for Engineers - I							
	U25LEG03	French for Engineers - I							
	U25LEG04	Hindi for Engineers - I							
	U25LEG09	Chinese for Engineers - I							
9	U25BM102	Biomedical Engineering Essentials	PCC	TwL	1	-	4	-	3
Total									22
MANDATORY CREDIT COURSES (MCC - Non CGPA) / MANDATORY NON-CREDIT COURSES (MNC)									
10	U25MCC01	Induction Program - Universal Human Values I	MCC	MCC	2	1	-	-	3
11	U25MCC02	Heritage of Tamils	MCC	Tamil Courses	1	-	-	-	1
12	U25MCC03	Design Thinking	MCC	MCC	1	-	2	-	2
	U25MCC04	Computer Fundamentals and Coding Essentials @							
	U25MCC05	Biology for Engineers \$							
Total									6

\$ - For Non-Biology Students, @ - For Biology Students

SEMESTER II

No	Course Code	Title	Category	Type	L	T	P	J	C
1	U25ENG02	English Proficiency II	HSMC	L	-	-	2	-	1
2	U25MA203	Linear Algebra and Complex Variables	BSC	TwL	2	-	2	-	3
3	U25PH201	Medical Physics	BSC	TwP	2	-	-	2	3
4	U25CY201	Environmental Science and Sustainability	BSC	TwL	1	-	2	-	2
5	U25CSG05	Computational Problem Solving using Python	ESC	TwL	2	-	2	-	3

No	Course Code	Title	Category	Type	L	T	P	J	C
6	U25CEG01	Basics of Civil Engineering	ESC	TwL	1	-	2	-	2
	U25ECG01	Basics of Electronics Engineering							
	U25EEG01	Basics of Electrical Engineering							
	U25MEG02	Basics of Mechanical Engineering							
7	U25BM201	Analog Electronics for Biomedical Applications	PCC	TwL	1	-	2	-	2
8	U25LEG05	German for Engineers - II	HSMC	TwL	1	-	2	-	2
	U25LEG06	Japanese for Engineers - II							
	U25LEG07	French for Engineers - II							
	U25LEG08	Hindi for Engineers - II							
	U25LEG10	Chinese for Engineers - II							
Total									18
MANDATORY CREDIT COURSES (MCC - Non CGPA) / MANDATORY NON-CREDIT COURSES (MNC)									
9	U25MCC06	Universal Human Values II	MCC	MCC	2	1	-	-	3
10	U25MCC07	Tamils and Technology	MCC	Tamil Courses	1	-	-	-	1
11	U25MCC03	Design Thinking	MCC	MCC	1	-	2	-	2
	U25MCC04	Computer Fundamentals and Coding Essentials @							
	U25MCC05	Biology for Engineers \$							
Total									6

\$ - For Non-Biology Students, @ - For Biology Students

SEMESTER III

No	Course Code	Title	Category	Type	L	T	P	J	C
1	U25MA302	Probability and Statistics	BSC	TwL	2	-	2	-	3
2	U25BM301	Human Anatomy and Physiology	PCC	T	3	-	-	-	3
3	U25BM302	Biomedical Sensors and Instrumentation	PCC	T	3	-	-	-	3
4	U25ECG02	Digital System Design	PCC	T	3	-	-	-	3
5	U25ADG02	Data Structures and Algorithms	PCC	TwL	3	-	2	-	4
6	U25BM303	Biomaterials	PCC	TwP	2	-	-	2	3
7	U25BM304	Human Anatomy and Physiology Laboratory	PCC	L	-	-	2	-	1
8	U25BM305	Biomedical Sensors and Instrumentation Laboratory	PCC	L	-	-	4	-	2
9	U25ECG03	Digital System Design Laboratory	PCC	L	-	-	2	-	1
Total									23
MANDATORY CREDIT COURSES (MCC - Non CGPA) / MANDATORY NON-CREDIT COURSES (MNC)									
10	U25MNC02	Essence of Indian Traditional Knowledge	MNC	MNC	1	-	-	-	-
11	U25MCC08	Professional Skill Development - I	MCC	MCC	-	-	-	-	1
Total									1

SEMESTER IV

No	Course Code	Title	Category	Type	L	T	P	J	C
1	U25MA402	Stochastic Processes in Engineering Systems	BSC	T	3	-	-	-	3
2	U25BM401	Microbiology and Pathology	PCC	T	3	-	-	-	3
3	U25BM402	Hospital Administration	PCC	T	3	-	-	-	3
4	U25CSG11	Object Oriented Programming Using Java	PCC	T	3	-	-	-	3
5	U25BM403	Biophysical Signals and Systems	PCC	TwL	2	-	2	-	3
6	U25BM404	Microbiology and Pathology Laboratory	PCC	L	-	-	4	-	2
7	U25CSG13	Object Oriented Programming Using Java Laboratory	PCC	L	-	-	2	-	1
8	-	Open Elective I	OEC	T	3	-	-	-	3
					2	-	2	-	
Total									21
MANDATORY CREDIT COURSES (MCC - Non CGPA) / MANDATORY NON-CREDIT COURSES (MNC)									
9	U25MNC03	Indian Constitution	MNC	MNC	1	-	-	-	-
10	U25MCC09	Professional Skill Development - II	MCC	MCC	-	-	-	-	1
Total									1

T - Theory, L - Laboratory, TwL - Theory with Laboratory, TwP - Theory with Project

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SEMESTER I

U25ENG01	English Proficiency I (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		0	0	2	0	1

COURSE OBJECTIVES:

- Comprehend technical vocabulary
- Apply reading strategies to understand academic and professional texts

COURSE OUTCOMES:

CO 1: Comprehend technical and professional documents using vocabulary and strategies

Remember

CO 2: Evaluate the understanding from technical reports and case studies

Understand

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	-	-	-	-	-	-	-	2	3	-	2	-	-
CO 2	-	-	-	-	-	-	-	2	3	-	2	-	-

LIST OF EXPERIMENTS

1. Contextual lexicon – Discourse markers – Strategies for reading – Read aloud: stress and intonation – Interpretive Reading and narrative analysis – Critical reading of abstracts and conclusions from research articles / magazines / blogs
2. Newspaper: Opinions, Editorials and Columns – Short Story: The Bet – Anton Chekhov – Science Fiction: Never Let Me Go – Kazuo Ishiguro
3. Reading Standard Operating Procedures (SOPs) – Manuals – Case Studies (Field Work) Evaluation – Sustainability Practices in Industry: A Case Study – Biographies of Popular Engineers and Inventors – Success Stories of Start-ups and Entrepreneurs

CONTACT PERIODS:

Lecture: - Periods

Tutorial: - Periods

Practical: 30 Periods

Project: - Periods

Total: 30 Periods

TEXTBOOKS:

1. Meenakshi Raman and Sangeeta Sharma, "Technical Communication: Principles and Practice", 3rd Edition, Oxford University Press, 2015
2. Debra Daise and CharlNorloff, "Q Skills for Success: Q: Skills for Success: Reading and Writing, Level 4", 3rd Edition, Oxford University Press, 2019

REFERENCES:

1. Sudharshana N P and Savitha C, "English for Technical Communication", 1st edition, Cambridge University Press, 2016
2. Thomas L. Means, "English and Communication for Colleges", 4th Edition, Cengage India Private Limited, 2017


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SEMESTER I

U25MA101	Calculus and Differential Equations (Common to AD, AM, BM, CB, CS, EC, EE, IT, SC)	Category: BSC				
		L	T	P	J	C
		2	0	2	0	3

COURSE OBJECTIVES:

- To develop a strong foundation in multivariable calculus, vector calculus, and differential equations for application in engineering problems
- To equip students with the skills needed to solve optimization, integration, and differential equations problems relevant to real – world engineering scenarios
- To foster the ability to apply advanced mathematical techniques for analyzing and modeling physical systems in various engineering fields

COURSE OUTCOMES:

- CO 1:** Understand and apply the concepts of multivariable calculus, including partial derivatives, total derivatives, Understand and the Taylor series for multiple variables, to solve engineering problems
- CO 2:** Solve optimization problems using methods like Lagrange multipliers and find the extrema of multivariable functions Apply
- CO 3:** Compute and interpret double and triple integrals, including change of order and change of variables, and Understand apply them to calculate areas and volumes in engineering contexts
- CO 4:** Apply vector calculus concepts such as gradient, divergence, curl, and directional derivatives to analyze physical systems and engineering problems Apply
- CO 5:** Solve ordinary and partial differential equations, including those with constant and variable coefficients, and apply these solutions to engineering scenarios Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: MULTIVARIABLE CALCULUS

6 + 6

Functions of several variables – Partial derivatives and total derivative – Taylor series for two variables – Extrema of multivariable functions – Lagrange multipliers method

UNIT II: MULTIPLE INTEGRALS AND APPLICATIONS

6 + 6

Double and triple integrals – Change of order and change of variables – Applications in computing area and volume

UNIT III: VECTOR CALCULUS**6 + 6**

Vector functions, differentiation of vectors – Gradient, divergence and curl – Directional derivatives – Line, surface, and volume integrals (introductory concepts)

UNIT IV: ORDINARY DIFFERENTIAL EQUATIONS**6 + 6**

Second and higher order linear differential equations with constant coefficients – Variable coefficients – Euler Cauchy equation – Legendre's equation - Applications

UNIT V: PARTIAL DIFFERENTIAL EQUATIONS**6 + 6**

Formation of partial differential equations – Singular integrals – Lagrange's linear equation – Solution methods for second order homogeneous equations with constant coefficients

LIST OF EXPERIMENTS

1. Multivariable Calculus – Plot single – variable functions – Identify extrema using first and second derivative tests
2. Multivariable Optimization – Compute and visualize partial derivatives – Find local maxima/minima using contour plots
3. Area and Volume by Integration – Numerically compute double/triple integrals – Visualize regions of integration
4. Solving and Visualizing Ordinary Differential Equations – Euler's method – Runge-Kutta method
5. Solving Partial Differential Equations and Visualizing Solutions – Form and solve basic PDEs – Visualize solutions in 2D and 3D

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th edition, Wiley India Pvt Ltd, New Delhi, 2018
2. George B Thomas, D. Weir and J.Hass, Thomas Calculus, 13th edition, Pearson Education India, 2018

REFERENCES:

1. Grewal, B.S. Higher Engineering Mathematics, 44th Edition, Khanna Publishers, 2017
2. Douglas C. Montgomery, Applied Statistics and Probability for Engineers, 7th Edition, Wiley, 2019
3. Robert L. Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage, 2012



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SEMESTER I

U25PH101	Engineering Physics (Common to all programmes)	Category: BSC				
		L	T	P	J	C
		2	0	2	0	3

COURSE OBJECTIVES:

- To understand the fundamental mechanical and thermal properties of solids and fluids for real-world engineering applications
- To explore advanced concepts in ultrasonic waves and their applications in imaging, testing, and sensing technologies
- To gain insights into semiconductor physics and photonics for their role in modern electronic and optical systems

COURSE OUTCOMES:

- CO 1:** Explain the modulus of elasticity and stress-strain behavior of materials to infer the elastic properties of materials Understand
- CO 2:** Examine the heat transfer in thermal systems and properties of fluids Analyze
- CO 3:** Apply the principles of ultrasonics in testing, imaging, and communication technologies Apply
- CO 4:** Estimate charge carrier transport in semiconductors and the performance of devices such as Hall effect sensors and Schottky diodes Apply
- CO 5:** Organise the principles of laser and fiber optics for industrial and medical applications Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: MECHANICAL PROPERTIES OF SOLIDS

6 + 6

Modulus of Elasticity – Stress-strain diagram – Poisson's ratio – Elastic and plastic deformation – Stress-strain behaviour in metals, polymers and ceramics – Bending Moment – Cantilever – Applications (GIRDERS, MEMS)

UNIT II: FUNDAMENTALS OF HEAT TRANSFER AND FLUIDS

6 + 6

Heat transfer – Thermal expansion – Heat conductivity – Lee's Disc method – Surface tension – Viscosity – Coefficient of viscosity using Poiseuille's flow experiment – Solar water heater – Microwave oven – Heat exchangers – Radiators – Cooling towers

UNIT III: ULTRASONICS AND ITS APPLICATIONS

6 + 6

Properties of Ultrasonic waves – Production of ultrasonic waves – Piezoelectric Oscillator – Magnetostriction Oscillator – Velocity measurement of Ultrasonic waves – SONAR – Non-Destructive Testing – Ultrasound imaging in medicine – Ultrasonic scanning methods

UNIT IV: SEMICONDUCTOR PHYSICS**6 + 6**

Properties – Direct and Indirect bandgap-semiconductor – Intrinsic and extrinsic Semiconductors – Carrier concentration in n-type semiconductor – P-type semiconductor – Carrier Transport in Semiconductor – Hall effect – Ohmic contacts – Schottky diode

UNIT V: PHOTONICS**6 + 6**

Interaction of Radiation with Matter – Laser Characteristics – Population Inversion – CO₂ laser – Semiconductor Diode Laser – Laser applications – Total Internal Reflection – Structure and working principle of Optical fibre – Fiber optic Endoscopy – Fiber optic sensors

LIST OF EXPERIMENTS

1. Determine the moduli of elasticity of the given beams and evaluate them for different structural applications. (High/Medium/Low modulus)
2. Evaluate the shear moduli of the different materials and rank them for suitable applications with reference to their strength
3. Select the most effective thermal insulation material from mica, cardboard, and glass for optimal heat protection
4. Determine the Viscosity of Liquids Using Poiseuille's Method and Identify the Fastest-Flowing Liquid
5. Measure the speed of ultrasound in liquids and calculate their compressibility for different hydraulic purposes
6. Categorize the specified semiconducting materials according to their energy bandgap values
7. Determine a semiconducting material's Hall coefficient and identify its type
8. Determination of wavelength of given laser and the particle size of the given samples using diffraction method
9. Use an optical fiber to measure its light-gathering capacity and calculate the propagation angle
10. Calculate the surface tension of different liquids and examine how surfactants affect it
11. Determination of wavelength of various spectral lines by using spectrometer and grating
12. Determination of velocity of light passing through glass medium using spectrometer

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. M.N. Avadhanulu, P.G. Kshirsagar, and T.V.S. Arun Murthy, "A Textbook of Engineering Physics", 11th edition, S. Chand Publishing, New Delhi, 2022
2. R.K. Gaur and S.L. Gupta, "Engineering Physics", 8th edition, Dhanpat Rai Publications, New Delhi, 2017

REFERENCES:

1. Harald Ibach and Hans Luth, "Solid State Physics: An Introduction", 4th edition, Springer Publications, 2020
2. Charles Kittel, revised by David Pines (Editor) "Introduction to Solid State Physics", 9th edition, Wiley & Sons, US, 2020
3. H.K. Malik and A.K. Singh "Engineering Physics" Publisher: McGraw Hill Education India 2022
4. <https://onlinecourses.nptel.ac.in/noc20cy17/preview>

SEMESTER I

U25CY102	Applied Chemistry for Electronics Engineers (Common to BM, EC, EE, MI)	Category: BSC				
		L	T	P	J	C
		2	0	2	0	3

COURSE OBJECTIVES:

- To explain the properties, classifications and engineering applications of polymeric materials
- To describe corrosion mechanisms and evaluate electrochemical principles relevant to energy conversion and storage technologies
- To investigate the materials and working principles underlying display technologies, photonic devices, sensors, and wafer fabrication processes

COURSE OUTCOMES:

- CO 1:** Execute polymer synthesis, molecular weight determination using viscometry, and the structure–functional behavior of polymers in electronic applications.(Apply) Apply
- CO 2:** Utilize appropriate corrosion prevention and coating strategies for engineering materials based on corrosion analysis. Apply
- CO 3:** Implement appropriate energy storage devices and colorimetric analysis based on photochemical principles Apply
- CO 4:** Execute sensor principles in pH-metric and conductometric titrations for solution analysis and in materials used for display and smart sensing devices. Apply
- CO 5:** Employ wafer fabrication techniques for manufacturing micro- and nanoelectronic devices and for extracting copper from PCB boards. Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: POLYMERIC MATERIALS

6 + 6

Polymers – classification and properties, Polymer compounding: (Compression, Injection, Extrusion) – Conductive Polymers – (PANI, PEDOT) Synthesis, Properties, Mechanism and applications, Photochromic polymers: Azobenzenes, Diarylethenes – Mechanism of photo-switching, Electroluminescent polymers – Fabrication of light-emitting electrochemical cells and application, Biopolymers – PLA – Synthesis and applications – Packaging materials for integrated circuits – Purpose, key components and types

6 + 6

UNIT II: CORROSION SCIENCE

Types of corrosion – dry, wet – Electrochemical theory – Electrochemical series – Factors influencing corrosion and control methods – Cathodic protection – Corrosion inhibitors – anodic, cathodic, mixed – Metallic coatings – Electroplating – Tinning, Phosphating, Carburizing, Nitriding, Protective Coatings – Advanced surface treatments and protective coatings – powder and antifouling coatings – Self-healing and corrosion-sensing paints

6 + 6

UNIT III: ENERGY CONVERSION AND STORAGE

Batteries – Classification, Fabrication & working – Li-polymer, LiFePO_4 – Fuel Cells (Proton Exchange Membrane, Solid Oxide Fuel Cell, Microbial Fuel Cells) and Green Hydrogen Technologies – Laws of Photochemistry – Jablonski Diagram, Solar Cells – Dye-Sensitized Solar Cells, Supercapacitors – Electrostatic double layer, Pseudocapacitors, Hybrid Supercapacitors

6 + 6

UNIT IV: MATERIALS FOR DISPLAY AND SENSING DEVICES

Liquid Crystal Displays, OLED, QLED – structure, properties and mechanism – Emerging Display Materials – Perovskite emitters – Phase-Change Memory (PCM) materials – Sensors – Electrochemical sensor, Conductometric, Potentiometric, pH metric titrations – principle, working and applications

6 + 6

UNIT V: WAFER TECHNOLOGY

Semiconductors (GaAs, SiGe), Insulators and High Resistive Materials (Porcelain, Bakelite, Transformer oil, Epoxy, SF_6) – Wafer Manufacturing and Purification – Czochralski and Float Zone methods and applications – Photolithography and Microfabrication – Epitaxial Growth and its Significance – Smart Materials and Nano-enabled Devices – MEMS & NEMS

LIST OF EXPERIMENTS

1. Synthesis of Polyaniline (PANI) and Bakelite
2. Determination of molecular weight and degree of polymerisation of a given polymer using an Ostwald viscometer
3. Determination of rate of corrosion of mild steel by weight loss method
4. Potentiometric estimation of Fe present in corrosion medium
5. Estimate the concentration of copper (Cu^{2+}) or nickel (Ni^{2+}) in a given solution using colorimetric analysis based on Beer-Lambert's law
6. Evaluate the strength of the given HCl by pH metry
7. Determination of the amount of HCl present in the given solution by conductometric titration
8. Recover copper from waste printed circuit boards (PCBs) using chemical methods and estimate the amount of copper recovered using appropriate analytical techniques

CONTACT PERIODS:

Lecture: 30 Periods Tutorial: - Periods Practical: 30 Periods Project: - Periods Total: 60 Periods

TEXTBOOKS:

1. Wiley India Pvt. Ltd., "Engineering Chemistry", 2nd edition, Wiley India Pvt. Ltd., New Delhi, 2013
2. S.S. Dara and S.S. Umare, "A Textbook of Engineering Chemistry", 12th edition, Chand Publishing, New Delhi, 2024
3. R.V. Gadag and A. Nityananda Shetty, "Engineering Chemistry", 3rd edition, I.K. International Publishing House, New Delhi, 2014
4. Sunita Rattan, "Experiments in Applied Chemistry", 3rd edition, S.K. Kataria & Sons, New Delhi 2021

REFERENCES:

1. Fred W Billmeyer, "Textbook of Polymer Science", 4th edition, John Wiley & Sons, New York, 1999

2. Lieng-Huang Lee, "Conductive Polymers and Plastics: In Industrial Applications", 1st edition, Springer, New York, 1990
3. M.F. Ashby and D.R.H. Jones, "Engineering Materials 2: An Introduction to Microstructures, Processing and Design", 4th edition, Elsevier, UK, 2012
4. Kirby W Beard, "Linden's Handbook of Batteries", 5th edition, McGraw Hill, New York, 2019
5. G.A Ozin and C.A. Andre, "Nanochemistry: A Chemical Approach to Nanomaterials", 2nd edition, Royal Society of Chemistry, Cambridge, 2005



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SEMESTER I

U25CSG01	Problem Solving using C Programming (Common to AD, AM, BM, CB, CS, EC, EE, IT, SC)	Category: ESC				
		L	T	P	J	C
		2	0	2	0	3

COURSE OBJECTIVES:

- To enable students to understand the fundamentals of C programming, including problem-solving techniques, flowcharts, algorithms, and the structure of a C program
- To impart knowledge on arrays, strings, functions, and pointers to efficiently solve computational problems using modular programming
- To introduce structured data types like structures and unions and demonstrate their use in handling complex data
- To familiarize students with file handling operations and apply C programming constructs to solve real-world problems

COURSE OUTCOMES:

CO 1:	Explain fundamental programming concepts and control structures used in C for problem-solving	Understand
CO 2:	Implement and Manipulate one and two dimensional array and strings for basic processing	Apply
CO 3:	Apply function, recursion, and pointers for efficient problem solving	Apply
CO 4:	Apply structures, unions and storage classes to organize and manage complex data effectively in C Programs	Apply
CO 5:	Implement file handling concepts and operations, including text and binary files, error handling and command-line arguments	Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: C PROGRAMMING BASICS

6 + 6

Fundamentals of Problem Solving – Importance of logical and analytical thinking – Algorithm – Flow Chart – Pseudo code – Introduction to C programming – Structure of a C program – Compilation and linking processes – C Programming Constructs: Keywords, Identifiers, Constants – Variables – Data Types – Operators – Managing I/O operations – Conditional Statements – Looping statements

UNIT II: ARRAYS AND STRINGS

6 + 6

Array: Declaration and Initialization – Accessing and manipulating array elements – One-dimensional array – Two-dimensional array – Strings: Declaring and initializing strings – String operations – String Arrays – Practice problems based on real-world applications

UNIT III: FUNCTIONS AND POINTERS**6 + 6**

Functions: Definition – Function call – Return statement – Types of Functions – Recursion. Pointer: Declaration – Initialization – Passing arguments by value vs by reference – Pointer to pointer – Array of Pointers – Dynamic Memory Allocation: malloc(), calloc(), realloc(), free()

UNIT IV: STRUCTURES AND UNION**6 + 6**

Grouping data using structures – Declaring structure variables – Accessing members using dot (.) operator – Nested Structures – Arrays of Structures – Pointer to Structure – Access members through pointers (→) operator – Memory sharing in unions – Storage classes

UNIT V: FILE HANDLING**6 + 6**

Importance of File Handling – Types of files – File modes – File operations: Open, Read, Write, Close – Serialization and file operations with DAT files – Common errors in file handling – File pointers: ftell(), fseek(), rewind() – Command line arguments – Practical Exercises Using Files for Data Persistence

LIST OF EXPERIMENTS

1. Demonstrating the use of simple statements and expressions in C
2. Implementing the flow control of programs using decision and iteration constructs
3. Demonstrating the creation and manipulation of arrays in C
4. Programs using string operations
5. Illustrate function declaration, definition, and calling mechanisms
6. Hands-on practice with recursive solutions for mathematical problems
7. Hands-on practice with pointers in memory access and manipulation
8. Applications of structures and unions in organizing and processing data
9. Implementation of file operations such as open, read, write, append, and close
10. Perform arithmetic operations using values passed through command line

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. David D. Railey and Kenny A.Hunt , "Computational Thinking for Modern problem Solver", 1st Edition, CRC Press, 2014
2. Brian W. Kernighan and Dennis Ritchie, "The C Programming Language", 2nd Edition, Pearson, 2015

REFERENCES:

1. Paolo Ferragina and Fabrizio Luccio, "Computational Thinking First Algorithms", Then Code",1st Edition, Springer International Publishing, 2018
2. Reema Thareja, "Programming in C", 2nd Edition, Oxford University Press, 2016
3. Paul Deitel and Harvey Deitel, "C How to Program", 7th Edition, Pearson Publication, 2015
4. Juneja, B. L and Anita Seth, "Programming in C",1st Edition, Cengage Learning India Pvt. Ltd., 2011
5. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", 1st Edition, Oxford University Press, 2009

SEMESTER I

U25CSG03	Digital Technologies (Common to all programmes)	Category: ESC				
		L	T	P	J	C
		1	0	0	0	1

COURSE OBJECTIVES:

- To explain the foundational concepts of AI, IoT, cloud, cybersecurity, and blockchain technologies
- To apply practical knowledge of OpenAI, RPA, and digital marketing strategies effectively
- To analyse interconnected smart systems, big data, and evolving digital landscapes
- To evaluate ethical implications of AI, data privacy, and societal impact of technologies

COURSE OUTCOMES:

- CO 1:** Understand the foundational concepts of AI, ML, DL, and key OpenAI generative tools Understand
- CO 2:** Explain the interplay of AI, wearables, and big data in emerging technologies like the Metaverse and Edge AI Understand
- CO 3:** Describe the key components and uses of IoT, cloud computing, and cybersecurity, including common threats Understand
- CO 4:** Interpret the core principles and practical uses of blockchain, RPA, and digital marketing strategies Understand
- CO 5:** Recognize the key concepts and applications of 3D printing, digital manufacturing, AR/VR, Metaverse, and ethical considerations in AI Understand

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: MODERN ARTIFICIAL INTELLIGENCE AND OPENAI TOOLS 6

An Overview of Artificial Intelligence – Introduction to Machine Learning and Deep Learning – ChatGPT – GPT 4 – OpenAI Tools: AI Text Classifier – OpenAI Tools: Point-E – Text to Image Generator – DALL-E

UNIT II: MART SYSTEMS AND ANALYTICS 6

Intelligent Wearables – AI and Metaverse – Edge AI / TinyML – Evolution of Big Data Analytics – Applications of Big Data Analytics

UNIT III: IOT, CLOUD, CYBERSECURITY ESSENTIALS 6

Internet of Things – Applications of IoT – Industrial Internet of Things or IIoT – Digital Payments – Overview of Cloud Computing – Applications of Cloud Computing – Service Models in Cloud Computing – Overview of Cybersecurity – Applications of Cybersecurity – Types of Cyber Attacks – Data Privacy and User Data Control – Deepfake

UNIT IV: DIGITAL INNOVATION AND AUTOMATION

6

Evolution of Blockchain – Applications of Blockchain in Finance Industry – Impact of Blockchain on Workforce & Workplace – Getting Started with Robotic Process Automation – Applications of Robotic Process Automation in Banking & Insurance Industry – Web, Mobile Development and Marketing – 5Ds of Digital Marketing – Digital Storytelling

UNIT V: DIGITAL DESIGN AND RESPONSIBILITY

6

3D Printing Modelling – Digital Manufacturing – Augmented Reality and Virtual Reality – Pre-requisites for Augmented Reality & Virtual Reality – Metaverse – Applications of Augmented Reality – Virtual Reality in – AI Ethics – Ethical Considerations of Generative AI

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** - Periods **Total:** 30 Periods

TEXTBOOKS:

1. Faheem Syeed Masoodi, Zubair Sayeed Masoodi, Khalid Bashir Dar, "Digital and Technological Solutions: Exploring the Foundations of Digitization", 1st Edition, BPB Publications, 2024

REFERENCES:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach", 4th Edition, Pearson, 2020
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-On Approach" Universities Press, 2014
3. Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles and Practice", Addison-Wesley, 2016
4. Daniel Drescher, "Blockchain Basics: A Non-Technical Introduction in 25 Steps" Apress, 2017
5. Xiaofei Wang, Yunchuan Sun, "Edge AI: Convergence of Edge Computing and Artificial Intelligence", Wiley, 2022
6. Mark Coeckelbergh, "AI Ethics", MIT Press, 2020
7. <https://www.futureskillsprime.in/journey/digital-101-30-hours/> - Digital 101 Futureskills Prime Course by NASSCOM



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SEMESTER I

U25BM101	Electronic Devices and Circuits	Category: PCC				
		L	T	P	J	C
		2	0	2	0	3

COURSE OBJECTIVES:

- To summarize the foundational understanding of electrical circuits and the principles of circuit analysis techniques
- To familiarize the operation and applications of semiconductor devices including diodes, transistors

COURSE OUTCOMES:

- CO 1:** Make use of electrical laws and circuit theorems to analyze circuits involving active and passive elements **Apply**
- CO 2:** Illustrate the working principles and characteristics of various semiconductor diodes **Understand**
- CO 3:** Construct and analyze rectifiers, clippers, clampers, voltage regulators and logic circuits using semiconductor diodes **Apply**
- CO 4:** Analyze and design basic analog and digital circuits by integrating the characteristics of various active and passive electronic components **Apply**
- CO 5:** Utilize the theoretical knowledge to analyze, simulate, and evaluate the characteristics and practical behavior of electronic components and circuits **Precision**

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: ELECTRICAL CIRCUITS AND ANALYSIS

6 + 6

Active and Passive Elements: Current and Voltage Sources, Resistors, Inductors and Capacitors – Circuits: Resistors in series and parallel circuits, Passive Filters – Ohm's Law, Kirchhoff's Laws – Analysis: Mesh and Nodal analysis

UNIT II: SEMICONDUCTOR DIODES

6 + 6

Ideal Diode: Diode resistance, Transition and Diffusion capacitance – Structure, Working principle and Characteristics: PN junction diode, Zener diode, Light emitting diode, Photodiode

UNIT III: APPLICATIONS OF SEMICONDUCTOR DIODES

6 + 6

Rectifier, Clipper and Clamper circuits, Logic Circuits: AND, OR Gates – Voltage regulator – Seven segment Displays – Solar Cell

UNIT IV: CURRENT CONTROLLED TRANSISTORS

6 + 6

Bipolar Junction Transistor: Construction, Operation and Types – Characteristics: Common base configuration, Common emitter configuration, Common collector configuration – BJT switching – BJT amplification

UNIT V: VOLTAGE CONTROLLED TRANSISTORS

6 + 6

Construction, Operation, Types and Characteristics: JFET, MOSFET – CMOS Operation and Applications: Inverter, NAND and NOR Gates

LIST OF EXPERIMENTS

1. Interpretation of Diode and Transistor Characteristics from Datasheets
2. Verification of Kirchhoff's Current and Voltage Laws
3. V-I Characteristics of a PN Junction Diode
4. V-I Characteristics of a Zener Diode
5. Design and Analysis of a Full-Wave Rectifier
6. Design and Testing of a DC Voltage Regulator using Zener Diode
7. Input and Output Characteristics of BJT
8. Drain and Transfer Characteristics of a JFET
9. Drain and Transfer Characteristics of a MOSFET
10. Simulation and Verification of CMOS Logic Gates

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. William H. Hayt, Jack Kemmerly, Jamie Phillips and Steven M. Durbin, "Engineering Circuit Analysis", 10th Edition, McGraw-Hill Education, 2024
2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 11th Edition, Pearson Education, 2015

REFERENCES:

1. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", 7th Edition, McGraw-Hill Education, 2022
2. David A. Bell, "Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2008



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SEMESTER I

U25LEG01	German for Engineers - I (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

COURSE OBJECTIVES:

- Gain basic proficiency in listening, speaking, reading, and writing - understanding everyday conversations, speaking in survival situations, reading short texts, and writing simple sentences
- Acquire essential knowledge of German grammatical structures to support communication and comprehension
- Gain introductory insights into German cultural norms, practices, and everyday life

COURSE OUTCOMES:

CO 1: Acquire familiarity in the German alphabet & basic vocabulary	Understand
CO 2: Listen and identify individual sounds of German	Understand
CO 3: Use basic sounds and words while speaking	Apply
CO 4: Read and understand simple advertisements, brochures and invitations	Understand
CO 5: Use basic grammar and appropriate vocabulary in completing language tasks	Remember

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: INTRODUCTION TO GERMAN LANGUAGE AND SOUNDS

6 + 3

Alphabet and pronunciation (phonetics and name spelling) – Basic greetings and farewells – Asking for and giving personal information – Countries – Languages – Professions – Numbers (0–100) – Cultural focus: German-speaking countries

UNIT II: GRAMMAR FOUNDATIONS AND SENTENCE BUILDING

6 + 3

Formal vs. informal register: Sie vs. du – Personal pronouns: ich - du - Sie - er - sie - es – Verb conjugation in Präsens (regular and irregular) – Verbs: sein - haben (to be - to have) – Questions: wo - wer - wie - was - etc – Yes/No questions (Ja-/Nein-Fragen) – Cultural focus: Formal vs. informal speech

UNIT III: DAILY LIFE AND ROUTINES

6 + 3

Describing daily activities and routines – Talking about time – Days – Routine verbs and nouns – Grammar: Separable verbs (aufstehen - mitkommen) – Modal verbs (intro): können - müssen – Negation: nicht - kein – Cultural focus: Typical German daily schedules

UNIT IV: GRAMMAR – CASES AND STRUCTURE

6 + 3

Accusative case: articles and pronouns – Dative case: definite and indefinite articles – Grammar focus: Prepositions with dative (in, auf, bei, mit, zu) – Cultural focus: Office hours and punctuality in German culture

UNIT V: NAVIGATION AND PUBLIC INTERACTION

6 + 3

Asking for/giving directions – Describing locations and surroundings – Places in the city: Supermarkt, Bahnhof – Post – Kino – Reading and understanding public signs – Maps – Timetables – Grammar: Imperative (basic usage for giving directions) – Cultural focus: Public transportation – City services in German-speaking countries

LIST OF EXPERIMENTS

1. Prepare a family tree chart
2. Record a self-intro video
3. Describe your college
4. Presentation related to culture
5. Dialogue roleplay
6. Mock interview

CONTACT PERIODS:

Lecture: 30 Periods Tutorial: - Periods Practical: 15 Periods Project: - Periods Total: 45 Periods

TEXTBOOKS:

1. Buscha- A & Szita, S-Begegnungen Deutsch als Fremdsprache A1+: Integriertes Kurs- und Arbeitsbuch- 1st Edition, 2021
2. Brüseke, R., "Grammatik leicht A1," 1st Edition-2019

REFERENCES:

1. Netzwerk Deutsch als Fremdsprache A1, 1st Edition: BlueNBells, 2012
2. Huber, K., & Keller, F., "DaF kompakt A1: Deutsch als Fremdsprache," 3rd Edition, Langenscheidt, 2018



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SEMESTER I

U25LEG02	Japanese for Engineers - I (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

COURSE OBJECTIVES:

- Gain basic proficiency in listening, speaking, reading, and writing - understanding everyday conversations, speaking in survival situations, reading short texts, and writing simple sentences
- Acquire essential knowledge of Japanese grammatical structures to support communication and comprehension
- Gain introductory insights into Japanese cultural norms, practices, and everyday life

COURSE OUTCOMES:

CO 1: Acquire familiarity in the Japanese alphabet and basic vocabulary	Understand
CO 2: Listen and identify individual sounds of Japanese	Understand
CO 3: Use basic sounds and words while speaking	Apply
CO 4: Read and understand simple advertisements, brochures and invitations	Understand
CO 5: Use basic grammar and appropriate vocabulary in completing language tasks	Remember

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: INTRODUCTION TO JAPANESE WRITING AND GREETINGS

6 + 3

Hiragana Mastery – Basic greetings & expressions – Desu (~です) – Particles: は (wa), の (no), か (ka) – Basic vocabulary: Professions, countries, school related terms – Cultural note: Bowing – Formal vs. informal speech

UNIT II: KATAKANA AND BASIC COMMUNICATION

6 + 3

Katakana Mastery – Numbers -time - and age expressions – Vocabulary: Objects, locations and daily expressions – Particles: を (wo), - に (ni) - で (de) – Grammar: Arimasu / Imasu (existence) – Negation: じゃありません / ではありません – Cultural note: Japanese use of numbers and time in daily life

UNIT III: VERB BASICS AND SENTENCE STRUCTURE

6 + 3

Verb sentence structure – Verb conjugation basics: Non-past affirmative/negative – Asking about objects – Time and location expressions – Vocabulary: Places - classroom items - basic actions – Cultural note: School and work environments in Japan

UNIT IV: DAILY ACTIVITIES AND VOCABULARY EXPANSION**6 + 3**

Daily routine verbs: おきます, たべます, ねます, etc., – Days of the week – Frequency expressions – Vocabulary: Food - drink - daily routine – Common locations: Library - school - station – Particles: は, を, に, で, も, へ – Cultural note: Japanese daily life and food habits

UNIT V: INTRODUCTION TO KANJI AND PRACTICAL USE**6 + 3**

Kanji: Recognition (~50), Writing (~30) – Practical reading and writing exercises using learned Kanji – Review of particles in context – Integration of all skills through short dialogues and written practice – Cultural note: Importance of Kanji in Japanese society and signage

LIST OF EXPERIMENTS

1. Prepare a family tree chart
2. Record a self-intro video
3. Describe your college
4. Presentation related to culture
5. Dialogue roleplay
6. Mock interview

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 15 Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. 3A Corporation, "Minna no Nihongo Shokyū I: Main Textbook," 2nd Indian Edition, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2018
2. Banno, Eri, Yutaka Ohno, Yoko Sakane, Chikako Shinagawa, and Kyoko Tokashiki, "Genki I: An Integrated Course in Elementary Japanese," 3rd Edition, The Japan Times Publishing, Tokyo, 2020

REFERENCES:

1. Yamada, M., & Fujita, T., "Japanese for Beginners: A Practical Approach," 1st Edition, Tuttle Publishing, 2019
2. Takahashi, A., & Sato, M., "Nihongo Pro: Japanese for N5 Level," 1st Edition, KADOKAWA, 2018


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SEMESTER I

U25LEG03	French for Engineers - I (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

COURSE OBJECTIVES:

- Gain basic proficiency in listening, speaking, reading, and writing - understanding everyday conversations, speaking in survival situations, reading short texts, and writing simple sentences
- Acquire essential knowledge of French grammatical structures to support communication and comprehension
- Gain introductory insights into French cultural norms, practices, and everyday life

COURSE OUTCOMES:

CO 1: Acquire familiarity in the French alphabet and basic vocabulary	Understand
CO 2: Listen and identify individual sounds of French	Understand
CO 3: Use basic sounds and words while speaking	Apply
CO 4: Read and understand simple advertisements, brochures and invitations	Understand
CO 5: Use basic grammar and appropriate vocabulary in completing language tasks	Remember

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: INTRODUCTION TO FRENCH LANGUAGE AND BASICS

6 + 3

Alphabet and pronunciation: French sounds – Accents – Spelling names – Greeting people and introducing yourself and others – Asking about someone: names – Nationalities, and countries – Grammar: Subject pronouns (je, tu, il, elle...) - être (to be) - s'appeler (to be called) – Articles: definite/indefinite (le, la, un, une) - Gender and number of nouns – Cultural focus: French-speaking countries – forms of address (tu vs. vous)

UNIT II: DESCRIBING PEOPLE AND BACKGROUND

6 + 3

Describing yourself and others: nationality – profession – Age – Asking and answering personal questions – Numbers: 0–69 – Talking about languages spoken – Grammar: Verbs avoir (to have) parler (to speak) – Negation: ne...pas – Cultural focus: Francophone diversity – naming conventions (nom, prénom)

UNIT III: GRAMMAR AND AGREEMENT IN DESCRIPTIONS

6 + 3

Gender agreement of adjectives and professions – Asking questions: Interrogative expressions (Où, Quoi, Qui, Quel(le)) – Practice with personal descriptions – More on sentence structure and simple dialogues – Cultural focus: Intercultural identity – Polite introductions and small talk

UNIT IV: TALKING ABOUT DAILY LIFE**6 + 3**

Describing a typical day – Talking about daily activities and frequency – Saying what you like/don't like doing – Talking about schedules and routines – Cultural focus: A typical day in France – school/work life in Francophone countries

UNIT V: TIME, VERBS, AND DAILY EXPRESSIONS**6 + 3**

Telling time – grammar: Regular -er verbs in present tense – The verb aller (to go) and expressions with faire – Prepositions: à -chez - en - au -Cultural focus: French meal times – Weekend habits – Transportation

LIST OF EXPERIMENTS

1. Prepare a family tree chart
2. Record a self-intro video
3. Describe your college
4. Presentation related to culture
5. Dialogue roleplay
6. Mock interview

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 15 Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. Marie-José Lopes & Jean-Thierry Bougnec, "Inspire 2 A1-A2 Méthode de français," 1st Edition, Hachette Français Langue Etrangère, 2020
2. Gibbe, C., Berthet, A., & Hugot, C., "Édito A2: Méthode de français," 1st Edition, Didier, 2024

REFERENCES:

1. Chantal Fougères & Marc de la Harpe, "Le Nouveau Sans Frontières 2: Méthode de français A2," 1st Edition, Hachette FLE, 2020
2. Xavier Maingueneau, "Le Français pour les Nuls: A2-B1," 3rd Edition, Wiley, 2021



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SEMESTER I

U25LEG04	Hindi for Engineers - I (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

COURSE OBJECTIVES:

- Gain basic proficiency in listening, speaking, reading, and writing - understanding everyday conversations, speaking in survival situations, reading short texts, and writing simple sentences
- Acquire essential knowledge of Hindi grammatical structures to support communication and comprehension
- Gain introductory insights into Hindi cultural norms, practices, and everyday life

COURSE OUTCOMES:

CO 1: Acquire familiarity in the Hindi alphabet and basic vocabulary	Understand
CO 2: Listen and identify individual sounds of Hindi	Understand
CO 3: Use basic sounds and words while speaking	Apply
CO 4: Read and understand simple advertisements, brochures and invitations	Understand
CO 5: Use basic grammar and appropriate vocabulary in completing language tasks	Remember

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: UNIT I INTRODUCTION TO HINDI SCRIPT AND CULTURE

6 + 3

Devanagari script basics (vowels and consonants) – Hindi sound system (aspirated/unaspirated, retroflex sounds) – Basic greetings and self-introduction – Sentence ending with है (hai) – Vocabulary: Professions – Nationalities – Countries – Family members – Grammar: Personal pronouns (मैं, तुम, आप, वह, यह) – Use of है and क्या (kya) for yes/no questions – Simple nominal sentences – Cultural note: Indian naming conventions – Forms of address (तुम vs. आप) – Gestures like namaste and head nods – Sociolinguistic formality

UNIT II: SENTENCE STRUCTURE AND EVERYDAY CONTEXTS

6 + 3

Introducing others – Talking about objects and places – Yes/no and WH- questions – Negation using नहीं – Use of यह (yeh) – वह (voh) – Vocabulary: Everyday objects – Common locations – Classroom and household terms – Grammar: Postpositions में (mein), से (se), का/की/के (possessives) – Verb basics with है and नहीं है, Subject-object-verb (SOV) structure – Cultural note: Spatial metaphors in Hindi, gestures with demonstratives, plural forms, and respect levels

UNIT III: DESCRIBING DAILY LIFE AND HABITS**6 + 3**

Describing daily routines like waking – Eating – Going – Returning – Sleeping – Vocabulary: Daily activities – Time expressions – Common verbs – Talking about routines in present tense – Adverbs of frequency: हमेशा - कभी-कभी - कभी नहीं – Grammar: Present tense of जाना - खाना - करना - उठना - सोना – Verb agreement by gender and number – Use of को (ko) as object marker – Cultural note: Time perception – Daily routines in Indian homes – Lifestyle differences – Typical student/professional day

UNIT IV: EXPANSION OF VERB USE AND QUESTIONS**6 + 3**

Extended verb usage in different contexts – Asking and answering questions with Wh-words – Expressing possession – Giving simple commands and requests – Vocabulary: Verbs of movement – Expression – Need – Grammar: Imperatives – Compound verbs – Continued use of postpositions – Sentence expansion using connectors – Cultural note: Politeness in commands – Body language in communication – Informal/formal tone shift

UNIT V: PRACTICAL COMMUNICATION AND REVIEW**6 + 3**

Role-plays: shopping – Traveling, introducing family – Speaking about preferences and opinions – Listening to simple dialogues and identifying key points – Vocabulary: Common nouns – Adjectives – Survival phrases – Grammar: Review of present tense – Pronouns – Postpositions – Negation – Cultural note: Real-life communication scenarios – Marketplace culture – Indian transportation and hospitality norms

LIST OF EXPERIMENTS

1. Prepare a family tree chart
2. Record a self-intro video
3. Describe your college
4. Presentation related to culture
5. Dialogue roleplay
6. Mock interview

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 15 Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. Pavithra Publications, "Spoken Hindi: Through Tamil," 2nd Edition, Pavithra Publications, Chennai, 2015
2. Dakshina Bharat Hindi Prachar Sabha, "Prathamik Text Book: New Syllabus," 1st Edition, Dakshina Bharat Hindi Prachar Sabha, Madras, 2023

REFERENCES:

1. Ganga, K., & Ramesh, V., "Learn Hindi in 30 Days: A Beginner's Guide," 3rd Edition, Hindi Academy, 2020
2. Vyas, S., "Spoken Hindi for Beginners," 1st Edition, Orient BlackSwan, 2018



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SEMESTER I

U25LEG09	Chinese for Engineers - I (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

COURSE OBJECTIVES:

- Gain basic proficiency in listening, speaking, reading, and writing - understanding everyday conversations, speaking in survival situations, reading short texts, and writing simple sentences
- Acquire essential knowledge of Chinese grammatical structures to support communication and comprehension
- Gain introductory insights into Chinese cultural norms, practices, and everyday life

COURSE OUTCOMES:

CO 1: Acquire familiarity in the Chinese alphabet & basic vocabulary	Understand
CO 2: Listen and identify individual sounds of Chinese	Understand
CO 3: Use basic sounds and words while speaking	Apply
CO 4: Read and understand simple advertisements, brochures and invitations	Understand
CO 5: Use basic grammar and appropriate vocabulary in completing language tasks	Remember

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: FUNDAMENTAL CHINESE FOR BEGINNERS

6 + 3

Introduction to Mandarin Chinese, daily greetings – Learning Mandarin alphabet initials, finals, 4 tones and tone change rules (Pinyin 拼音) – Learning numbers 0–20 – Learning basic in-class vocabulary and phrases

UNIT II: NUMBERS AND VOCABULARY EXPANSION

6 + 3

Learning numbers up to 999 – Learning country names and nationalities – Learning personal pronouns and Subject-Verb-Object (SVO) sentence structure – Practice with short dialogues and self-introductions

UNIT III: THE NEW CLASSMATE

6 + 3

Learning vocabulary related to names and introductions – Learning the differences among 是 (to be), 叫 (to be called), 姓 (to have a surname) – Learning how to form questions with 吗 – Learning abbreviated questions with 呢 – Practice dialogues: exchanging names and personal details

UNIT IV: TIME AND POSSESSION**6 + 3**

What time do you go to the university? – Learning vocabulary for time, dates, and days of the week – Learning grammar: placement of time words (S + Time word + V) – Learning to express possession with 有 / 沒有 – Learning the usage of 的 as a possessive particle – Practice with daily schedules and activities

UNIT V: COMMUNICATION AND REVIEW**6 + 3**

Grammar consolidation: auxiliary verbs and sentence order – Forming positive-negative questions (e.g., 是不是, 有沒有) – Conversational practice: greetings, introductions, time, possession – Role-play in real-life scenarios – Cultural notes: politeness and forms of address – Final review and integrated practice of Units I–IV

LIST OF EXPERIMENTS

1. Prepare a family tree chart
2. Record a self-intro video
3. Describe your college
4. Presentation related to culture
5. Dialogue roleplay
6. Mock interview

CONTACT PERIODS:

Lecture: 30 Periods Tutorial: - Periods Practical: 15 Periods Project: - Periods Total: 45 Periods

TEXTBOOKS:

1. Mandarin Training Centre, National Taiwan Normal University, Modern Chinese I 時代華語 I, Edited by Chih-Ping Chou, Taipei: Cheng Chung Book Company Ltd., 2019
2. Huayu101 / 華語101, Taiwan Ministry of Education, Taiwan Mandarin Educational Resources Centre, 2018

REFERENCES:

1. Cheng Chung Book Company Ltd, 時代華語 I 教師手冊 [Modern Chinese I Teacher's Manual, 2019]
2. www.lmit.edu.tw/bag



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SEMESTER I

U25BM102	Biomedical Engineering Essentials	Category: PCC				
		L	T	P	J	C
		1	0	4	0	3

COURSE OBJECTIVES:

- To familiarize with application of electronics in biomedical devices and systems
- To practise key biomedical equipment, including diagnostic, therapeutic, and monitoring devices used in clinical settings
- To study nanomaterials used in medical applications, focusing on their properties, functions, and interactions with the human body

COURSE OUTCOMES:

CO 1: Apply engineering principles to biomedical equipment and hospital systems	Apply
CO 2: Apply techniques to assess diagnostic and therapeutic device performance	Apply
CO 3: Develop solutions for biomedical problems through the field visits	Apply
CO 4: Summarize findings in reports with effective communication	Apply
CO 5: Apply communication and lifelong learning in industry-based reporting	Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: ELECTRONICS IN BIOMEDICAL APPLICATIONS	3 + 12
Electronic Components – Analog and Digital Signals – Sensors and Transducers – Field visit	
UNIT II: DIAGNOSTIC EQUIPMENT	3 + 12
Vital parameters: Temperature, NIBP, ECG, SpO2, Heart rate – Field visit	
UNIT III: THERAPUTIC EQUIPMENT	3 + 12
Ventilators – Diathermy – Defibrillators – Field visit	
UNIT IV: PRINCIPLES AND APPLICATIONS OF RADIOLOGICAL EQUIPMENT	3 + 12
X-ray and CT – Ultrasound Imaging – MRI Scanners – Field visit	
UNIT V: HOSPITAL ADMINISTRATION	3 + 12
Departments in hospital – Accreditation – Medical device regulation – Field visit	

CONTACT PERIODS:

Lecture: 15 Periods

Tutorial: - Periods

Practical: 60 Periods

Project: - Periods

Total: 75 Periods

TEXTBOOKS:

1. R. S. Khandpur, Handbook of Biomedical Instrumentation, 3rd ed., McGraw-Hill Education, New Delhi, 2014
2. William H. Hayt, Jack E. Kemmerly, and Steven M. Durbin, Engineering Circuit Analysis, 10th ed., McGraw-Hill Education, 2024
3. J. Park and R. S. Lakes, Biomaterials: An Introduction, 4th ed., Academic Press, 2020

REFERENCES:

1. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", 4th edition, Pearson Education, New Delhi, 2001
2. Leslie Cromwell, Fred J. Weibell, and Erich A. Pfeiffer, "Biomedical Instrumentation and Measurements", 2nd edition, Pearson Education, New Delhi, 2011
3. Access: Introduction to Biomaterials – NPTEL, IIT Kanpur
4. <https://alison.com/course/introduction-to-biomedical-engineering-theory>



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SEMESTER I

U25MCC01	Induction Program - Universal Human Values I (Common to all programmes)	Category: MCC				
		L	T	P	J	C
		2	1	0	0	3

COURSE OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human beings), family, society, and nature/existence
- Understanding (or developing clarity) of the harmony in the human being, family, society, and nature/existence
- Strengthening of self-reflection
- Development of commitment and courage to act

COURSE OUTCOMES:

- CO 1: Recognize the essentials of human values and skills Understand
- CO 2: Analyse connection between profession and happiness Understand
- CO 3: Develop appropriate technologies and management patterns to create harmony in family and society Understand
- CO 4: Evaluate the significance of trust, mutually satisfying human behaviour, and enriching interaction with nature Understand
- CO 5: Demonstrate professional and ethical responsibility Understand

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT, AND PROCESS FOR VALUE EDUCATION 6 + 3

Purpose and motivation for the course – Self-Exploration: what is it – Its content and process; 'Natural Acceptance' and Experiential Validation – as the mechanism for self-exploration – Continuous Happiness and Prosperity – A look at basic Human Aspirations – Right understanding, Relationship, and Physical Facilities – the basic requirements for the fulfillment of aspirations of every human being with their correct priority – Understanding Happiness and Prosperity correctly – A critical appraisal of the current scenario – Method to fulfill the above human aspirations: understanding and living in harmony at various levels

UNIT II: HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF 6 + 3

Understanding human beings as a co-existence of the sentient 'I' and the material 'Body' – Understanding the needs of Self ('I') and 'Body' – Happiness and Convenience – Understanding the Body as an instrument of 'I' (I being the doer, seer, and enjoyer) – Understanding the harmony of I with the Body: Self-control and Welfare; correct appraisal of Physical needs – Meaning of Prosperity in detail – Programs to ensure Self-control and Welfare

UNIT III: HARMONY IN THE FAMILY AND SOCIETY**6 + 3**

Understanding values in human – Human relationships; the meaning of Justice (nine universal values in relationships) and the program for its fulfillment to ensure satisfaction – Trust and Respect as the foundational values of relationship – Understanding the meaning of Trust – Difference between intention and competence – Understanding the meaning of Respect – The Difference between respect and differentiation; and the other salient values in relationship – Understanding the harmony in the society (society being an extension of the family): Peace, Prosperity, Courage, and Coexistence as comprehensive Human Goals – Visualizing a universal harmonious order in society – Undivided Society – Universal Order from family to world family

UNIT IV: HARMONY IN THE NATURE AND EXISTENCE**6 + 3**

Understanding the harmony in Nature, Interconnectedness, and mutual fulfillment among the four orders of nature – Recyclability and self-regulation in nature – Understanding Existence as a Co-existence of mutually interacting units in an all-pervasive space – Holistic perception of harmony at all levels of existence – Practice sessions to discuss human beings as the cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology, etc

UNIT V: HARMONY ON PROFESSIONAL ETHICS**6 + 3**

Natural acceptance of human values – Definitiveness of Ethical Human Conduct – Basic for Humanistic Education – Humanistic Constitution, and Humanistic Universal Order – Competence in professional ethics – Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people, friendly and eco-friendly production systems, and Ability to identify and develop appropriate technologies and management patterns for the above production systems – Case studies of typical holistic technologies, management models, and production systems – Strategy for a transition from the present state to Universal Human Order – At the level of the individual: as socially and ecologically responsible engineers, technologists, and managers – At the level of society: as mutually enriching institutions and organizations

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** 15 Periods **Practical:** - Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. R R Gaur, R. Asthana , G P Bagaria, A Foundation course in Human Values and Professional Ethics, 3rd Edition, Excel Books, New Delhi, 2024
2. Prof. K. V. Subba Raju, Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition, 2013

REFERENCES:

1. Ivan Illich, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA, 1974
2. E. F. Schumacher, Small is Beautiful: a study of economics as if people mattered. Blond & Briggs, Britain, 1973



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SEMESTER I

U25MCC02	Heritage of Tamils (Common to all programmes)	Category: MCC				
		L	T	P	J	C
		1	0	0	0	1

COURSE OBJECTIVES:

- Learn the extensive literature of classical Tamil
- Review the fine arts heritage of Tamil culture
- Realize the contribution of Tamils in Indian freedom struggle

COURSE OUTCOMES:

CO 1:	Understand the extensive literature of Tamil and its classical nature	Understand
CO 2:	Understand the heritage of sculpture, painting and musical instruments of ancient people	Understand
CO 3:	Review on folk and martial arts of Tamil people	Understand
CO 4:	Realization of Thina concepts, trade and victory of Chozha dynasty	Understand
CO 5:	Understand the contribution of Tamils in Indian freedom struggle, Self-esteem movement and siddha medicine	Understand

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: LANGUAGE AND LITERATURE

3

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

UNIT II: HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE

3

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, Yash and Nadhaswaram – Role of Temples in Social and Economic Life of Tamils

UNIT III: FOLK AND MARTIAL ARTS

3

Tattooing, basket weaving, Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance – Sports and Games of Tamils

UNIT IV: THINAI CONCEPT OF TAMILS**3**

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

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

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

CONTACT PERIODS:

Lecture: 15 Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** - Periods **Total:** 15 Periods

TEXTBOOKS:

1. Jayanthi Ravikrishna K, Heritage of Tamils, Sri Krishna publications, First Edition, 2023
2. S. Priyadharshini, Heritage of Tamils, V. K. Publications

REFERENCES:

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை, International Institute of Tamil Studies, C.P.T Campus, Chennai
2. கணினித் தமிழ் - முனைவர். இல. சுந்தரம், விகடன் பிரசுரம், அண்ணா சாலை, சென்னை, திசம்பர் 2016
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம், தொல்லியல் துறை வெளியீடு, தமிழ்நாடு அரசு, சென்னை, ஆறாம் பதிப்பு 2020
4. Social Life of Tamils, Dr. K. K. Pillay, A joint publication of TNTB & ESC and RMRL (in print) University of Madras, Chennai, Second Edition 1975
5. The Contributions of the Tamils to Indian Culture, Dr.M.Valarmathi, International Institute of Tamil Studies, C.I.T Campus, Tharamani, Chennai, First Edition 1995



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SEMESTER I & II



U25MCC03	Design Thinking (Common to all programmes)	Category: MCC				
		L	T	P	J	C
		1	0	2	0	2

COURSE OBJECTIVES:

- To understand the basics of Design Thinking, its principles, processes, and tools used
- To empathize with stakeholders and frame problems using structured tools and techniques
- To generate ideas, create prototypes, and present solutions effectively using design tools

COURSE OUTCOMES:

CO 1: Explain purpose and features of design thinking process	Understand
CO 2: Use required tools to empathize with the stockholders to identify the problem	Apply
CO 3: Define the identified problem elaborately and clearly	Apply
CO 4: Develop prototypes for conceptual solutions	Apply
CO 5: Present the identified solution to all the stakeholders	Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: FUNDAMENTALS OF DESIGN THINKING	3 + 6
Introduction to Design Thinking: Definition, relevance, and applications – Contexts and situations where Design Thinking is most effective – Core process of implementing Design Thinking – Stakeholders involved in a Design Thinking approach – Design The Thinking – Personal Visualization, The Wheel of Life, and Balancing Priorities – Understanding and appreciating the concept of 'Design' – The 3 Laws of Design Thinking	
UNIT II: THE EMPHATHIZE STAGE	3 + 6
Understanding Stakeholders – Role of Empathy in Design Thinking – Tools: Persona, Journey Mapping, Stakeholder Mapping, CATWOE, Cartographic Perspective (L0), Empathy Map – Case Study	
UNIT III: THE DEFINE STAGE	3 + 6
Problem Framing and Reframing – Role of a Design Thinker – Tools: Five Whys, Anti-Pattern, Problem Paraphrasing, Challenge Mapping – Introduction to LORD Skillset – Case Study	


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UNIT IV: THE DIVERGENCE AND CONVERGENCE STAGE**3 + 6**

Ideation through Divergent and Convergent Thinking – Tools: Brainstorming, Metaphor, Random Association, End-State Visualization, 10gm–100gm–1000gm – Prototyping Basics – Wire framing – Case Study – Communicating for Effective Outcome

UNIT V: THE COMMUNICATION STAGE**3 + 6**

Presenting and Packaging Design Outcomes – Tools: 4Cs Framework, Naming, Packaging, Storyboarding, Presentation Techniques, Distribution Methods.

LIST OF EXPERIMENTS

1. Personal Visualization
2. 3 Laws of Design Thinking®
3. Persona
4. Journey Mapping
5. Cartographic Perspective
6. Anti-Pattern, Problem Paraphrasing
7. Brainstorming
8. 10gm–100gm–1000gm
9. Prototyping Basics
10. Storyboarding
11. Presentation Techniques

CONTACT PERIODS:

Lecture: 15 Periods Tutorial: - Periods Practical: 30 Periods Project: - Periods Total: 45 Periods

TEXTBOOKS:

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins Publishers Ltd., 2018
2. Idris Mootee, Design Thinking for Strategic Innovation, John Wiley & Sons Inc, 2013
3. Arun Jain, UnMukt: Science & Art of Design Thinking, School of Design Thinking, 2020

REFERENCES:

1. Roger Martin, The Design of Business: Why Design Thinking is the Next Competitive Advantage, Harvard Business Press, 2009
2. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), Design Thinking: Understand – Improve– Apply, Springer, 2011
3. Liedtka, Andrew King, Kevin Bennett, Book - Solving Problems with Design Thinking - Ten Stories of What Works, Columbia Business School Publishing, 2013
4. Maurício Vianna, Ysmar Vianna, Isabel K. Adler, Brenda Lucena, Beatriz Russo, Design thinking: Business Innovation, MJV Press, 2011
5. Burgelman, Christensen, and Wheelwright, Strategic Management of Technology and Innovation, 5th Edition, McGraw Hill Publications, 2017

SEMESTER I & II

U25MCC04	Computer Fundamentals and Coding Essentials (Common to all programmes)	Category: MCC				
		L	T	P	J	C
		1	0	2	0	2

COURSE OBJECTIVES:

- To develop an understanding of fundamental computing concepts such as data types, variables, operators and algorithmic problem-solving.
- To enable students to write, debug, and execute simple programs in C using control structures, arrays and strings for solving basic scientific and engineering problems.
- To introduce the basic structure and functioning of computer systems, including hardware, software, operating systems and file management.

COURSE OUTCOMES:

- CO 1: Build basic computational concepts such as data types, variables, operators, algorithms to solve simple problems Apply
- CO 2: Develop simple programs using input/output operations, control structures, arrays, and strings in C language Apply
- CO 3: Describe the fundamental components of a computer system and explain the role of operating systems and file management in computing Understand

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	3	2	2	-	-	-	-	-	-	2	-	-
CO 2	3	3	3	-	2	2	-	-	-	-	2	-	-
CO 3	3	2	-	-	2	-	-	-	-	-	-	-	-

SYLLABUS:

UNIT I: FUNDAMENTALS OF COMPUTING

3 + 5

Introduction to algorithms and flowcharts –Data types, variables, and operators

UNIT II: INTRODUCTION TO PROGRAMMING

6 + 5

Programming languages overview - Input/output, conditional statements, loops - Basic data structures: arrays and strings - Overview of Logic gates and basic digital circuits - System software

UNIT III: INTRODUCTION TO COMPUTERS

6 + 5

Evolution of Computers - Overview of computer hardware and software - Number Systems - Understanding input/output devices, memory, storage – Basics of operating systems and file management

LIST OF EXPERIMENTS

1. Identifying computer components
2. Installation and debugging of Operating System
3. Programs using variables and data types



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4. Programs using Conditional Statements
5. Programs using Loops and Iterations
6. Program using Nested Loops & Pattern Printing

CONTACT PERIODS:

Lecture: 15 Periods **Tutorial:** - Periods **Practical:** 15 Periods **Project:** - Periods **Total:** 30 Periods

TEXTBOOKS:

1. Glenn Brookshear J and Dennis Brylow, "Computer Science: An Overview", 13th Edition, Perarson, 2020
2. Rajaraman V and Neeharika Adabala "Fundamentals of Computers", 6th Edition PHI Learning Private Limited, 2015
3. Yashavant Kanetkar, "Let Us C", 17th Edition, BPB Publications, 2020

REFERENCES:

1. Reema Thareja, "Programming in C", 2nd Edition, Oxford University Press, 2016
2. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", 1st Edition, Oxford University Press, 2009



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SEMESTER I & II

U25MCC05	Biology for Engineers (Common to all programmes)	Category: MCC				
		L	T	P	J	C
		1	0	2	0	2

COURSE OBJECTIVES:

- To understand the biological concepts from an engineering perspective
- To understand the importance of human physiology and sensing techniques
- To perform the various laboratory tests with the relevant instruments / equipment

COURSE OUTCOMES:

CO 1: Interpret the biological concepts of cell and its structure	Understand
CO 2: Describe the importance of human physiology	Understand
CO 3: Summarize the various sensing techniques and assistive devices	Understand
CO 4: Utilize the instruments / equipment to perform the microbial growth and laboratory tests	Precision
CO 5: Apply the principles to demonstrate the microbial growth and laboratory test	Precision

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: BASICS OF CELL

5

Cell structure and function – Cell division – Mitosis – Meiosis – Cell Membrane potential

UNIT II: HUMAN PHYSIOLOGY

5

Circulatory system – Respiratory system – Digestive system – Neurology system Carbohydrates – Proteins and amino acid – Nucleic acid (DNA and RNA)

UNIT III: SENSING TECHNIQUES AND ASSISTIVE DEVICES

5

Sensory organs: Eyes and ears – Visual aids – Hearing aids – Electronic nose – Electronic tongue – Electronic skin

UNIT IV: BIOINSPIRATION

15

Demonstration on bionic principles in nature-inspired design – Exploration of biomimetic materials and their engineering applications – Identification of natural structures mimicked in robotics and sensors – Observation and analysis of bioinspired prototypes (e.g., soft actuators, lotus-effect surfaces)

UNIT V: BASIC LABORATORY TESTS**15**

Separation of serum – Identification of blood groups – Estimation of blood pressure – Measurement of pH – Acquisition of ECG signals – Introduction to bioinformatics for biomedical data interpretation: visualization of gene/protein sequences, exploration of databases such as NCBI and UniProt, and understanding their applications in clinical diagnostics and personalized medicine

CONTACT PERIODS:

Lecture: 15 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. Campbell N.A., Reece J.B., Urry L., Cain M.L. and Wasserman S.A., "Biology: A global approach", 12th edition, Pearson Education Ltd, 2020
2. Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., "Biology for Engineers", 1st edition, Tata McGraw-Hill, 2018
3. Elaine N. Marieb and Suzanne. M. Keller, "Essential of Human Anatomy and Physiology", 12th edition, Pearson Education, 2017

REFERENCES:

1. Leslie Cromwell, Erich A. Pfeiffer, Fred J. Weibell, "Biomedical Instrumentation", 2nd Edition, Prentice Hall, 2011
2. Arthur T Johnson, "Biology for Engineers", 1st edition, CRC press, 2011
3. David. L. Nelson, Michael. M. Cox, "Lehninger Principles of Biochemistry", 7th edition, WH Freeman, 2017
4. John Enderle and Joseph Bronzino, "Introduction to Biomedical Engineering", 3rd edition, Academic Press, 2012



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SEMESTER II

U25ENG02	English Proficiency II (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		0	0	2	0	1

COURSE OBJECTIVES:

- Be an active listener for better comprehension and retention
- Identify main points in spoken materials such as lectures, podcasts, and conversations

COURSE OUTCOMES:

CO 1: Deploy effective listening strategies in academic, technical and everyday situations

Remember

CO 2: Engage in discussions expressing opinions and responding to ideas and arguments

Understand

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	-	-	-	-	-	-	-	2	3	-	2	-	-
CO 2	-	-	-	-	-	-	-	2	3	-	2	-	-

LIST OF EXPERIMENTS

1. Listening to Lectures: Structure and Emphasis – Note-making Techniques: capturing main ideas and details – Conversations, Dialogues and Identifying Opinions – Podcasts and Interviews – Active Listening Skills: Overcoming Barriers and Improving Focus
2. Listening for Specific Information: Facts, Figures, and Sequences – Global Accents: British, American, Australian – Following Instructions and Procedures: Task-based listening – Listening to Technical Explanations: Engineering Concepts – Short Writing Task: Summary or outline from technical input
3. Listening to Workplace Conversations: Meetings, Calls and Voice Notes – Listening to News & Current Events: Identifying Main Ideas and Recognizing – Colloquial Expressions and Idioms in Context: Enhancing comprehension of informal speech

CONTACT PERIODS:

Lecture: - Periods

Tutorial: - Periods

Practical: 30 Periods

Project: - Periods

Total: 30 Periods

TEXTBOOKS:

1. Rob Freire and Tamara Jones, "Q: Skills for Success: Listening & Speaking", Level 4, 3rd edition, Oxford University Press, 2019
2. Ashraf M. Rizvi and Priyadarshi Patnaik, "Effective Technical Communication", 3rd Edition, McGraw Hill, 2024

REFERENCES:

1. Nixaly Leonardo, "Active Listening Techniques: 30 Practical Tools to Hone Your Communication Skills", Embassy Books, 2022
2. Heather R. Younger, "The Art of Active Listening: How People at Work Feel Heard, Valued, and Understood", Berrett-Koehler Publishers, 2023

SEMESTER II

U25MA203	Linear Algebra and Complex Variables (Common to BM, EC)	Category: BSC				
		L	T	P	J	C
		2	0	2	0	3

COURSE OBJECTIVES:

- To introduce the concepts of linear algebra and complex analysis relevant to engineering systems
- To apply matrix methods and complex techniques in solving engineering problems
- To develop analytical skills for modeling and analyzing engineering systems using linear algebra and complex variables

COURSE OUTCOMES:

CO 1: Understand vector spaces and linear transformations in engineering contexts	Understand
CO 2: Apply matrix operations and eigenvalue analysis to engineering systems	Apply
CO 3: Utilize complex variables and functions in solving engineering problems	Apply
CO 4: Apply and solve systems of linear equations relevant to engineering applications	Apply
CO 5: Model and simulate engineering systems using linear algebra and complex analysis techniques	Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: VECTOR SPACES AND LINEAR TRANSFORMATIONS 6 + 6

Definition and examples – Linear combinations – Span – Linear independence – Basis and dimension – Linear transformations – Kernel and range – Applications in engineering systems

UNIT II: MATRICES AND EIGENVALUE ANALYSIS 6 + 6

Matrix operations – Determinants – Inverse and transpose – Rank – Eigenvalues and eigenvectors – Diagonalization – Applications to engineering systems

UNIT III: COMPLEX VARIABLES AND FUNCTIONS 6 + 6

Complex numbers – Functions of a complex variable – Analytic functions – Cauchy-Riemann equations – Conformal mapping – Applications in engineering

UNIT IV: SYSTEMS OF LINEAR EQUATIONS 6 + 6

Transient response of RL, RC and RLC circuits with DC and sinusoidal excitations – Two port networks – Z and Y parameters

UNIT V: SIMULATIONS USING LINEAR ALGEBRA AND COMPLEX ANALYSIS**6 + 6**

Modeling engineering systems using linear algebra – Simulation using complex analysis techniques – Case studies and applications

LIST OF EXPERIMENTS

1. Vector Spaces and Linear Transformations – Visualize vector spaces and subspaces – Implement linear transformations and analyze their effects
2. Matrices and Eigenvalue Analysis – Perform matrix operations and compute eigenvalues/eigenvectors – Apply diagonalization to engineering problems
3. Complex Variables and Functions – Plot complex functions and analyze their properties – Implement conformal mappings and explore applications
4. Systems of Linear Equations – Solve systems using Gaussian elimination and LU decomposition – Apply solutions to engineering case studies
5. Modeling and Simulation – Develop models of engineering systems using linear algebra and complex analysis – Simulate and analyze system behavior

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. David C. Lay, Linear Algebra and Its Applications, 5th Edition, Pearson Education, 2015
2. James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 9th Edition, McGraw-Hill Education, 2013

REFERENCES:

1. Gilbert Strang, Introduction to Linear Algebra, 5th Edition, Wellesley Cambridge Press, 2016
2. Dennis G. Zill and Patrick D. Shanahan, A First Course in Complex Analysis with Applications, 3rd Edition, Jones & Bartlett Learning, 2011
3. Howard Anton and Chris Rorres, Elementary Linear Algebra: Applications Version, 11th Edition, Wiley, 2013


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SEMESTER II

U25PH201	Medical Physics	Category: BSC				
		L	T	P	J	C
		2	0	0	2	3

COURSE OBJECTIVES:

- To acquire the basics of atomic physics and non-ionizing radiation
- To inculcate the principles behind senses and radioactive nuclides
- To gain the knowledge of interaction of radiation and its effects in human body

COURSE OUTCOMES:

CO 1: Classify the types of senses, vision, and audition	Understand
CO 2: Summarise the basics of atomic physics and non – ionizing radiation	Understand
CO 3: Utilise the concepts of radioactivity and radionuclides in various medical applications	Apply
CO 4: Examine the interaction of radiation with matter and its clinical significance	Analyze
CO 5: Analyse the radiation exposure, dosage effects and prevention measures	Analyze

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: PHYSICS OF THE SENSES

6 + 6

Cutaneous sensation – The chemical senses: Gustation, Taste equation, Olfaction – Audition – Doppler effect – Vision – Psychophysics (Introduction)

UNIT II: ATOMIC PHYSICS AND NON-IONIZING RADIATION

6 + 6

Atomic Physics: Absorption and Emission of light – Zeeman effect – Anomalous Zeeman effect – Stark effect – Non-ionizing electromagnetic radiation: Low frequency effects and High frequency effects

UNIT III: PRINCIPLES OF RADIOACTIVE NUCLIDES

6 + 6

Radioactive Decay – Isomeric Transition – Sources of Radioisotopes: Natural and artificial radioactivity – Radionuclide – Cyclotron and reactor produced Radionuclide – Medical applications

UNIT IV: INTERACTION OF RADIATION WITH MATTER

6 + 6

Interaction of charged particles with matter – Specific ionization – Linear energy transfer range, Bremsstrahlung, Annihilation – Interaction of X-ray with matter – Interaction of neutron with matter and their clinical significance (Radiation Dosimetry)

UNIT V: RADIATION QUANTITIES AND RADIATION EFFECTS**6 + 6**

Radiation Quantities: Inverse square law – KERMA and absorbed dose – Stopping power – Bragg's curve – Concept of LD50
 Radiation Effects and Prevention Measures: Stochastic and Non-stochastic effects – Principles of radiation protection in diagnostic medical exposure – Individual prevention measures

LIST OF PROJECTS

1. How Sound Travels: Demonstrating the Doppler Effect
2. Taste and Smell Sensitivity Test
3. Basic Light Perception Test
4. Spectra Observation with a DIY Spectroscope
5. Non-Ionizing Radiation Around Us
6. Mini Research: Zeeman and Stark Effect
7. Radioactivity in Everyday Life
8. Model of a Cyclotron (Craft Project)
9. Applications of Radioisotopes in Medicine
10. Radiation Penetration: A Simulation
11. Bragg Curve Visualization
12. Basic Dosimetry Concept Presentation
13. Inverse Square Law with Light
14. Radiation Safety Poster
15. Role-Play: Hospital Radiation Safety Drill

CONTACT PERIODS:

Lecture: 30 Periods Tutorial: - Periods Practical: - Periods Project: 30 Periods Total: 60 Periods

TEXTBOOKS:

1. Brown B. H., Smallwood R. H., Barber D., Lawford P. V and Hose D. R., "Medical Physics and Biomedical Engineering", 1st edition, CRC Press, 2017
2. Rachel A. Powsner, Edward R. Powsner, "Essentials of Nuclear Medicine Physics and Instrumentation", 4th edition, Wiley-Blackwell, West Sussex, 2022

REFERENCES:

1. Muhammad Maqbool "An Introduction to Medical Physics" 2017 edition, Springer, 2018
2. Woodcock J. P., "Ultrasonics Medical Physics Handbook – 1", Adam Hilger Ltd, Bristol, 2002
3. Attix F H, "Introduction to Radiological Physics and Radiation dosimetry", Wiley – VCH, Verlag, 2004
4. Meredith W. J. and Massey J. B., "Fundamental Physics of Radiology", Varghese Publishing house, 1992
5. <https://nptel.ac.in/courses/115103101>

SEMESTER II

U25CY201	Environmental Science and Sustainability (Common to all programmes)	Category: BSC				
		L	T	P	J	C
		1	0	2	0	2

COURSE OBJECTIVES:

- To provide the basic concepts of ecosystems, biodiversity, air and water systems and how to protect them
- To analyze the effects of human activities on the lithosphere, waste generation, and environmental health, and evaluate disaster management and technological solutions
- To apply the principles of sustainable living and green technologies in alignment with the UN Sustainable Development Goals

COURSE OUTCOMES:

- CO 1: Utilize the ecosystem and biodiversity conservation concepts to address environmental issues Apply
- CO 2: Implement atmospheric and hydrospheric concepts for water quality parameter determination. Apply
- CO 3: Develop effective strategies to manage land-use challenges, agricultural issues, and waste management practices Apply
- CO 4: Utilize technological tools to monitor environmental issues, resource recovery, and pollution control processes Apply
- CO 5: Implement sustainable development strategies for green practices and waste management Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: ENVIRONMENTAL SCIENCE AND BIODIVERSITY

3 + 6

Ecosystems – Classification, Structure, Energy Flow, Ecological Succession – Biodiversity – Importance, Values and Levels – India as a Mega-diversity Nation – Red Data Book, Hotspots and Conservation of Biodiversity Self-Learning and Case Studies – Wildlife Crime in India (Poaching) – Man and Wildlife Conflict (e.g., Elephant-Human conflict in Odisha or Assam)

UNIT II: ATMOSPHERE AND HYDROSPHERE

3 + 6

Atmosphere – Structure, Climatic Zones, Air Quality Standards (National & WHO), Air Pollution – Causes, effects, control measures, Carbon Emissions – Greenhouse Effect, Global Warming. Hydrosphere – Hydrological Cycle – Water Quality Parameters, water pollution – Causes, effects, control measures, Overutilization of Ground Water – Water Conservation Strategies, Microplastics as emerging pollutants-Causes, effects and control measures Self-Learning and Case Studies – Atmosphere – Urban air quality (Delhi, Beijing case), Hydrosphere – (National Water Mission (NAPCC), NRCP, Jal Shakti Abhiyan – Cape Town Water Crisis (2017–2018)

UNIT III: LITHOSPHERE AND SOLID WASTE MANAGEMENT**3 + 6**

Lithosphere – Composition, Plate tectonics, continental drift, Soil Nutrients, Nitrogen cycles, Soil Pollution – Causes, effects (Land degradation, desertification) and control measures, Agriculture – Problems of modern agriculture. E-waste-causes, effects and control measures. Solid Waste Management – Types & Sources of waste, waste management processes. Self-Learning and Case Studies - (Land degradation – Rajasthan - Soil erosion – Narmada River Basin, MP – Desertification – Thar Desert – Eco buddy program).

UNIT IV: GLOBAL ISSUES, HUMAN WELFARE AND ROLE OF TECHNOLOGY**3 + 6**

Disasters & Disaster management cycle – Floods, Landslides, Land Clearing Projects – Dam sites, Highways projects. Resettlement and Rehabilitation (R&R). Population – Global and national growth patterns, Population explosion, Role of information Technology (IT) in Environmental studies and human health monitoring. Self-Learning and Case Studies – Use of IT in environmental monitoring (GIS, Remote Sensing, sensors, data loggers) Pollution Monitoring – Water, Air.

UNIT V: SUSTAINABLE DEVELOPMENT AND GREEN PRACTICES**3 + 6**

Sustainable Development – Introduction, Concepts and Strategies, Sustainable Practices and Circular Economy – 5Rs, Zero Waste Lifestyle Sustainable Development – Introduction, Concepts and Strategies, Sustainable Practices and Circular Economy – 5Rs, Zero Waste Lifestyle. Sustainable Agriculture, Green Technologies – Green Chemistry and reagent in industries, Environmental Management – ISO 14001:2004, energy efficiency, sustainable transport, carbon sequestration. Self-Learning and Case Studies - Overview of United Nations SDGs (focus on SDGs 6, 7, 11, 12, 13), Role of India in implementing SDGs, Ambikapur, Chhattisgarh – Zero waste city model, Pune, Maharashtra – Integrating informal waste sector, Delhi Metro – Energy efficiency, carbon credits from regenerative braking, solar power use, Kochi, Kerala – Sustainable urban transport with water metro and public transit integration.

LIST OF EXPERIMENTS

1. Estimation of hardness (total, temporary, permanent) in water samples
2. Iodometric / Argentometric determination of available chlorine in a sample of bleaching powder.
3. Estimation of dissolved oxygen in water.
4. Determination of nitrate/ammonium estimation — colorimetric tests for nitrate/ammonium to study N availability
5. Recovery of Aluminum from waste materials.
6. Photocatalytic degradation of dye using TiO_2 .
7. Synthesis of biodiesel from vegetable oil.
8. Coir pith composting and application study.
9. Determination of conductivity, TDS and turbidity test for potable water

CONTACT PERIODS:

Lecture: 15 Periods Tutorial: - Periods Practical: 30 Periods Project: - Periods Total: 45 Periods

TEXTBOOKS:

1. E. Bharucha, "Environmental Studies for Undergraduate Courses", 2nd edition, Hyderabad, University Press (India) Pvt. Ltd., 2005
2. R. Rajagopalan, "Environmental Studies: From Crisis to Cure", 3rd edition, New Delhi: Oxford University Press, 2016
3. A. Kaushik and C. P. Kaushik, "Environmental Science and Engineering" 5th edition, New Delhi: New Age International Publishers, 2019
4. R. R. Hiremath, "Sustainable Development", 1st edition, New Delhi: Himalaya Publishing House, 2008

5. P. D.Sharma, "Ecology and Environment" 13th edition, Meerut: Rastogi Publications, 2020

REFERENCES:

1. P. Meenakshi, "Elements of Environmental Science and Engineering" 1st edition, New Delhi: Prentice Hall of India, 2005
2. G. R. Chatwal and Harish Sharma, "A Textbook of Environmental Studies" 3rd edition, Mumbai: Himalaya Publishing House, 2018
3. A. Kumar, "Environmental Studies", Revised edition, Patna: Bharati Bhawan Publishers & Distributors, 2019
4. V. Desai, "Environment and Sustainable Development" 1st edition, Mumbai: Himalaya Publishing House, 2009
5. G. K. Taneja, Gopal and S. C. Sharma, "Environmental Sustainability and Development", 2nd edition, New Delhi: Deep and Deep Publications, 2010



HOD BIOMEDICAL ENGINEERING
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SEMESTER II

U25CSG05	Computational Problem Solving using Python (Common to AD, AM, BM, CB, CS, EC, EE, IT, SC)	Category: ESC				
		L	T	P	J	C
		2	0	2	0	3

COURSE OBJECTIVES:

- To introduce the foundational concepts of Python programming
- To equip students with skills in functional and object-oriented programming
- To develop proficiency in core data structures and file handling techniques
- To enable learners to apply Python for real-world data analysis and visualization

COURSE OUTCOMES:

CO 1:	Understand basic Python syntax, data types, and debugging using script and interactive modes	Understand
CO 2:	Develop programs using conditionals, loops, functions, recursion, and apply appropriate variable scopes	Apply
CO 3:	Implement object-oriented concepts and manipulate Python collections using slicing, aliasing, and comprehension	Apply
CO 4:	Perform file operations, handle exceptions, and manage modules, packages, and dependencies in Python	Apply
CO 5:	Apply NumPy, Pandas, and visualization tools to perform data analysis and generate real-world insights	Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: PYTHON BASICS AND PROGRAMMING CONSTRUCTS

6 + 6

Python interpreter – Script and interactive mode – Execution flow – Data types – Variables – Expressions – Statements – Operators – IO Operations – Comments – Error types – Debugging techniques – Basic IDE usage

UNIT II: CONTROL STRUCTURES AND FUNCTIONAL PROGRAMMING

6 + 6

Conditional statements – Boolean logic – Loops – Function definition – Function arguments and its types – Return values – Scope – Recursion

UNIT III: CORE DATA STRUCTURES AND OBJECT ORIENTED PROGRAMMING

6 + 6

Python Collections and Data Manipulation: String – List – Tuples – Set – Dictionary – Slicing, Mutability, Aliasing, Packing and unpacking – List comprehension. Classes and Object Oriented Programming (OOP) – Class definition – Constructors – Instance methods – Inheritance – Method overloading and overriding.

UNIT IV: FILE HANDLING, EXCEPTIONS, AND MODULES**6 + 6**

Text and CSV file operations: File operations – Handling using with keyword. Exception handling: Try, Except, Else, Finally, Custom exceptions – Command line arguments using sys.argv – Modules, Packages and Virtual environments – Managing dependencies with PIP

UNIT V: DATA ANALYSIS AND VISUALISATION WITH COMPUTATIONAL THINKING**6 + 6**

NumPy: Slicing, Broadcasting and Vectorized Operations. Pandas: Series and Data frames – Reading and writing files – Data Filtering, Sorting, Grouping and Aggregation. Visualization: Matplotlib

LIST OF EXPERIMENTS

1. Demonstrating Python Programming Using Simple Statements and Expressions
2. Solving Problems Using Decision Making and Looping Constructs
3. Creating Programs Using Lists, Tuples, and Sets
4. Manipulating Data Using Dictionaries
5. Handling Exceptions and String Operations in Python
6. Implementing Programming Using User-Defined and Recursive Functions
7. Implementing Object-Oriented Programming Using Classes and Inheritance
8. Performing File Operations and Using Python Modules
9. Exploratory Data Analysis Using NumPy and Pandas
10. Data Visualization Using Matplotlib

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. Reema Thareja, "Python programming: Using problem solving approach", 1st Edition, Oxford Press, 2017
2. William McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, 2nd Edition, Shroff/O'Reilly Publication, 2017

REFERENCES:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016
2. Ashok Namdev Kamthane and Amit Ashok Kamthane, "Programming and Problem Solving with Python", 2nd Edition, McGrawHill Education, 2018
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", 1st Edition, Pearson India Education Services Pvt. Ltd., 2016



HO'D BIOMEDICAL ENGINEERING
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SEMESTER II

U25CEG01	Basics of Civil Engineering (Common to AD, AM, BM, CB, CS, EC, EE, IT, SC)	Category: ESC				
		L	T	P	J	C
		1	0	2	0	2

COURSE OBJECTIVES:

- To provide knowledge about different types of building materials
- To teach the difference between conventional and modern infrastructure systems

COURSE OUTCOMES:

CO 1:	Explain traditional and modern building materials, their properties, and applications	Understand
CO 2:	Describe substructure and superstructure components with their functions and construction methods	Understand
CO 3:	Discuss basic concepts of highways, railways, airways, and waterways	Understand
CO 4:	Explain BIM principles, green building concepts, and smart city planning	Understand
CO 5:	Describe sustainable practices in material selection, solid waste management, and eco-friendly construction	Understand

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: BUILDING MATERIALS AND COMPONENTS

9 + 25

Building Materials: Introduction – Bricks – Stones – Sand – Aggregate – Cement – Mortar – Concrete – Steel – Wood – Smart materials. Surveying: Objects – Classification – Sub Structures: Soil Classification – Bearing capacity – Foundation – Function – Requirements – Types of foundations – Super Structures: Brick masonry – Stone masonry – Beams – Columns – lintels – Roofing – Flooring – Plastering – Damp proofing – Weathering course

UNIT II: BASIC INFRASTRUCTURE AND TRANSPORTATION

6 + 5

Introduction to Highways – Railways – Airways and Waterways – Building Information Modeling (BIM) – Solid waste management system – Concept of Green Building – Benefits of Green Buildings – Green Building Materials – Smart Cities

LIST OF EXPERIMENTS

1. Compressive Strength test on Bricks
2. Water absorption test on Bricks
3. Water absorption test on coarse aggregates
4. Impact Test on aggregates
5. Determination of Specific gravity of soil solids

6. Study on Centre line marking for building components - Foundations

CONTACT PERIODS:

Lecture: 15 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. S K Duggal, "Building Materials", Sixth Edition, New Age International Publishers, 2025
2. Sharma. S.K, "Civil Engineering Construction Materials", Khanna Publishing House, New Delhi, 2024

REFERENCES:

1. K.K. Dwivedi and K.K. Shukla, "Basic Civil Engineering & Engineering Mechanics", Dhanpat rai & Co PVT Ltd., 2020
2. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", 10th Edition, Scitech Publications (India), Chennai, 2018



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SEMESTER II

U25ECG01	Basics of Electronics Engineering (Common to AD, AM, BM, CB, CE, CS, IT, SC)	Category: ESC				
		L	T	P	J	C
		1	0	2	0	2

COURSE OBJECTIVES:

- To study about the basic electronics components and their applications
- To explore operational amplifiers for different applications
- To introduce Arduino programming

COURSE OUTCOMES:

CO 1: Analyze the characteristics of diodes & BJT and implement simple applications

Analyze

CO 2: Construct various applications using operational amplifier

Apply

CO 3: Implement simple applications using Arduino controller

Apply

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	3	2	2	-	-	-	2	2	-	1	-	-
CO 2	3	2	1	1	-	-	-	2	2	-	1	-	-
CO 3	3	2	1	1	2	-	-	2	2	-	1	-	-

SYLLABUS:

UNIT I: BASIC ELECTRONIC COMPONENTS AND APPLICATIONS

5 + 10

PN junction diode and Zener diode – Bipolar Junction Transistor – Metal Oxide Semiconductor Field Effect Transistor – Applications of PN diode – SMPS

UNIT II: OPERATIONAL AMPLIFIER

5 + 10

Operational amplifier – Ideal characteristics – Inverting and non-inverting amplifier – Applications of op-amp – Adder, subtractor, integrator, differentiator and comparator

UNIT III: ARDUINO PROGRAMMING

5 + 10

Introduction to microprocessor and microcontroller – Arduino UNO – Architecture, pin diagram – I/O functions

LIST OF EXPERIMENTS

1. Plot V-I characteristics of PN diode and Zener diode
2. Plot input and output characteristics of BJT
3. Construct a half wave and full wave rectifier using PN diode
4. Design the power supply circuits using passive and active components
5. Verify the operation of adders and subtractor circuit using op-amps
6. Simple application program using Arduino UNO

CONTACT PERIODS:

Lecture: 15 Periods

Tutorial: - Periods

Practical: 30 Periods

Project: - Periods

Total: 45 Periods

TEXTBOOKS:

1. S. Salivahanan, N. Sureshkumar, A. Vallavaraj, "Electronic Devices and Circuits", 3rd edition, Tata McGraw Hill, 2010
2. Donald A Neaman, "Semiconductor Physics and Devices", 4th edition, Tata McGraw Hill, 2012

REFERENCES:

1. R. S. Sedha, "A Textbook of Applied Electronics", 3rd edition, S.Chand & Company Ltd, 2013
2. Robert L Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 11th edition Pearson India Education Services (P) Ltd., 2015
3. Roy Chaudary, "Linear Integrated Circuits", 6th edition, New Age International Publishers, 2021
4. J.M. Hughes, "Arduino: A Technical Reference", 1st edition, O'Reilly Media Inc, 2016



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SEMESTER II

U25EEG01	Basics of Electrical Engineering (Common to AD, AM, BM, CB, CE, CS, EC, IT, SC)	Category: ESC				
		L	T	P	J	C
		1	0	2	0	2

COURSE OBJECTIVES:

- To introduce the fundamentals of electric circuits, power systems, and basic electrical measurements
- To provide an understanding of electrical machines and SMPS with relevance to computing applications
- To create awareness of electrical installations, safety practices, and protective systems in practical environments

COURSE OUTCOMES:

CO 1: Analyse basic electrical circuits using Ohm's and Kirchhoff's laws	Analyze
CO 2: Measure electrical quantities using appropriate instruments	Understand
CO 3: Explain the working principles and applications of Electrical Machines and SMPS	Understand
CO 4: Identify the components of residential electrical installations	Apply
CO 5: Apply electrical safety procedures and identify protective devices used in electrical systems	Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: FUNDAMENTALS OF ELECTRIC CIRCUITS AND MEASUREMENTS 5 + 10

Ohm's Law, Kirchhoff's Laws (KVL, KCL) – Series and parallel circuits, voltage and current division – Introduction to AC and DC supply – Power, energy, and power factor – Basic measuring instruments: Voltmeter, Ammeter, Wattmeter, Energy Meter

UNIT II: ELECTRICAL MACHINES AND POWER CONVERSION DEVICES 5 + 10

Single Phase Transformer, DC Machines and Three Phase Induction Motor: Working principle, types, and applications – Stepper and Servo motors: Basics and applications – Switched Mode Power Supply: concept, types (buck, boost, buck-boost), and applications

UNIT III: ELECTRICAL INSTALLATIONS AND SAFETY 5 + 10

Components of a simple electrical installation – Earthing, Fuses, MCB, ELCB – Single-line diagram of a residential system – Introduction to batteries, UPS and inverters – Electrical safety measures and shock preventions

LIST OF EXPERIMENTS

1. Verification of Ohm's Law and Kirchhoff's Laws
2. Measurement of voltage, current, and power in DC circuits
3. Load test on a single-phase transformer



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B.E. - BM - R2025 - CBCS

4. Speed control of DC motor
5. Starting and reversal of direction of a three-phase induction motor
6. Demonstration of SMPS and UPS operation

CONTACT PERIODS:

Lecture: 15 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. D.P. Kothari and I.J. Nagrath, "Basic Electrical Engineering", 4th edition, Tata McGraw Hill, 2024
2. V.K. Mehta & Rohit Mehta, "Principles of Electrical Engineering and Electronics", 2nd revised edition, S. Chand, 2019

REFERENCES:

1. D.P. Kothari and I.J. Nagrath, "Basic Electrical and Electronics Engineering", 2nd edition, Tata McGraw Hill, 2020
2. M.H. Rashid, "Power Electronics: Circuits, Devices and Applications", 4th edition, Pearson Education, 2023
3. Hughes, "Electrical and Electronic Technology", Pearson Education, 12th edition, 2016



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SEMESTER II

U25MEG02	Basics of Mechanical Engineering (Common to AD, AM, BM, CB, CE, CS, EC, EE, IT, SC)	Category: ESC				
		L	T	P	J	C
		1	0	2	0	2

COURSE OBJECTIVES:

- To provide the fundamental knowledge of mechanical elements, actuation systems, and manufacturing processes essential for engineering applications
- To develop an understanding of energy conversion, thermodynamics, heat transfer, fluid mechanics, and power generation systems for solving practical problems

COURSE OUTCOMES:

- CO 1:** Identify the mechanical elements and actuation systems used in basic engineering applications Understand
- CO 2:** Classify various manufacturing processes and distinguish between shaping, joining, and additive manufacturing methods Understand
- CO 3:** Interpret the concepts of thermodynamics, heat transfer, and fluid mechanics to practical engineering problems Understand
- CO 4:** Identify the various conventional and non-conventional methods of power generation Understand

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	2	1	-	-	-	1	-	1	1	-	-	-	-
CO 2	2	1	-	-	1	1	-	1	1	-	-	-	-
CO 3	2	1	-	-	-	-	-	1	1	-	-	-	-
CO 4	2	1	-	-	-	1	-	1	1	-	-	-	-

SYLLABUS:

UNIT I: MECHANICAL ELEMENTS AND ACTUATION SYSTEMS

3 + 8

Mechanical elements – Gears, chains, shaft, keys, coupling, bolts, nuts, screws, spring, bearings – Actuators – Hydraulics actuators, pneumatics actuators

UNIT II: FUNDAMENTALS OF MANUFACTURING PROCESSES

4 + 4

Introduction to manufacturing – Classification of manufacturing processes – Shaping processes – Casting, molding, powder metallurgy, additive manufacturing (FDM, SLA) – Joining processes – Arc welding, brazing and soldering

UNIT III: BASICS OF THERMAL AND FLUID SYSTEMS

4 + 12

Basic thermodynamics concepts – System, surroundings, properties, state, process, cycle, laws of thermodynamics and its application – Heat transfer basics – Modes of heat transfer – Conduction, convection, and radiation (basic explanation with examples) – Properties of fluids – Density, specific gravity, viscosity, surface tension, capillarity – Pressure and measurements, pascal's law – Types of fluid flow – Introduction to pumps and its types


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UNIT IV: ENERGY CONVERSION SYSTEMS

4 + 6

Introduction to IC and EC Engines – General layout and working of electric vehicle – Power plant – Working and types – Thermal power plant – Hydro power plant – Nuclear power plant – Gas power plant

LIST OF EXPERIMENTS

1. Determine the velocity ratio using simple and compound gear trains
2. Construct and demonstrate a basic pneumatic circuit using single-acting and double-acting cylinders
3. Demonstrate the working of 3D printer by printing a simple object
4. Determination of heat transfer coefficient under natural convection from vertical cylinder
5. Verification of Bernoulli's theorem
6. Performance characteristics of a centrifugal pump
7. Demonstration on IC engine components

CONTACT PERIODS:

Lecture: 15 Periods Tutorial: - Periods Practical: 30 Periods Project: - Periods Total: 45 Periods

TEXTBOOKS:

1. Pravin Kumar, "Basic Mechanical Engineering", 3rd Edition, Pearson Education India, 2018
2. H. S. Bawa, "Manufacturing Processes", Latest Edition, Tata McGraw-Hill Education, 2004

REFERENCES:

1. P. K. Nag, "Engineering Thermodynamics", 6th Edition, Tata McGraw Hill Education, 2017
2. Godfrey C. Onwubolu, "Mechatronics: Principles and Applications", 1st Edition, Elsevier, 2006
3. P. K. Nag, "Power Plant Engineering", 4th Edition, McGraw Hill Education, 2017


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SEMESTER II

U25BM201	Analog Electronics for Biomedical Applications	Category: PCC				
		L	T	P	J	C
		1	0	2	0	2

PRE-REQUISITES:

- U25BM101 - ELECTRONIC DEVICES AND CIRCUITS

COURSE OBJECTIVES:

- To develop a comprehensive understanding of operational amplifiers (ideal & practical) and their applications in biosignal conditioning and processing
- To apply design and experimental skills in constructing biomedical circuits (amplifiers, filters, converters) using operational amplifiers for biosignal acquisition and analysis

COURSE OUTCOMES:

CO 1: Illustrate the operation of ideal and practical operational amplifiers	Understand
CO 2: Determine the performance characteristics of operational amplifiers	Apply
CO 3: Construct the converters using operational amplifiers to digitalize the biosignals	Apply
CO 4: Apply the principles of operational amplifiers to design biosignal conditioning circuits	Precision
CO 5: Experiment with ICs to implement and test biosignal processing circuits	Precision

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: BASICS OF OPERATIONAL AMPLIFIERS

5

Ideal Operational Amplifier – General Operational Amplifier – Configurations: Inverting, Non-inverting and Buffer amplifier – Differential and Common – Mode Operation

UNIT II: CHARACTERISTICS OF OPERATIONAL AMPLIFIERS

5

AC performance characteristics: Frequency response, Bandwidth and Slew rate – DC performance characteristics: Input bias current, Input offset current and Input offset voltage

UNIT III: DIGITIZING BIOSIGNALS

5

Digital to Analog Conversion: R-2R Ladder type – Sample-and-hold circuits – Analog to Digital Conversion: Successive Approximation type – Converter Performance Specifications

UNIT IV: BIOSIGNAL CONDITIONING

15

Design of Summing and Difference Amplifier – Design of Differentiator and Integrator – Design of Instrumentation Amplifier – Design of Comparators – Design of Active Filters

UNIT V: BIOREFERENCE GENERATORS

15

Sine waveform: Wien Bridge Oscillator and Phase Shift Oscillator – Square waveform: Schmitt trigger – Triangular waveform – Sawtooth waveform

CONTACT PERIODS:

Lecture: 15 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 4 th Edition, McGraw-Hill Education, 2016
2. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", 6 th Edition, New Age International Pvt.Ltd., 2021

REFERENCES:

1. Robert F.Coughlin, Frederick F.Driscoll, "Operational Amplifiers and Linear Integrated Circuits", 6 th Edition, Prentice Hall, 2001
2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 11 th Edition, Pearson Education, 2015



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SEMESTER II

U25LEG05	German for Engineers - II (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

COURSE OBJECTIVES:

- To improve comprehension of real-life conversations in familiar everyday situations (shopping, dining, describing spaces, etc.)
- To develop fluency in expressing preferences, describing people, homes, and daily routines using basic sentence structures
- To build competence in writing short, structured texts such as messages, descriptions, and informal communications

COURSE OUTCOMES:

- CO 1: Engage in simple conversations while shopping, dining, or asking for information using appropriate Remember vocabulary and phrases
- CO 2: Describe people, homes, weather, and daily routines using structured sentences with correct grammar Understand
- CO 3: Read and interpret simple texts such as product labels, menus, signs, and weather updates Understand
- CO 4: Write short messages or descriptions related to everyday topics like hobbies, weather, or family Understand
- CO 5: Apply core grammatical rules such as adjective endings, possessive pronouns, and prepositions of place Apply with improved accuracy

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: EVERYDAY SHOPPING AND DINING

6 + 3

Shopping for groceries and clothes – Ordering food and drinks at a restaurant – Talking about prices and quantities – Expressing preferences – Reading menus, labels, and receipts – Grammar: Accusative case review with articles and adjectives, Plural forms of nouns, Adjective endings in nominative and accusative – Cultural Focus: Eating habits in Germany, Austria, and Switzerland – Supermarket etiquette – Restaurant culture – Tipping practices

UNIT II: PEOPLE AND PERSONAL INTERESTS

6 + 3

Talking about family and relationships – Describing people's appearance and personality – Hobbies and free time activities – Likes and dislikes – Grammar: Possessive pronouns - Adjective endings with possessive pronouns – Word order in main clauses – Cultural Focus: Family structures – Popular hobbies and sports – Work-life balance in German-speaking countries

UNIT III: HOME AND LIVING**6 + 3**

Describing your home and rooms – Furniture and household items – Talking about home layout and comfort – Grammar: Two-way prepositions with accusative/dative – Use of es gibt – Describing location vs. movement – Cultural Focus: Typical German homes – Living arrangements – Interior design norms

UNIT IV: SEASONS AND WEATHER**6 + 3**

Talking about weather and seasons – Seasonal activities – Preferences for seasons – Grammar: Temporal phrases – Review of present tense verb usage with seasonal context – Use of weil (because) – Cultural Focus: Seasonal festivals like Weihnachten and Oktoberfest – Weather patterns in German speaking countries

UNIT V: PUTTING IT TOGETHER – DAILY LIFE**6 + 3**

Combining shopping – Personal life – Home, and seasonal activities into daily routines – Conversational practice across units – Grammar: Practice of main and subordinate clauses – Sentence structure review – Verb position with weil and prepositions – Cultural Focus: Daily routines in Germany – Overview of regional variations in culture and habits

LIST OF EXPERIMENTS

1. Prepare a city map
2. Video: Talk about your daily routine
3. Describe your school (using past tense)
4. Presentation related to culture
5. Dialogue roleplay
6. Mock interview

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 15 Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. Buscha, A., & Szita, S., "Begegnungen Deutsch als Fremdsprache A1+: Integriertes Kurs- und Arbeitsbuch," 1st Edition, 2021
2. Brüseke, R., "Grammatik leicht A1," 1st Edition, 2019

REFERENCES:

1. Netzwerk Deutsch als Fremdsprache A1, 1st Edition: BlueNBells, 2012
2. Huber, K., & Keller, F., "DaF kompakt A1: Deutsch als Fremdsprache," 3rd Edition, Langenscheidt, 2018



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SEMESTER II

U25LEG06	Japanese for Engineers - II (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

COURSE OBJECTIVES:

- To improve comprehension of real-life conversations in familiar everyday situations (shopping, dining, describing spaces, etc.)
- To develop fluency in expressing preferences, describing people, homes, and daily routines using basic sentence structures
- To build competence in writing short, structured texts such as messages, descriptions, and informal communications

COURSE OUTCOMES:

- CO 1:** Engage in simple conversations while shopping, dining, or asking for information using appropriate vocabulary and phrases Remember
- CO 2:** Describe people, homes, weather, and daily routines using structured sentences with correct grammar Understand
- CO 3:** Read and interpret simple texts such as product labels, menus, signs, and weather updates Understand
- CO 4:** Write short messages or descriptions related to everyday topics like hobbies, weather, or family Understand
- CO 5:** Apply core grammatical rules such as adjective endings, possessive pronouns, and prepositions of place with improved accuracy Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: SHOPPING AND QUANTITIES

6 + 3

Shopping-related expressions – Asking prices and quantities – Counting objects with counters: ～つ, ～人, ～枚, ～本 – Describing wants using ～がほしいです – Offering and requesting using ～をください – Grammar: Verbs in -masu form (かいます, かります, あげます, もらいます) – Particles: と, や, から, まで – Sentence structures: ～があります / ～がいます, ～は～にあります – Vocabulary: Money, items, colors, shops – Kanji: Numbers (一～十), Days (日, 月, 火) – Basic shopping terms – Cultural note: Japanese currency – Store etiquette – Giving/receiving customs

UNIT II: DAILY LIFE AND TIME EXPRESSIONS

6 + 3

Talking about schedules and habits – Expressing future plans using time expressions and verb tense – Grammar: Verb conjugation (non-past affirmative/negative) – Introduction to te-form: ～てください, ～てもいいです – Sequence with ～てから – Frequency expressions: ～まいにち, ～ときどき, ～よく – Vocabulary: School/work schedule, leisure activities, public places, transportation – Kanji: Days of the week (月, 火, 水, 木, 金, 土, 日) – Time-related (時, 分, 半) – Motion verbs (行く, 来る, 帰る) – Cultural note: Japanese daily routines – Work-life balance, punctuality

UNIT III: MAKING REQUESTS AND SEQUENCING ACTIONS**6 + 3**

Talking about likes and dislikes: ～が好きです / ～がきらいです – Describing abilities: ～がじょうずです / ～がへたです – Vocabulary: Hobbies, sports, entertainment terms – Inviting someone using ～ませんか – Accepting or declining invitations: いいですね / ちょっと – Grammar: Verb forms for expressing preference and intention – Particle: が for subject in expressions of ability and preference – Kanji: Verbs related to hobbies (見, 聞, 読, 書, 食) – Nouns related to interests – Cultural note: Popular hobbies in Japan – Seasonal pastimes – Communication norms in social invitations

UNIT IV: HOBBIES AND PREFERENCES**6 + 3**

Asking and giving directions – Describing locations of people and things – Using maps and signs – Grammar: Particles に and で for location and direction – Expressions: ～のまえに, ～のとなり, ～のなかに – Vocabulary: Places in town – Transportation terms – Directional phrases – Kanji: Location and place words (駅, 右, 左, 上, 下, 中) – Common public signs – Cultural note: Navigating Japanese cities – Polite phrases for asking directions – Public transport norms

UNIT V: ABILITIES AND SOCIAL INTERACTIONS**6 + 3**

Review of shopping – Preferences, routines, and directions – Roleplays: at the store, planning a weekend – Inviting a friend – Asking for help and giving opinions – Grammar: Integrated use of learned verb forms and particles – Vocabulary: Reinforcement through conversation – Kanji: Mixed use in real-life contexts – Cultural note: Everyday conversation etiquette – Blending formal and informal speech – Real-life scenarios in Japan

LIST OF EXPERIMENTS

1. Prepare a city map
2. Video: Talk about your daily routine
3. Describe your school (using past tense)
4. Presentation related to culture
5. Dialogue roleplay
6. Mock interview

CONTACT PERIODS:

Lecture: 30 Periods Tutorial: - Periods Practical: 15 Periods Project: - Periods Total: 45 Periods

TEXTBOOKS:

1. 3A Corporation, "Minna no Nihongo Shokyū I: Main Textbook," 2nd Indian Edition, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2018
2. Banno, Eri, Yutaka Ohno, Yoko Sakane, Chikako Shinagawa, and Kyoko Tokashiki, "Genki I: An Integrated Course in Elementary Japanese," 3rd Edition, The Japan Times Publishing, Tokyo, 2020

REFERENCES:

1. Yamada, M., & Fujita, T., "Japanese for Beginners: A Practical Approach," 1st Edition, Tuttle Publishing, 2019
2. Takahashi, A., & Sato, M., "Nihongo Pro: Japanese for N5 Level," 1st Edition, KADOKAWA, 2018



SEMESTER II

U25LEG07	French for Engineers - II (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

COURSE OBJECTIVES:

- To improve comprehension of real-life conversations in familiar everyday situations (shopping, dining, describing spaces, etc.)
- To develop fluency in expressing preferences, describing people, homes, and daily routines using basic sentence structures
- To build competence in writing short, structured texts such as messages, descriptions, and informal communications

COURSE OUTCOMES:

- CO 1: Engage in simple conversations while shopping, dining, or asking for information using appropriate Remember vocabulary and phrases
- CO 2: Describe people, homes, weather, and daily routines using structured sentences with correct grammar Understand
- CO 3: Read and interpret simple texts such as product labels, menus, signs, and weather updates Understand
- CO 4: Write short messages or descriptions related to everyday topics like hobbies, weather, or family Understand
- CO 5: Apply core grammatical rules such as adjective endings, possessive pronouns, and prepositions of place Apply with improved accuracy

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: FOOD AND SHOPPING ESSENTIALS

6 + 3

Food items – Quantities – Packaging – Prices – Navigating markets and stores – Asking for prices and quantities – Expressing preferences and choices – Grammar: Partitive articles (du - de la - des) – Expressions of quantity (un kilo de - beaucoup de - etc.) – Use of il y a – Verb prendre (to take) – Vouloir (to want) – Acheter (to buy) in the present tense – Cultural Focus: French culinary culture – Market etiquette – Typical meals and menus

UNIT II: DINING OUT AND CAFÉ CULTURE

6 + 3

Ordering in a café or restaurant – Understanding menus – Making polite requests – Expressing likes and dislikes – Talking about meals – Grammar: Adjective placement and agreement with nouns – Review of present tense verbs – Questions and polite forms – Cultural Focus: Café culture in France and Francophone regions – Dining customs – Tipping practices

UNIT III: DESCRIBING HOME AND SURROUNDINGS**6 + 3**

Talking about where you live – Describing your home and rooms – Locating objects in a room – Discussing furniture and appliances – Grammar: Prepositions of place (sur - sous - devant - derrière - entre) – Demonstrative adjectives (ce - cette - ces) – Verb habiter and other -er verbs – Cultural Focus: Types of housing in France – Apartment etiquette – Real estate ads in Francophone cities

UNIT IV: DAILY ROUTINES AND PERSONAL DESCRIPTIONS**6 + 3**

Describing people – Talking about daily routines – Introduction to reflexive verbs – Using adverbs of place (ici - là-bas) – Giving simple directions – Grammar: Reflexive verbs (s'habiller, se lever) – Adverbs of place – Review of verb placement – Cultural Focus: Urban vs. rural living – Typical neighborhood life in French cities

UNIT V: LEISURE, WEATHER, AND SOCIAL LIFE**6 + 3**

Talking about hobbies and sports – Weekend activities – Making and responding to invitations – Expressing preferences and future intentions – Grammar: Verbs faire, aimer, préférer, sortir, aller – Contractions with à and de (au, du) – Near future tense (futur proche: aller + infinitive) – Use of on – Cultural Focus: Leisure activities in Francophone countries – Popular sports and pastimes – Social norms around outings and gatherings

LIST OF EXPERIMENTS

1. Prepare a city map
2. Video: Talk about your daily routine
3. Describe your school (using past tense)
4. Presentation related to culture
5. Dialogue roleplay
6. Mock interview

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 15 Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. Marie-José Lopes & Jean-Thierry Bougnec, "Inspire 2 A1-A2 Méthode de français," 1st Edition, Hachette Français Langue Etrangère, 2020
2. Gibbe, C., Berthet, A., & Hugot, C., "Édito A2: Méthode de français," 1st Edition, Didier, 2024

REFERENCES:

1. Chantal Fougères & Marc de la Harpe, "Le Nouveau Sans Frontières 2: Méthode de français A2," 1st Edition, Hachette FLE, 2020
2. Xavier Maingueneau, "Le Français pour les Nuls: A2-B1," 3rd Edition, Wiley, 2021



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SEMESTER II

U25LEG08	Hindi for Engineers - II (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

COURSE OBJECTIVES:

- To improve comprehension of real-life conversations in familiar everyday situations (shopping, dining, describing spaces, etc.)
- To develop fluency in expressing preferences, describing people, homes, and daily routines using basic sentence structures
- To build competence in writing short, structured texts such as messages, descriptions, and informal communications

COURSE OUTCOMES:

- CO 1:** Engage in simple conversations while shopping, dining, or asking for information using appropriate vocabulary and phrases **Remember**
- CO 2:** Describe people, homes, weather, and daily routines using structured sentences with correct grammar **Understand**
- CO 3:** Read and interpret simple texts such as product labels, menus, signs, and weather updates **Understand**
- CO 4:** Write short messages or descriptions related to everyday topics like hobbies, weather, or family **Understand**
- CO 5:** Apply core grammatical rules such as adjective endings, possessive pronouns, and prepositions of place with improved accuracy **Apply**

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: SHOPPING LANGUAGE AND NUMBER USAGE

6 + 3

Interacting in markets and shops – Asking prices and quantities – Expressing need and preference – Vocabulary: Fruits – Vegetables – clothes – Money terms – Numbers (1–100) – Classifiers: किलो - दर्जन – Use of polite requests – Grammar: Verbs चाहना - लेना - देना in present tense – Use of कुछ and कितना – Postpositions: के लिए - के पास – Emphatic words: ही - भी – Cultural note: Indian market etiquette – Bargaining norms – Respectful phrases for shopkeepers – Currency handling

UNIT II: DESCRIBING PEOPLE AND RELATIONSHIPS

6 + 3

Talking about family and people – Describing physical appearance and personality – Expressing family relations – Vocabulary: Family members – Descriptive adjectives – Colors – Body parts – Grammar: Adjective agreement by gender and number – Possessives with का/की/के – Verb होना in past tense (था/थी/थे) – Using का रिश्ता for relationships – Honorific subject-verb agreement – Cultural note: Kinship terms – Family address norms – Formal/informal differences – Indian respect systems

UNIT III: HOBBIES, LIKES, AND SOCIAL LANGUAGE**6 + 3**

Talking about hobbies and free time – Expressing likes and dislikes – Making suggestions and invitations – Vocabulary: Leisure activities – hobbies - entertainment words – Days of the week – Grammar: पसंद होना constructions – Compound verb use with करना (e.g., किताब पढ़ना) – Use of मुझे X पसंद है – Use of को for preferences – Future tense basics with गा/गी/गे – Cultural note: Indian leisure culture – Film and music – Inviting friends – Group social etiquette

UNIT IV: EVERYDAY CONVERSATIONS AND NEEDS**6 + 3**

Describing needs and routines in daily life – Making polite offers and requests – Talking about simple problems and solutions – Vocabulary: Basic needs – Services – Tools – simple household and health terms – Grammar: Requests with क्या आप...? – Use of चाहिए – Conditional phrases with अगर (if) – More on present vs. future tense use – Cultural note: Navigating services in India – Polite refusals – Help seeking expressions

UNIT V: RECAP AND REAL-LIFE PRACTICE**6 + 3**

Conversational roleplays: shopping – Family introductions – Hobby discussion – Describing routines and asking for help – Combining sentence structures from previous units – Vocabulary: Review and integrate all learned sets – Grammar: Review of verb tenses – Question structures – Postpositions – Honorifics – Cultural note: Integrating cultural etiquette with language use – Real-world scenarios for communication in Hindi

LIST OF EXPERIMENTS

1. Prepare a city map
2. Video: Talk about your daily routine
3. Describe your school (using past tense)
4. Presentation related to culture
5. Dialogue roleplay
6. Mock interview

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 15 Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. Pavithra Publications, "Spoken Hindi: Through Tamil," 2nd Edition, Pavithra Publications, Chennai, 2015
2. Dakshina Bharat Hindi Prachar Sabha, "Prathamik Text Book: New Syllabus," 1st Edition, Dakshina Bharat Hindi Prachar Sabha, Madras, 2023

REFERENCES:

1. Ganga, K., & Ramesh, V., "Learn Hindi in 30 Days: A Beginner's Guide," 3rd Edition, Hindi Academy, 2020
2. Vyas, S., "Spoken Hindi for Beginners," 1st Edition, Orient BlackSwan, 2018


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SEMESTER II

U25LEG10	Chinese for Engineers - II (Common to all programmes)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

COURSE OBJECTIVES:

- To improve comprehension of real-life conversations in familiar everyday situations (shopping, dining, describing spaces, etc.)
- To develop fluency in expressing preferences, describing people, homes, and daily routines using basic sentence structures
- To build competence in writing short, structured texts such as messages, descriptions, and informal communications

COURSE OUTCOMES:

- CO 1: Engage in simple conversations while shopping, dining, or asking for information using appropriate vocabulary and phrases **Remember**
- CO 2: Describe people, homes, weather, and daily routines using structured sentences with correct grammar **Understand**
- CO 3: Read and interpret simple texts such as product labels, menus, signs, and weather updates **Understand**
- CO 4: Write short messages or descriptions related to everyday topics like hobbies, weather, or family **Understand**
- CO 5: Apply core grammatical rules such as adjective endings, possessive pronouns, and prepositions of place with improved accuracy **Apply**

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: WOULD YOU LIKE TO HAVE COFFEE OR TEA?

6 + 3

Learning transposed objects – Learning how to express "too", "also" with 也 – Learning how to express "excessively" with 太.....了 – Learning numerical system in Chinese – Learning how to express "more than" with 多

UNIT II: WHERE IS MY WALLET?

6 + 3

Learning 在 as a verb with a place word – Learning location of an action (S + 在 + 處所詞 (PW) + 動作 (V)) – Learning how to express suggestion with 吧 – Learning noun + directional word as a place word – Learning existential sentences with 有

UNIT III: LET'S PLAY TENNIS THIS WEEKEND!

6 + 3

Learning how to express acquired skills with 會 (know how to) – Learning complement marker 得 – Learning 有(一)點(兒) as an adverb – Learning auxiliary verb 可以

UNIT IV: HOW MUCH IS THIS?

6 + 3

Learning new vocabulary for shopping – Learning measure words (個, 本, 張, 件) – Learning how to ask and answer about prices (多少錢). Using 塊, 毛, 分 for money – Practicing shopping dialogues

UNIT V: WHAT'S YOUR FAVORITE FOOD?

6 + 3

Learning new vocabulary for food and drinks – Learning common verbs for eating and drinking (吃, 喝) – Expressing preferences with 喜歡 / 不喜歡 – Using 還是 to make choices – Role-play: ordering food in a restaurant

LIST OF EXPERIMENTS

1. Prepare a city map
2. Video: Talk about your daily routine
3. Describe your school (using past tense)
4. Presentation related to culture
5. Dialogue roleplay
6. Mock interview

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 15 Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. Mandarin Training Centre, National Taiwan Normal University, Modern Chinese I 時代華語 I, Edited by Chih-Ping Chou, Taipei: Cheng Chung Book Company Ltd., 2019
2. Huayu101 / 華語101, Taiwan Ministry of Education, Taiwan Mandarin Educational Resources Centre, 2018

REFERENCES:

1. Cheng Chung Book Company Ltd, 時代華語 I 教師手冊 [Modern Chinese I Teacher's Manual, 2019
2. www.lmit.edu.tw/bag



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SEMESTER II

U25MCC06	Universal Human Values II (Common to all programmes)	Category: MCC				
		L	T	P	J	C
		2	1	0	0	3

PRE-REQUISITES:

- U25MCC01 - Universal Human Values I

COURSE OBJECTIVES:

- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature

COURSE OUTCOMES:

- CO 1:** Evaluate the significance of value inputs in formal education and start applying them in their life and Understand profession
- CO 2:** Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Understand Body, Intention and Competence of an individual, etc
- CO 3:** Analyze the value of harmonious relationship based on trust and respect in their life and profession Understand
- CO 4:** Examine the role of a human being in ensuring harmony in society and nature Understand
- CO 5:** Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession Understand

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: INTRODUCTION-BASIC HUMAN ASPIRATION, ITS FULFILLMENT THROUGH ALL ENCOMPASSING6 + RESOLUTION 3

The basic human aspirations and their fulfillment through Right understanding and Resolution – Right understanding and Resolution as the activities of the Self-self being central to Human Existence – All encompassing Resolution for a Human Being – Its details and solution of problems in the light of Resolution

UNIT II: RIGHT UNDERSTANDING - KNOWER, KNOWN & THE PROCESS 6 + 3

The domain of right understanding starting from understanding the human being and extending up to understanding nature/ existence – its interconnectedness and co-existence – and finally understanding the role of human being in existence (human conduct)

UNIT III: UNDERSTANDING HUMAN BEING**6 + 3**

Understanding the human being comprehensively as the first step and the core theme of this course – Human being as co-existence of the self and the body – The activities and potentialities of the self-basis for harmony/contradiction in the self

UNIT IV: UNDERSTANDING NATURE AND EXISTENCE**6 + 3**

A comprehensive understanding about the existence – Nature being included – The need and process of inner evolution – Particularly awakening to activities of the Self: Realization – Understanding and Contemplation in the Self

UNIT V: UNDERSTANDING HUMAN CONDUCT, ALL-ENCOMPASSING RESOLUTION & HOLISTIC WAY OF LIVING 6 + 3

Understanding Human Conduct – Different aspects of all encompassing Resolution – Holistic way of living for Human Being with all encompassing resolution covering all four dimensions of human endeavor viz., realization, thought, behavior and work leading to harmony at all levels from Self to Nature and entire Existence

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** 15 Periods **Practical:** - Periods **Project:** - Periods **Total:** 45 Periods

TEXTBOOKS:

1. R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019

REFERENCES:

1. E G Seebauer & Robert L. Berry, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press, 2000
2. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd
3. B P Banerjee, Foundations of Ethics and Management, Excel Books, 2005
4. B L Bajpai, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008



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SEMESTER II

U25MCC07	Tamil and Technology (Common to all programmes)	Category: MCC				
		L	T	P	J	C
		1	0	0	0	1

COURSE 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

COURSE OUTCOMES:

CO 1: Understand the weaving and ceramic technology of ancient Tamil people nature	Understand
CO 2: Understand the construction technology, building materials in Sangam period and case studies	Understand
CO 3: Infer the metal process, coin and beads manufacturing with relevant archeological evidence	Understand
CO 4: Realize the agriculture methods, irrigation technology and pearl diving	Understand
CO 5: Apply the knowledge of scientific Tamil and Tamil computing	Understand

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: WEAVING AND CERAMIC TECHNOLOGY

3

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

UNIT II: DESIGN AND CONSTRUCTION TECHNOLOGY

3

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

UNIT III: MANUFACTURING TECHNOLOGY

3

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

UNIT IV: AGRICULTURE AND IRRIGATION TECHNOLOGY**3**

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

UNIT V: SCIENTIFIC TAMIL & TAMIL COMPUTING**3**

Development of Scientific Tamil – The role of journals in the development of scientific Tamil – Scientific Tamil vocabulary – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project

CONTACT PERIODS:

Lecture: 15 Periods Tutorial: - Periods Practical: - Periods Project: - Periods Total: 15 Periods

TEXTBOOKS:

1. Tamils and Technology, K. Jayanthi Ravikrishna, Sri Krishna publications, Mahalakshmi Nagar, Velappanchavadi, Chennai – 600 007, First Edition 2023
2. Tamils and Technology, S. Priyadharshini, V. K. Publications, 55, Gopuram Colony, Sivakasi – 626 124

REFERENCES:

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை, International Institute of Tamil Studies, C.P.T Campus, Chennai
2. கணினித் தமிழ் - முனைவர். இல. சுந்தரம், விகடன் பிரசுரம், அண்ணா சாலை, சென்னை, திசம்பர் 2016
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம், தொல்லியல் துறை வெளியீடு, தமிழ்நாடு அரசு, சென்னை, ஆறாம் பதிப்பு 2020
4. The Contributions of the Tamils to Indian Culture, Dr. M. Valarmathi, International Institute of Tamil Studies, C.I.T Campus, Tharamani, Chennai, First Edition 1995
5. Studies in the History of India with Special Reference to Tamil Nadu, Dr. K. K. Pillay, 1979


 MOD BIOMEDICAL ENGINEERING
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SEMESTER III

U25MA302	Probability and Statistics (Common to BM, CE, CH, EC, EE, ME, MI)	Category: BSC				
		L	T	P	J	C
		2	0	2	0	3

PRE-REQUISITES:

- U25MA101 - Calculus and Differential Equations / U25RMA101 - Multivariable Calculus and Applications

COURSE OBJECTIVES:

- To introduce the fundamental concepts of probability and statistics relevant to engineering
- To facilitate with students, use their understanding of statistical methods for data analysis and inference in their areas of study
- To develop probabilistic models to handle uncertainty and charts to check for quality control in engineering systems

COURSE OUTCOMES:

CO 1:	Explain the fundamental concepts of probability and examine discrete probability distributions	Understand
CO 2:	Apply suitable continuous distributions, such as uniform, exponential and normal to interpret and analyse statistical data	Apply
CO 3:	Calculate and evaluate covariance and correlation to examine the relationship between two random variables using pairs of random variables	Apply
CO 4:	Determine the estimation theory of parameters, testing of hypotheses for means and apply the Chi-square test for attribute independence	Apply
CO 5:	Perform analysis of variances to compare the means of multiple samples and apply control charts to check for quality control	Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: ONE-DIMENSIONAL DISCRETE RANDOM VARIABLES 6 + 6

Probability – Conditional probability, independence – Baye's theorem – Discrete random variables, probability mass functions – Cumulative distribution functions – Mean and variance – Binomial, Poisson and geometric distributions

UNIT II: ONE-DIMENSIONAL CONTINUOUS RANDOM VARIABLES 6 + 6

Continuous random variables – Probability density functions – Cumulative distribution functions – Mean and variance – Uniform, exponential, normal distributions

UNIT III: TWO-DIMENSIONAL PROBABILITY DISTRIBUTIONS**6 + 6**

Two dimensional discrete and continuous random variables – Marginal probability distributions – Independence – Covariance – Correlation

UNIT IV: INFERENCE STATISTICS**6 + 6**

Estimation - Point estimation – Interval estimation – Hypothesis testing – Hypotheses concerning means – Large, small samples - Chi square test for independence of attributes

UNIT V: ANOVA AND STATISTICAL QUALITY CONTROL**6 + 6**

Analysis of variance – Completely randomized designs – Randomized block designs – Control charts for measurements ($\bar{X}$, R charts) – Control charts for attributes (p, np)

LIST OF EXPERIMENTS

1. One-Dimensional Discrete Random Variables – Mean and Variance of discrete RVs. – Discrete Probability distributions
2. One-Dimensional Continuous Random Variables – Mean and Variance of Continuous RVs. – Continuous Probability distributions
3. Two- Dimensional Probability Distributions – Marginal Probability distributions – Covariance and Correlation
4. Inferential Statistics – Estimation theory – Testing of hypotheses
5. ANOVA and SQC – Analysis of Variance. – Control charts ($\bar{X}$, R, p, np)

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. Douglas C. Montgomery and George C. Runger, "Applied Statistics and Probability for Engineers", Wiley, 2018
2. Richard A. Johnson, "Miller & Freund's Probability and Statistics for Engineers", Pearson Education, New Delhi, 2017

REFERENCES:

1. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, "Probability & Statistics for Engineers & Scientists", Pearson Education, New Delhi, 2016
2. Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", Cengage Learning, NewDelhi 2020
3. Sheldon M Ross, "Introduction to Probability and Statistics for Engineers and Scientists", Academic press, USA, 2020
4. Robert V. Hogg, Elliot Tanis and Dale Zimmerman, "Probability and Statistical Inference", Pearson Education, USA, 2014



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SEMESTER III

U25BM301	Human Anatomy and Physiology	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

COURSE OBJECTIVES:

- To understand the structural and functional organization of major human body systems
- To explain the physiological mechanisms regulating normal body functions
- To apply basic anatomical and physiological concepts in biomedical contexts

COURSE OUTCOMES:

CO 1:	Apply the fundamental concepts of cell structure to explain the real world human physiological processes	Apply
CO 2:	Apply cardiac and respiratory physiology to interpret heart function and gas exchange processes relevant to biomedical assessment	Apply
CO 3:	Utilize skeletal and urinary system concepts to interpret bone functions, urine formation, and regulatory processes for maintaining homeostasis	Apply
CO 4:	Make use of nervous and digestive physiology to interpret neural functions, autonomic actions, digestive mechanisms, and metabolic control	Apply
CO 5:	Organize endocrine and sensory functions to show how hormonal and sensory pathways coordinate body activities	Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: THE CELL AND GENERAL PHYSIOLOGY

9

Human cell: Structure, organelles and their functions – Cell membrane – Tissue types: epithelial, connective, muscle, nervous – Electrophysiology fundamentals: membrane potential, resting potential, action potential – Homeostasis – Blood Cells: Structure and Function – Blood vessels: Vein, Artery and Capillaries – Blood Groups – Blood clotting

UNIT II: CARDIOVASCULAR AND RESPIRATORY SYSTEMS

9

Structure of heart – Properties of Cardiac muscle – Cardiac cycle – Cardiac output – Heart sound – Volume and pressure changes and regulation of heart rate – Coronary Circulation – Respiratory System: Organization of the respiratory tract-mechanics of breathing – lung volumes and capacities – gas exchange and transport of oxygen and carbon dioxide – Regulation of respiration and acid-base balance

UNIT III: SKELETAL AND URINARY SYSTEMS**9**

Skeletal system: Bone Structure, types and functions – Physiology of bone formation – Axial Skeleton and Appendicular Skeleton – Joint: classification and function – Cartilage structure, types and functions – Urinary system: Structure of Kidney and Nephron – Mechanism of Urine formation – Urinary reflex – Water and blood pressure regulation by urinary system

UNIT IV: NERVOUS AND DIGESTIVE SYSTEMS**9**

Nervous system: Structure and types of neurons and neuroglia – Cross-sectional Anatomy of Brain-Physiology of nervous system – Autonomic nervous system and its functions – Digestive system: Structure and function of alimentary canal and digestive glands – Physiology of digestion, absorption, and assimilation – Metabolism of carbohydrates, proteins, and lipids – Integration of digestive and metabolic control in energy balance

UNIT V: ENDOCRINE AND SPECIAL SENSORY SYSTEM**9**

Endocrine glands: Pituitary, Thyroid, Parathyroid, Adrenal – Hormones and their functions – Special Sensory system – Anatomy of Eye – Mechanism of Vision – Errors of Refraction – Anatomy of Ear – Mechanism of Hearing – Taste and smell receptors – Anatomy of Skin – Functions of Skin

CONTACT PERIODS:

Lecture: 45 Periods Tutorial: - Periods Practical: - Periods Project: - Periods Total: 45 Periods

TEXTBOOKS:

1. Waugh, A., & Grant, A., "Ross & Wilson Anatomy and Physiology in Health and Illness", Elsevier, 2022
2. Hall, J. E., "Guyton and Hall Textbook of Medical Physiology", 15th edition, Elsevier, 2025

REFERENCES:

1. Marieb, E. N., "Essential of Human Anatomy and Physiology", 8th edition. Pearson Education, New Delhi, 2022
2. Pocock, G., & Richards, C. D., "The Human Body: An Introduction for Biomedical and Health Sciences", Oxford University Press, 2022



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SEMESTER III

U25BM302	Biomedical Sensors and Instrumentation	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

COURSE OBJECTIVES:

- To equip students with the fundamental principles of biomedical instrumentation systems, including the characteristics of transducers and the essentials of signal conditioning for accurate physiological measurement
- To develop the ability to analyze bio-potential signals and evaluate electrical safety requirements, ensuring the effective and safe application of medical electronic equipment

COURSE OUTCOMES:

CO 1: Evaluate the static and dynamic performance characteristics of the instruments comprising transducers	Analyze
CO 2: Differentiate between various transducer types for a given biomedical application	Analyze
CO 3: Diagnose artifacts and anomalies in acquired bio-potential signals (ECG, EEG, EMG)	Analyze
CO 4: Construct signal conditioning system for biomedical measurements and devise methods to mitigate inherent noise	Apply
CO 5: Evaluate electrical safety hazards in medical equipment and apply safety standards	Analyze

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: INSTRUMENTATION AND PERFORMANCE CHARACTERIZATION

9

Introduction to Basic Instrumentation System: Block diagram and function of each block – Transducers: classification (Active/Passive, Analog/Digital) – Static Characteristics: Accuracy, Precision, Resolution, Sensitivity, Linearity, Hysteresis, Range, Span – Dynamic Characteristics: Zero, First, and Second order system responses; Speed of Response, Fidelity, Lag, Dynamic Error – Errors in Measurement: Types (Gross, Systematic, Random), basic statistical analysis

UNIT II: PRINCIPLES AND SELECTION OF BIOMEDICAL TRANSDUCERS

9

Displacement, Position, and Motion Transducers: Potentiometric, LVDT, Piezoelectric – Pressure Transducers: Strain Gauge, Capacitive, Piezoresistive for blood pressure monitoring – Temperature Transducers: Thermistors, RTDs, Thermocouples – Optical Sensors: Phototransistors, Optical Fibers and their applications – Biosensors: Definition, key components



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UNIT III: BIO-POTENTIAL INTERPRETATION AND ARTIFACT DIAGNOSIS**9**

Electrodes and its types – Electrocardiography (ECG): Standard 12-lead system, ECG waveform interpretation (P, QRS, T) and artifacts – Electroencephalography (EEG): Electrode placement (10-20 system), Frequency bands, and artifacts such as ocular and muscle interference – Electromyography (EMG): The electrical activity of muscles, Signal characteristics, and common artifacts like motion artifact

UNIT IV: SIGNAL CONDITIONING CIRCUITS FOR BIOMEDICAL APPLICATIONS**9**

General Considerations for Signal Conditioners – Amplifier Design: Preamplifier requirements, Instrumentation Amplifier design, Differential, Carrier, Chopper, and Isolation Amplifiers – Sources of Noise in Low-Level Measurements: Thermal (Johnson) Noise, Shot Noise, 1/f Noise - Noise Reduction Strategies: Shielding, Guarding, and Grounding

UNIT V: ELECTRICAL SAFETY, STANDARDS AND RISK VALIDATION**9**

Electric Shock Hazards: Physiological effects of current (macro vs. micro-shock) – Leakage Currents: Types (Earth, Enclosure, Patient Lead) and permissible limits – Safety Codes and Standards: Introduction to IEC 60601-1, AAMI, NFPA 99 – Methods for Ensuring Safety: Grounding Systems, Isolation, Equipotential Bonding – Electrical Safety Analyzer: Principles and operation of analyzers like the Fluke 612 for validating equipment safety compliance

CONTACT PERIODS:

Lecture: 45 Periods Tutorial: - Periods Practical: - Periods Project: - Periods Total: 45 Periods

TEXTBOOKS:

1. Khandpur, R. S., "Handbook of Biomedical Instrumentation", 3rd edition, Tata McGraw Hill, 2014
2. Sawhney, A. K., "A Course in Electrical, Electronic Measurements and Instrumentation", Dhanpat Rai & Sons, 2019

REFERENCES:

1. Webster, J. G. (Ed.), "Medical Instrumentation: Application and Design" 4th edition, John Wiley & Sons, 2009
2. Carr, J. J., and Brown, J. M., "Introduction to Biomedical Equipment Technology", 4th edition, Pearson, 2001



110D BIOMEDICAL ENGINEERING
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SEMESTER III

U25ECG02	Digital System Design (Common to BM, EC)	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

COURSE OBJECTIVES:

- To understand the fundamentals of digital logic circuits
- To design the combinational logic circuits
- To design the synchronous and asynchronous sequential circuits

COURSE OUTCOMES:

CO 1: Solve Boolean expressions and realize using universal gates	Apply
CO 2: Design combinational circuits and implement using logic gates	Apply
CO 3: Develop synchronous sequential circuits using flip-flops	Apply
CO 4: Design hazard-free asynchronous sequential circuits	Apply
CO 5: Implement logic functions using programmable memory devices	Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: BOOLEAN THEOREMS AND LOGIC REDUCTION	9
Number system – Complements – Boolean theorems – Codes – Logic gates – NAND and NOR realization– Representation of boolean expression – SOP, POS, canonical form – Simplification of logic functions using K-map, Quine McCluskey method	
UNIT II: COMBINATIONAL LOGIC DESIGN	9
Adder-1 Bit adder/subtractor, parallel adder, 2's complement adder/subtractor – Implementation of combinational circuits – Multiplexers, demultiplexers, decoders, encoders – Code converters - Magnitude Comparator – Parity generator and checker	
UNIT III: SYNCHRONOUS SEQUENTIAL CIRCUITS	9
Latches and flip-flops – Conversion of flip-flops – Analysis and design of clocked sequential circuits counters – UP/DOWN/ MOD Counter – Shift-registers – Ring and Johnson counter – Finite State Machines design – Mealy and Moore machine – Sequence detector design	
UNIT IV: ASYNCHRONOUS SEQUENTIAL CIRCUITS	9
Analysis and design of Asynchronous circuit design – Fundamental mode and Pulse mode – Race Conditions – Hazards in Asynchronous Circuits – Hazard-free logic design	

UNIT V: LOGIC FAMILIES AND MEMORY DEVICES

9

Overview of Logic Families – Propagation Delay, Fan-in, Fan-out, Noise Margin – Programmable Logic Devices – Realization of logic functions using PROM, PLA, PAL

CONTACT PERIODS:

Lecture: 45 Periods Tutorial: - Periods Practical: - Periods Project: - Periods Total: 45 Periods

TEXTBOOKS:

1. M.Morris Mano, Michael D Ciletti, "Digital Design", 6th edition, Pearson, 2018
2. Charles H. Roth, Jr, Larry L. Kinney "Fundamentals of logic design", 7th edition, Kluwer Academic Publishers, 2014

REFERENCES:

1. Thomas L.Floyd, "Digital Fundamentals", 11th edition, Prentice Hall, 2015
2. S. Salivahanan and S. Arivazhagan, "Digital Circuits and Design", 5th Edition, Oxford University Press, India, 2018
3. Ronald J Tocci, Neal S Widmer, Gregory L Moss, "Digital Systems Principles and Applications", 10th edition, Pearson, 2009
4. D. Donald Givone, "Digital Principles and Design", 4th edition, Tata McGraw Hill, 2008



HOD BIOMEDICAL ENGINEERING
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SEMESTER III

U25ADG02	Data Structures and Algorithms (Common to AD, BM, EC, EE, MI)	Category: PCC				
		L	T	P	J	C
		3	0	2	0	4

COURSE OBJECTIVES:

- To understand the fundamental concepts of ADT and data structure types
- To learn linear and non linear data structures
- To explore tree and graph data structures

COURSE OUTCOMES:

- CO 1: Implement linear data structures such as lists, stacks and queues using array-based and linked-list-based techniques Apply
- CO 2: Apply searching and sorting techniques to solve real-time data organization problems Apply
- CO 3: Apply tree-based data structures including binary trees, binary search trees and AVL trees to perform efficient data representation, traversal and manipulation Apply
- CO 4: Apply graph representations and graph algorithms to solve problems involving traversal, shortest paths, topological ordering and minimum spanning trees Apply
- CO 5: Explain the analysis of algorithms, time and space complexity Understand

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: LINEAR DATA STRUCTURES – LIST, STACKS, QUEUES

9 + 6

Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list-based implementation – Singly linked lists – Circularly linked lists – Doubly-linked lists – Applications of linked list: Polynomial ADT, Radix sort, Multilist. Stack ADT – Operations – Applications – Symbol balancing – Evaluating arithmetic expressions – Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – DeQueue – Applications of queues

UNIT II: SEARCHING, SORTING AND HASHING TECHNIQUES

9 + 6

Searching: Linear Search—Binary Search. Sorting: Bubble sort-Insertion sort-Selection sort- Merge sort - Quick sort. Hashing – Hash Functions – Separate Chaining – Open Addressing –Rehashing – Extendible Hashing

UNIT III: NON-LINEAR DATA STRUCTURES – TREES

9 + 6

Tree ADT – Tree traversals – Binary Tree ADT – Expression trees – Binary search tree ADT –AVL Trees

UNIT IV: NON-LINEAR DATA STRUCTURES - GRAPHS**9 + 6**

Introduction to Graph – Types of graph-Representation of graphs – Graph traversal: Breadth-first traversal – Depth-first traversal – Topological ordering –Dijkstra's algorithm- Minimum spanning tree algorithms – Prims algorithm - Kruskal's Algorithm

UNIT V: ALGORITHM ANALYSIS**9 + 6**

Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithm Efficiency – Asymptotic Notations and its properties – Mathematical analysis for Recursive and Non recursive algorithms.

LIST OF EXPERIMENTS

1. A small library stores the list of newly arrived books in an array-based structure. The librarian wants to maintain the order of arrival. Given the arrival sequence: "AI Basics", "Data Science", "Python 101", "Algorithms", "Machine Learning", Insert them into an array-based List ADT. A book "Cyber Security" arrives and must be inserted at position 3. Later, "Python 101" is removed as it's damaged. Design the array-based List ADT operations to update the list and display the final order.
2. A hospital needs to maintain a waiting list of patients dynamically as patients arrive and get treated. Insert patients: John, Priya, Abdul, Meera in order. A senior citizen "Ravi" should be added after Priya. "Abdul" leaves before consultation. Using Linked List ADT, show how the list changes after each operation.
3. An airport check-in counter processes passengers using a circular queue system. Passengers arriving in order: P1, P2, P3, P4, P5. The queue size is 4 due to staff shortage. • Enqueue all passengers in order and show how overflow occurs. Two passengers are processed (dequeued). P6 and P7 arrive. Simulate these operations using array-based circular queue and show rear/front updates.
4. A bank uses a linked-list-based queue for serving customers. Customers: A, B, C arrive. Then D arrives. B and C are served. Implement the queue operations and show the dynamic linked list changes.
5. A sports event records running times of participants. The unsorted times are 15.2, 12.8, 20.5, 11.6, 19.3. The coach wants to sort the times to shortlist top performers. Apply Bubble Sort and Insertion Sort separately to sort the timings. Show the status of the list after each pass for both algorithms.
6. An online store wants to quickly sort product prices for discount analysis. Prices are 499, 199, 999, 350, 150, 750. Use Quick Sort (first element as pivot) and show partition steps. Use Merge Sort and show the splitting and merging stages.
7. A college stores roll numbers of students in a system. For a particular exam, the roll numbers are sorted [101, 115, 130, 145, 152, 170, 185]. • Apply Binary Search and show mid calculations for each iteration. Compare it with how Linear Search would behave for the same case. A teacher wants to find whether roll number 152 is present.
8. A company stores employee IDs in a hash table of size 10. Employee IDs: [1001, 1123, 1198, 1455, 1677]. Apply open addressing and closed addressing hashing techniques and show the optimal one.
9. A university stores student scores in a BST for quick rank retrieval. Scores: [75, 60, 90, 45, 65, 85, 95]. Construct the BST. Apply inorder, preorder, and postorder traversal. Later, student scores 45, 65 and 75 need removal due to correction. Show the tree after each deletion and state the rule used.
10. A delivery company wants to find the fastest delivery route between warehouses in a city. Given a weighted graph (distances between warehouses): A → B : 4 A → C : 2 B → D : 5 C → B : 1 C → D : 8 D → E : 6 Apply Dijkstra's algorithm starting from A and determine: Shortest path from A to all other warehouses. Distance table update for each step.
11. A telecom company wants to lay cables between cities at minimum cost. The network between cities is modeled as a weighted graph. Apply Prim's algorithm to find the Minimum Spanning Tree and list the edges selected at each step, growing MST, total cost.
12. A power grid network wants to connect electricity stations with minimal wiring cost. The weighted edges between stations are provided. Apply Kruskal's algorithm by sorting edges by weight.

CONTACT PERIODS:

Lecture: 45 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 75 Periods

TEXTBOOKS:

1. Reema Thareja, "Data Structures and Algorithms", 1st edition, Oxford University Press, 2025
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson Freed, "Fundamentals of Data Structures in C", 2nd Edition, Techno Series, 2024

REFERENCES:

1. R. Venkatesan, S. Lovelyn Rose, "Data Structures", 2nd Edition, Wiley, 2019
2. Seymour Lipschutz, "Data Structures", 2nd Edition, McGraw Hill Education, 2017
3. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "The Design and Analysis of Computer Algorithms", 1st Edition, Pearson Education Asia, 2013


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SEMESTER III

U25BM303	Biomaterials	Category: PCC				
		L	T	P	J	C
		2	0	0	2	3

COURSE OBJECTIVES:

- To interpret the structure, properties, and functions of materials used in biomedical applications
- To explore the methods of fabrication and characterization of biomaterials for various biomedical applications

COURSE OUTCOMES:

CO 1: Identify the types of biomaterials with their mechanical properties and biological interactions	Apply
CO 2: Differentiate various metallic and ceramic biomaterials by examining their properties and applications	Analyze
CO 3: Make use of polymeric materials in various biomedical applications	Apply
CO 4: Utilize advanced characterization techniques to investigate the physical and surface properties of biomaterials	Apply
CO 5: Evaluate the various clinical and emerging applications of biomaterials	Analyze

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: INTRODUCTION TO BIOMATERIALS

6 + 6

Definition and types of biomaterials – Mechanical properties: tensile, compressive, shear – Viscoelastic behavior – Fracture – Fatigue – Body response to implants – Wound healing – Blood compatibility

UNIT II: METALS AND CERAMIC MATERIALS

6 + 6

Metallic implants – Stainless steel – Cobalt-chromium alloys – Titanium alloys – Nanostructured metallic implants – Ceramic implant – Bioinert – Bioresorbable – Bioactive ceramics

UNIT III: POLYMERIC BIOMATERIALS

6 + 6

Structure of polymers and types of polymerization – Biopolymers – Collagen – Elastin – Cellulose – Synthetic polymers – Polyethylene – Polymethylmethacrylate – Hydrogels – Silicones

UNIT IV: CHARACTERIZATION OF BIOMATERIALS

6 + 6

X-ray diffraction – Fourier transform infrared spectroscopy – Atomic force microscopy – Scanning electron microscopy – Transmission electron microscopy – Contact angle measurement

UNIT V: MEDICAL APPLICATIONS OF BIOMATERIALS

6 + 6

Orthopedic implants – Dental implants – Cardiovascular devices – Ophthalmology – Drug delivery systems – Tissue engineering

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** - Periods **Project:** 30 Periods **Total:** 60 Periods

TEXTBOOKS:

1. C. Mauli Agrawal, Joo L. Ong, Mark R. Appleford and Gopinath Mani., "Introduction to Biomaterials: Basic Theory with Engineering Applications", 2nd edition, Cambridge University Press, 2025
2. Guigen Zhang, Michael J. Yaszemski, Shelly E. Sakiyama-Elbert and William R Wagner., "Biomaterials Science: An Introduction to Materials in Medicine", 4th edition, Academic Press, 2020

REFERENCES:

1. Andrew F. Von Racum., "Handbook of Biomaterials Evaluation: Scientific, Technical and Clinical Testing of Implant Materials", 2nd edition, CRC Press, 2022
2. Gray E. Wnek and Gray L Browlin., "Encyclopedia of Biomaterials and Biomedical Engineering", Marcel Dekker Inc., New York, 2021



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AND TECHNOLOGY
ARASUR COIMBATORE-641 407

SEMESTER III

U25BM304	Human Anatomy and Physiology Laboratory	Category: PCC				
		L	T	P	J	C
		0	0	2	0	1

COURSE OBJECTIVES:

- To estimate various blood cell types and hematological parameters
- To assess basic physiological and sensory functions using standard biomedical tests

COURSE OUTCOMES:

CO 1: Perform precise hematological tests and interpret normal blood parameter ranges	Precision
CO 2: Demonstrate accurate use of microscopes and cell counting for blood and tissue analysis	Precision
CO 3: Assess, measure, and record vital physiological parameters for clinical evaluation	Precision
CO 4: Conduct and interpret basic sensory function tests such as visual acuity and auditory assessments	Articulation
CO 5: Accurately document laboratory observations, procedures, and results in a structured record	Manipulation

CO - PO MAPPING:

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

LIST OF EXPERIMENTS

- Study Compound Microscope and Neubauer chamber
- Separation of Blood Components – Plasma and packed cells using centrifugation
- Estimation of RBC Count using Neubauer chamber
- Estimation of WBC count and differential leukocyte count
- Estimation of Platelet Count
- Identification of blood group and Rh factor
- Determination of Hemoglobin concentration
- Estimation of Bleeding and Clotting Time
- Testing of Visual Activity (Snellen's Chart) and Hearing Ability (Tuning fork)
- Essential first-aid procedures – management of wounds, burns, and fractures

CONTACT PERIODS:

Lecture: - Periods Tutorial: - Periods Practical: 30 Periods Project: - Periods Total: 30 Periods

TEXTBOOKS:

- Waugh, A., & Grant, A., "Ross & Wilson Anatomy and Physiology in Health and Illness", Elsevier, 2022

REFERENCES:


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1. Hall, J. E., "Guyton and Hall Textbook of Medical Physiology", 15th edition, Elsevier, 2025



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SEMESTER III

U25BM305	Biomedical Sensors and Instrumentation Laboratory	Category: PCC				
		L	T	P	J	C
		0	0	4	0	2

COURSE OBJECTIVES:

- To develop precision in operating biomedical instrumentation and constructing sensor interfaces for the accurate acquisition of physiological signals
- To cultivate the ability to articulate and integrate multiple skills for troubleshooting complex measurement systems and building functional prototypes

COURSE OUTCOMES:

- CO 1:** Identify the appropriate sensors and instruments for measuring a specified physiological parameter **Precision**
- CO 2:** Construct sensor-based measurement circuits and select components to acquire appropriate signals **Articulation**
- CO 3:** Coordinate the complete procedure for acquiring signals efficiently, troubleshooting with minimal errors **Articulation**
- CO 4:** Analyze the acquired physiological data to interpret results and validate system performance against theoretical expectations **Precision**
- CO 5:** Document the experimental procedure, results, and analysis in a structured technical report **Manipulation**

CO - PO MAPPING:

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

LIST OF EXPERIMENTS

- Familiarization with Laboratory Instrumentation and Interpretation of Data Sheets
- Characterization of a displacement Sensor using a Linear Variable Differential Transformer (LVDT)
- Acquisition of temperature data using appropriate sensors
- Evaluation of a strain gauge-based pressure sensor
- Recording and analysis using LabVIEW a. PPG Signals b. force Signals
- Construction and testing of an ECG amplifier using AD620/AD8232
- Design and simulation of an ECG amplifier using Simulink
- Recording and interpretation of the human electrocardiogram (ECG)
- Acquisition and analysis of Electromyogram (EMG) signals
- Assessment of electrical safety in medical devices using FLUKE ESA 612

CONTACT PERIODS:

Lecture: - Periods Tutorial: - Periods Practical: 60 Periods Project: - Periods Total: 60 Periods

TEXTBOOKS:

1. Khandpur, R. S., "Handbook of Biomedical Instrumentation", 3rd edition, Tata McGraw Hill, 2014
2. Sawhney, A. K., "A Course in Electrical, Electronic Measurements and Instrumentation", Dhanpat Rai & Sons, 2019

REFERENCES:

1. John G. Webster., "Medical Instrumentation: Application and Design", 4th edition, John Wiley & Sons, New York, 2009
2. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer., "Biomedical Instrumentation and Measurements", 2nd edition, Pearson Education, New Delhi, 2011
3. Robert B. Northrop., "Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation", 2nd edition, CRC Press, Boca Raton, 2012
4. National Instruments, "LabVIEW for Everyone: Graphical Programming Made Easy and Fun", 6th edition, Prentice Hall, Texas, 2020
5. H. Klee, R. Allen., "Simulation of Dynamic Systems with MATLAB and Simulink", 3rd edition, CRC Press, Boca Raton, 2019

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SEMESTER III

U25ECG03	Digital System Design Laboratory (Common to BM, EC)	Category: PCC				
		L	T	P	J	C
		0	0	2	0	1

COURSE OBJECTIVES:

- To familiarize students with the fundamental concepts of digital logic, combinational circuits, and sequential circuits
- To enable students to design and implement combinational and sequential digital circuits using fundamental logic gates and digital design principles
- To provide hands-on experience in applying digital design techniques to real-time case studies and practical system implementations

COURSE OUTCOMES:

CO 1:	Apply the fundamental concepts of digital logic to construct and verify basic logic circuits	Apply
CO 2:	Analyze the design requirements and implement combinational and sequential circuits	Analyze
CO 3:	Examine the behavior of digital circuits through implementation and verification	Analyze
CO 4:	Demonstrate individual competency or effective teamwork in designing and implementing the experimental results	Apply
CO 5:	Apply ethical standards and present experimental results effectively	Apply

CO - PO MAPPING:

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

LIST OF EXPERIMENTS

1. Verify the logical functions of gates
2. Implementation of combinational logic design using MUX IC's
3. Design and implementation of various data path elements (Adder/Subtractor)
4. Design a circuit to convert one code into another using basic logic gates
5. Design and implement a 4-bit even parity generator and checker
6. Verify the logical functions of flip-flop
7. Design and implementation of synchronous sequential circuit (Counters/ Shift registers)
8. Design and implementation of asynchronous mod counters
9. Design a Mealy/Moore sequence detector for detecting the given sequence

CONTACT PERIODS:

Lecture: - Periods Tutorial: - Periods Practical: 30 Periods Project: - Periods Total: 30 Periods

REFERENCES:

1. M.Morris Mano, Michael D Ciletti, "Digital Design", 6th edition, Pearson, 2018



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SEMESTER III

U25MNC02	Essence of Indian Traditional Knowledge (Common to all programmes)	Category: MNC				
		L	T	P	J	C
		1	0	0	0	0

COURSE OBJECTIVES:

- Understand the Concept of culture in ancient, medieval and modern period.
- Know the need and importance of Indian languages and Literature.
- Understand the various religion and philosophy in various periods.

COURSE OUTCOMES:

CO 1: Understand Philosophy of Indian culture	Understand
CO 2: Distinguish the Indian languages and literature.	Understand
CO 3: Learn the philosophy of ancient, medieval and modern Indian	Remember
CO 4: Acquire the information about the fine arts in India	Apply
CO 5: Know the contribution of scientists different eras	Understand

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: INTRODUCTION TO CULTURE

5

Culture, Civilization, Culture and heritage, General characteristics of culture, Importance of culture in human literature, Indian culture, Ancient India, Medieval India, Modern India

UNIT II: INDIAN LANGUAGES AND LITERATURE

5

Indian Languages and Literature-I: The role of Sanskrit, Significance of scriptures to current society, Indian philosophies, other Sanskrit literature, Literature of south India Indian Languages and Literature-II: Northern Indian Languages & literature, Temples and Temple types, Sculptors 's specialties, Temples Individualities Festivals and hopes

UNIT III: RELIGION AND PHILOSOPHY

5

Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (Selected Movements only)



UNIT IV: ARTS, SCIENCE, TECHNOLOGY & ENGINEERING IN INDIA

5

Indian painting, Handicrafts, Music, Divisions of Indian classical music, Modern Indian music, Dance and drama, Indian architecture (ancient, medieval and modern), Science and technology in India, Development of science in different periods, Sushruta and Charaka, sages of South India, herbal treatments, Surgery methods of healers, Yoga and pranayama practices, Herbal usages and medication-making methods.

UNIT V: EDUCATION SYSTEM IN INDIA

5

Education in ancient, Medieval and modern India, Aims of education, subjects, languages, science and scientists of Ancient India, Medieval India and Modern India

CONTACT PERIODS:

Lecture: 25 Periods Tutorial: - Periods Practical: - Periods Project: - Periods Total: 25 Periods

TEXTBOOKS:

1. Kapil Kapoor, "Text and Interpretation: The India Tradition", ISBN: 81246033375, 2005.
2. "Science in Samskrit", Samskrita Bharti Publisher, ISBN: 978-8187276333, 2007.

REFERENCES:

1. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher, 1989.
2. M. Hiriyanna, "Essentials of Indian Philosophy", Motilal Banarsidass Publishers, ISBN: 9788120810990, 2014.
3. S. Narain, "Examinations in Ancient India", Arya Book Depot, 1993.
4. NCERT, "Position Paper on Arts, Music, Dance and Theatre", 2000.
5. B. Kumar Mohanta & Vipin Kumar Singh, "Traditional Knowledge System and Technology in India", 2012.


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SEMESTER III

U25MCC08	Professional Skill Development - I (Common to all programmes)	Category: MCC				
		L	T	P	J	C
		15 hours				1

COURSE OUTCOMES:

- CO 1: Demonstrate technical skill competency through attainment of industry-relevant certifications, participation in competitions, internships, and project-based learning activities **Apply**
- CO 2: Apply research, innovation, and problem-solving skills to develop impactful solutions through projects, publications, patents, and higher education preparation **Apply**
- CO 3: Exhibit leadership, ethical responsibility, community engagement, and professional digital presence to enhance career readiness and lifelong learning **Apply**

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	2	-	3	1	-	-	2	2	-	-	-
CO 2	2	2	3	3	2	2	-	-	1	1	-	-	-
CO 3	-	-	3	-	-	2	2	3	3	3	2	-	-

GUIDELINES:

- Certifications and Skill Credentials - Free awareness certs, NPTEL/Coursera, Associate-level, Professional-level, Expert-level
- Competitions, Hackathons, and Technical Challenges - Online, institution, state, national, international competitions and hackathons, Kaggle medals
- GATE Preparation and Performance - Study plan, mock tests, registration, appearing, score percentile
- Academic, Industry, and Innovation Projects - Mini-projects, intermediate projects, industry-grade deployed projects, funded or published projects
- Internships and Industrial Training - Virtual, on-site short, core role, CoE on-campus, PPO, PPO converted to offer
- Research Publications, Patents, Intellectual Property - Reading journals, survey papers, conference papers, Scopus/WoS, Q1/Q2 journals, patents from provisional to granted
- Leadership, Community, Digital Presence - Club membership, event roles, office bearer, president, outreach, LinkedIn, GitHub, portfolio, Google Scholar

CONTACT PERIODS:

Lecture: - Periods Tutorial: - Periods Practical: - Periods Project: - Periods Total: 0 Periods


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SEMESTER IV

U25MA402	Stochastic Processes in Engineering Systems	Category: BSC				
		L	T	P	J	C
		3	0	0	0	3

COURSE OBJECTIVES:

- To introduce foundational concepts of stochastic processes relevant to engineering systems
- To model, analyze, and interpret random processes in biomedical and electronic domains
- To develop analytical skills for stochastic modeling and problem-solving

COURSE OUTCOMES:

CO 1:	Understand basic stochastic processes and classify different types of random processes	Understand
CO 2:	Analyze Markov chains and apply them to discrete-time system modeling.	Apply
CO 3:	Apply Poisson processes and renewal theory in engineering systems	Apply
CO 4:	Model and analyze continuous-time Markov processes and queuing systems	Apply
CO 5:	Understand the fundamentals of queuing models and performance metrics	Understand

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: INTRODUCTION TO RANDOM PROCESSES

9

Definition and classification of stochastic processes – Stationary processes – Strict-sense and wide-sense, ergodic processes – Mean function, autocorrelation and cross-correlation functions

UNIT II: DISCRETE-TIME MARKOV CHAINS

9

Definition and properties – Transition probability matrix – Chapman-Kolmogorov equations – Classification of states – Recurrent, transient, periodic, aperiodic, irreducibility – Limiting distributions – Stationary distributions.

UNIT III: POISSON PROCESS AND RENEWAL THEORY

9

Introduction to Poisson process – Inter-arrival and waiting times – Exponential distribution properties – Memoryless property, renewal process – Renewal function and renewal reward theorem

UNIT IV: CONTINUOUS-TIME MARKOV CHAINS

9

Definition and properties – Birth and death processes – Kolmogorov forward and backward equations – Steady-state analysis – Transition rates and Limiting probabilities

UNIT V: QUEUING MODELS

9

Introduction to queuing systems – Kendall notation, single-server queues (M/M/1) – Multi-server queues (M/M/c) – General service time queues (M/G/1)

CONTACT PERIODS:

Lecture: 45 Periods Tutorial: - Periods Practical: - Periods Project: - Periods Total: 45 Periods

TEXTBOOKS:

1. Roy D Yates and David J Goodman, "Probability and Stochastic Processes", Wiley India, New Delhi, 2021
2. Kishor S. Trivedi, "Probability and Statistics with Reliability, Queuing, and Computer Science Applications", 2nd Ed., Wiley, 2002

REFERENCES:

1. Saeed Ghahramani, "Fundamentals of Probability with Stochastic Processes", CRC Press, USA, 2018
2. Sheldon M. Ross, "Stochastic Processes", 2nd Ed., Wiley, 1996
3. Medhi, J. "Stochastic Processes", 2nd Ed., New Age International Publishers, 1994
4. Stark, H and Woods, J. "Probability and Random Processes with Applications to Signal Processing", 3rd Ed., Pearson, 2002


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SEMESTER IV

U25BM401	Microbiology and Pathology	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- U25BM301 - HUMAN ANATOMY AND PHYSIOLOGY

COURSE OBJECTIVES:

- To understand the fundamentals of microbiology, classification of microorganisms, and their structural and functional characteristics relevant to biomedical systems
- To analyze microbial genetics, host-pathogen interactions, and pathological mechanisms involved in infectious diseases
- To apply principles of microbial control, biosafety, and industrial and clinical applications of microorganisms in biomedical engineering

COURSE OUTCOMES:

- CO 1: Apply the fundamental principles of microbiology and classification of microorganisms in relation to human diseases Apply
- CO 2: Identify cultivation, growth, and preservation of microorganisms with biomedical relevance Apply
- CO 3: Analyze microbial genetics, host-pathogen interactions, and mechanisms of disease progression Analyze
- CO 4: Apply principles of microbial control, biosafety, and evaluate ethical issues in pathology and laboratory practices Apply
- CO 5: Analyze microbial applications in diagnostics, therapeutics, and biomedical industries Analyze

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: APPLIED FUNDAMENTAL OF MICROBIOLOGY

9

History and scope of microbiology in biomedical sciences – Classification of microorganisms: bacteria, viruses, protozoa, algae, and fungi – Ultrastructure of prokaryotic and eukaryotic cells – Microbes under microscope – Principles and applications of Bright-field, Dark-field, Phase-contrast, Fluorescence, and Electron microscopy

UNIT II: CULTIVATION AND GROWTH OF MICROORGANISMS

9

Nutritional and physical requirements for microbial growth – Types of culture media – Selective, Differential, Enriched, Minimal – Isolation, maintenance, and preservation of pure cultures – Culture characteristics and growth curve – Batch and continuous cultures – Diauxic and synchronous growth – Enumeration techniques: direct, indirect, and viable count methods – Mathematical concepts in microbial growth (generation time, growth rate)

UNIT III: MICROBIAL GENETICS AND HOST-PATHOGEN INTERACTIONS

9

Genetic material in prokaryotes – Plasmids, episomes, transposons – Genetic recombination in microbes: Transformation, Transduction, Conjugation, Lytic and Lysogenic cycles of bacteriophages – Microbe-environment interactions: bioremediation, nitrogen fixation, bioleaching – Microbe-host interactions: commensalism, mutualism, parasitism – Mechanisms of pathogenic microbial interactions and disease progression

UNIT IV: MICROBIAL CONTROL, PATHOLOGY AND BIOSAFETY

9

Principles of microbial control – Physical agents: heat, filtration, radiation – Chemical agents: disinfectants, antiseptics, antibiotics – Mode of action and resistance – Biological control methods – Bacteriophages, probiotics, bacteriocins – Pathology: Mechanism of disease development, stages of infection, types of pathogens – Biosafety levels (BSL 1–4) – Biohazard symbols, and ethical practices in handling infectious materials

UNIT V: APPLIED AND INDUSTRIAL MICROBIOLOGY

9

Industrially relevant microorganisms: screening and optimization – Microbes as Biosensors: Methods to immobilize and use microbes as biosensors – Applications of microbes in medicine, food & fermentation, environment, energy, and biomedical materials – Introduction to SimBiology(MATLAB) – Concept of bioreactors and fermentation technology in biomedical applications – Ethical issues and safety in industrial microbiology

CONTACT PERIODS:

Lecture: 45 Periods	Tutorial: - Periods	Practical: - Periods	Project: - Periods	Total: 45 Periods
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TEXTBOOKS:

1. Prescott, L. M., Harley, J. P., & Klein, D. A., "Microbiology", McGraw-Hill Education, 7th edition, 2008
2. Chakraborty, P. A, "Textbook of Microbiology and Pathology", New Central Book Agency, 3rd edition, 2013

REFERENCES:

1. Tortora, G. J., Funke, B. R., & Case, C. L., "Microbiology: An Introduction", Pearson, 13th edition, 2018
2. Ananthanarayan & Paniker's, "Textbook of Microbiology", 12th edition, 2022
3. Willey, J. M., Sherwood, L. M., & Woolverton, C. J. Prescott's, "Microbiology", McGraw-Hill, 10th edition, 2017


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SEMESTER IV

U25BM402	Hospital Administration	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

COURSE OBJECTIVES:

- To apply management principles to enhance decision-making and improve organizational efficiency in hospital administration
- To analyze operational and managerial performance across hospital service areas using appropriate analytical approaches
- To integrate ethical frameworks and governance standards into administrative practices for responsible hospital management

COURSE OUTCOMES:

- CO 1: Develop prerequisites for efficient hospital administration, approaches to build organizational uniqueness and strategies for enhancing the effectiveness of hospital committees Apply
- CO 2: Identify relevant performance indicators to monitor and improve the efficiency of core and specialized hospital service areas Apply
- CO 3: Analyze the operational and management challenges within ancillary and support service departments Analyze
- CO 4: Examine the principles of human resource and financial management Analyze
- CO 5: Infer ethical frameworks and legal provisions governing hospital management Analyze

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: HOSPITAL ADMINISTRATOR AND ORGANIZATIONAL FRAMEWORK

9

India's National Health policy – Hospital Administrator: abilities, roles and responsibilities – Hospital Organization: types, organizational principles, functions and structure – Hospital Committees: administrative, regulatory, clinical, facilities, quality and safety

UNIT II: CORE AND SPECIALIZED SERVICES

9

Accident and Emergency Services: functions, facilities and workflow – Outpatient and Inpatient Services: scope, infrastructure and practices – Critical Care Services: organization, infrastructure and staffs – Diagnostic Services: range, point-of-care, and outsourcing

UNIT III: ANCILLARY AND SUPPORT SERVICES

9

Medical Records Management: nature and contents of medical records, filing methods, storage and retention – Hospital Pharmacy Management: organization and regulations – Linen and Laundry: physical infrastructure, equipment and workflow – Fire Management: local fire plan and staff training – Hospital Safety and Security: safety codes and risk management

UNIT IV: HUMAN RESOURCES AND FINANCE MANAGEMENT

9

Human Resource Management: functions, minimum wages act, contract labor, service rules and performance appraisal systems – Hospital Financial Management: pricing, key performance indicators, reimbursement systems and lean management

UNIT V: ETHICS AND LAWS

9

Ethics: ethical issues in hospitals, establishing ethical framework and resolving ethical conflicts – Laws Applicable to Hospitals: hospital establishment, environmental safety, licensing of professionals, medicolegal and patient care

CONTACT PERIODS:

Lecture: 45 Periods	Tutorial: - Periods	Practical: - Periods	Project: - Periods	Total: 45 Periods
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TEXTBOOKS:

1. Mario de Souza, "Hospital Management", 1st edition, Jaypee Brothers Medical Publishers, 2019
2. Ministry of Health and Family Welfare, "National Health Policy", Government of India, 2017

REFERENCES:

1. BV Subrahmanyam, "Hospital Management and Administration Principles and Practice Including Law", 1st edition, CBS Publishers and Distributors, 2023
2. GD Kunders, "Hospitals: Facilities Planning and Management", 19th Reprint, McGraw Hill Education, 2018
3. Alan Gillies, "Healthcare Management: Global Perspectives", 1st edition, Routledge, 2024



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SEMESTER III & IV

U25CSG11	Object Oriented Programming Using Java (Common to AD, AM, BM, CB, CS, EC, EE, IT, MI, SC)	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

COURSE OBJECTIVES:

- To introduce object-oriented programming concepts and Core Java programming fundamentals
- To develop Java applications using classes, inheritance, polymorphism, interfaces, and exception handling mechanisms
- To provide programming skills in multithreading, collections framework, and file handling using Java APIs
- To enable students to develop modular and reusable Java applications using standard libraries and object-oriented design principles

COURSE OUTCOMES:

- CO 1: Describe object-oriented programming concepts and Java fundamentals for developing simple Understand applications
- CO 2: Develop Java applications using inheritance, polymorphism, abstract classes, interfaces, and packages Apply
- CO 3: Develop Java programs incorporating exception handling and multithreading concepts Apply
- CO 4: Develop Java applications using collections, generics, and related utility classes Apply
- CO 5: Develop Java applications using file handling, stream processing, and object serialization techniques Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: INTRODUCTION TO OBJECT-ORIENTED PROGRAMMING AND JAVA BASICS

9

Procedure-Oriented vs Object-Oriented Java Features and Platform: JVM, JRE, JDK – Java Program Structure & Memory Layout – Classes and Objects – Static and non-static members, static and non-static Methods, Constructors – Access Modifiers, Abstraction and Encapsulation – Scanner and System classes

UNIT II: INHERITANCE AND POLYMORPHISM

9

Inheritance and types – Polymorphism: Method Overloading and Overriding – Abstract Classes and Methods – Interfaces. Java packages : Built in and user defined packages

UNIT III: EXCEPTION HANDLING AND MULTITHREADING

9

Exception Handling: try, catch, throw, throws, finally – Built in exception classes and User defined Exceptions – Multithreading: Thread Lifecycle, Creating Threads, Thread Class and Runnable Interface, Thread Priorities, Synchronization – Inter-thread Communication, Deadlock prevention

UNIT IV: COLLECTIONS FRAMEWORK AND GENERICS

9

Collections Framework – Generics and Type Safety – Wrapper Classes and Autoboxing/Unboxing – Interfaces and Classes: List, Set, Map, Queue – Implementations: ArrayList, LinkedList, HashSet, TreeSet, HashMap, TreeMap – Iterators – Comparator and Comparable Interfaces

UNIT V: JAVA I/O AND FILES

9

Java I/O Framework – Input and Output Streams – Readers and Writers – File I/O using File, FileReader, FileWriter, BufferedReader, BufferedWriter and Files – Console Input using Scanner and Console – Serialization and Deserialization – Object Streams

CONTACT PERIODS:

Lecture: 45 Periods	Tutorial: - Periods	Practical: - Periods	Project: - Periods	Total: 45 Periods
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TEXTBOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, 2018
2. Cay S. Horstmann and Gary Cornell, "Core Java 2, Vol 1, Fundamentals", 11th Edition, Pearson Education, 2020

REFERENCES:

1. J. Nino and F. A. Hosch, "An Introduction to Programming and OO Design using Java", 1st Edition, John Wiley & Sons, 2018
2. Paul Deitel and Harvey Deitel, "Java SE 8 for Programmers", 3rd Edition, Pearson, 2015
3. E. Balagurusamy, "Programming with Java", 6th Edition, McGraw Hill Education, 2019



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SEMESTER IV

U25BM403	Biophysical Signals and Systems	Category: PCC				
		L	T	P	J	C
		2	0	2	0	3

COURSE OBJECTIVES:

- To understand the basic properties of signals and systems
- To utilize Laplace and Z transform for discrete time signals and systems
- To integrate signals and systems to analyze physiological parameters

COURSE OUTCOMES:

CO 1:	Implement the concepts of various types of signals and systems to perform basic operations and analyze their behavior in practical scenarios	Apply
CO 2:	Demonstrate the application of time-domain operations on signals to study and interpret the resulting waveform characteristics	Apply
CO 3:	Employ frequency-domain techniques using Z-transform to solve and analyze discrete-time systems	Apply
CO 4:	Interpret Fourier-based spectral analysis and FFT techniques to analyze and interpret biomedical signals	Analyze
CO 5:	Evaluate and interpret the performance of digital filter structures (IIR and FIR) for biomedical signal applications	Analyze

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: INTRODUCTION TO SIGNALS AND SYSTEMS

6 + 6

Definition, classification, and representation of signals – Basic operations, sampling, and quantization – Sampling theorem, aliasing, reconstruction, and quantization errors – Biomedical signal classification and sampling rates – Biological system types, responses, and noise sources in biomedical signals

UNIT II: TIME DOMAIN ANALYSIS OF DISCRETE-TIME SYSTEMS

6 + 6

Discrete-time signals/systems: intro, properties, classification – LTI systems – Convolution (math, table, graphical, circular) – Difference-equation systems with homogeneous/particular solutions – Signal correlation (cross/auto) – Biomedical uses of 1D/2D convolution and correlation

UNIT III: FREQUENCY DOMAIN CHARACTERIZATION USING Z-TRANSFORM

6 + 6

Z-transform and ROC: intro, properties, standard sequence Z-transforms – One-sided/two-sided forms – Solving difference equations – Frequency response via poles/zeros – Laplace-Z relation – Inverse Z-transform and biomedical applications

UNIT IV: FOURIER AND FFT-BASED FREQUENCY DOMAIN ANALYSIS**6 + 6**

Fourier series of periodic sequences; DFT: intro, properties, standard signals, frequency analysis – Linear convolution via DFT – FFT (Radix-2, DIT, DIF, Goertzel) – Spectrum power, spectral density, DFT–Z link – Biomedical relevance of DFT/FFT and spectral interpretation

UNIT V: DIGITAL FILTER STRUCTURES AND REALIZATION TECHNIQUES**6 + 6**

LTI classification: IIR/FIR, recursive/non-recursive – IIR structures-Direct I/II, Cascade, Parallel – FIR structures-Direct, Cascade, Frequency-Sampling, Lattice – Zero-pole effects – IIR/FIR stability, characteristics, performance in biomedical processing

LIST OF EXPERIMENTS

1. Generation and visualization of common periodic and aperiodic waveforms; convolution of discrete-time signals using MATLAB
2. Implementation of correlation and linear filtering of discrete sequences; analysis and plotting of impulse and step responses of discrete-time systems
3. Frequency response analysis of discrete-time systems and interpretation of system characteristics
4. Solution of Linear Constant Coefficient Difference Equations (LCCDE) using computational tools
5. Computation of Z-Transform and Inverse Z-Transform for discrete sequences and their verification through MATLAB
6. Computation of Discrete Fourier Transform (DFT) and implementation of Fast Fourier Transform (FFT) using DIT and DIF algorithms with magnitude and phase interpretation

CONTACT PERIODS:

Lecture: 30 Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 60 Periods

TEXTBOOKS:

1. Salivahanan, S., Vallavaraj, A., & Gnanapriya, C., "Digital signal processing", 4th edition, McGraw-Hill Education India, 2019
2. Oppenheim, A. V., Willsky, A. S., & Nawab, S. H., "Signals and systems", 2nd edition, Pearson Education, 2013

REFERENCES:

1. Rangayyan, R. M., "Biomedical signal analysis", 3rd edition, Wiley–IEEE Press, 2024
2. Oppenheim, A. V., & Schafer, R. W., "Discrete-time signal processing", 3rd edition, Pearson Education, 2010
3. Lathi, B. P., "Principles of linear systems and signals", 2nd edition, Oxford University Press, 2009



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SEMESTER IV

U25BM404	Microbiology and Pathology Laboratory	Category: PCC				
		L	T	P	J	C
		0	0	4	0	2

COURSE OBJECTIVES:

- Understand aseptic techniques, safety measures, and handling procedures for microorganisms
- Apply appropriate methods for culture preparation, isolation, staining, and identification of bacteria
- Analyze environmental effects and antimicrobial

COURSE OUTCOMES:

- CO 1: Perform aseptic techniques and follow laboratory safety procedures while handling microorganisms **Manipulation**
- CO 2: Prepare culture media and cultivate microorganisms with accuracy using appropriate isolation methods **Precision**
- CO 3: Carry out staining, morphological observation, and motility tests to identify microorganisms with consistency **Precision**
- CO 4: Evaluate the influence of environmental parameters (temperature, pH, salinity) on microbial growth using experimental setups **Articulation**
- CO 5: Assess antimicrobial activity and determine the Minimum Inhibitory Concentration (MIC) using standardized laboratory protocols **Articulation**

CO - PO MAPPING:

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

LIST OF EXPERIMENTS

1. Lab Safety and Aseptic Techniques in a Clinical Microbiology Laboratory
2. Culture media preparation and Pure culture techniques (Pour plate method, Spread plate method, Streak plate)
3. Effect of temperature and salt concentration on the growth of micro-organism
4. Quantification of Bacteria and Simple staining of bacteria
5. Gram Staining (Positive and Negative) in a Clinical Microbiology Laboratory
6. Sputum Sample Processing for Detection of Respiratory Pathogens
7. Visualization of hematology and histopathological slides
8. Antibacterial susceptibility of a bacterial isolate
9. Determination of Minimum Inhibitory Concentration (MIC) of Antibiotics
10. Modelling bacterial growth and antibiotic effect using SimBiology (PK/PD Emax model)

CONTACT PERIODS:

Lecture: - Periods

Tutorial: - Periods

Practical: 60 Periods

Project: - Periods

Total: 60 Periods

TEXTBOOKS:

1. Prescott, L. M., Harley, J. P., & Klein, D. A., "Microbiology", McGraw-Hill Education, 7th edition, 2008 .
2. Chakraborty, P., "A Textbook of Microbiology and Pathology", New Central Book Agency, 3rd edition, 2013

REFERENCES:

1. Ananthanarayanan & Panicker, "Microbiology", 10th edition, Orient blackswan, 2017
2. Dubey RC and Maheswari DK., "A Textbook of Microbiology", Chand & Company Ltd, 2007



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SEMESTER III & IV

U25CSG13	Object Oriented Programming Using Java Laboratory (Common to AD, AM, BM, CB, CS, EC, EE, IT, MI, SC)	Category: PCC				
		L	T	P	J	C
		0	0	2	0	1

COURSE OBJECTIVES:

- To understand the fundamental concepts of object-oriented programming using Java for developing modular and reusable applications
- To apply inheritance, polymorphism, exception handling, and multithreading concepts in developing robust Java applications
- To develop collection-based and file-processing applications using Java I/O, generics, and collections framework for real-world problem solving

COURSE OUTCOMES:

- CO 1:** Implement the fundamental concepts of object-oriented programming, Java program structure, classes, objects, and encapsulation principles Apply
- CO 2:** Develop Java applications using inheritance, polymorphism, abstract classes, interfaces, and packages Apply
- CO 3:** Implement exception handling and multithreading mechanisms for developing reliable and concurrent applications Apply
- CO 4:** Utilize collections framework, generics, and sorting mechanisms for efficient data management and processing Apply
- CO 5:** Develop file handling and object persistence applications using Java I/O streams, serialization, and deserialization techniques Apply

CO - PO MAPPING:

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

LIST OF EXPERIMENTS

1. Design and implementation of Java programs demonstrating classes, objects, constructors, and methods
2. Development of applications illustrating static and non-static members, access modifiers, abstraction, and encapsulation
3. Implementation of console-based applications using Scanner and System classes for input and output processing
4. Design and implementation of applications demonstrating inheritance and its various types
5. Development of applications illustrating compile-time and runtime polymorphism using method overloading and method overriding
6. Implementation of applications using abstract classes, interfaces, and dynamic method dispatch mechanisms
7. Design and development of modular Java applications using built-in and user-defined packages
8. Implementation of robust exception handling mechanisms using built-in and user-defined exceptions
9. Development of multithreaded applications using Thread class and Runnable interface

B.E. - BM - R2025 - CBCS

10. Design and implementation of synchronized multithreaded applications with inter-thread communication
11. Development of applications demonstrating thread lifecycle management and deadlock prevention techniques
12. Implementation of generic collection-based applications using List, Set, Map, and Queue interfaces
13. Design of applications utilizing Comparator and Comparable interfaces for customized sorting operations
14. Development of file processing applications using Java I/O streams, readers, writers, and buffered streams
15. Implementation of object persistence mechanisms using serialization and deserialization techniques

CONTACT PERIODS:

Lecture: - Periods **Tutorial:** - Periods **Practical:** 30 Periods **Project:** - Periods **Total:** 30 Periods

REFERENCES:

1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, 2018
2. Cay.S.Horstmann and Gary Cornell, "Core Java 2, Vol 1, Fundamentals", 11th Edition, Pearson Education, 2020



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SEMESTER IV

U25MNC03	Indian Constitution (Common to all programmes)	Category: MNC				
		L	T	P	J	C
		1	0	0	0	0

COURSE OBJECTIVES:

- To understand the evolution and importance of the Constitution.
- To understand salient features of the Indian Constitution and philosophy of Fundamental Rights
- To gain the knowledge about the state government and local level administration

COURSE OUTCOMES:

- CO 1: Understand the historical background of the Constitution making and its importance for building a democratic India
- CO 2: Understand the value of Fundamental Rights and Duties for becoming a good citizen of India
- CO 3: Analyze the powers of the Central Government
- CO 4: Understand the role and responsibilities of State and Local Administration
- CO 5: Apply knowledge in strengthening constitutional institutions like Election Commission and UPSC for sustaining democracy

Understand

Analyze

Understand

Apply

CO - PO MAPPING:

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

SYLLABUS:

UNIT I: HISTORICAL BACKGROUND OF INDIAN CONSTITUTION

5

Introduction to Indian Constitution: Constitution Meaning of the term, History of Making of the Indian Constitution, Evolution of the Indian Constitution, Drafting Committee (Composition and Working).

UNIT II: FEATURES OF INDIAN CONSTITUTION

5

Philosophy and salient features of the Indian Constitution, Citizenship, Fundamental Rights, Duties and their significance, Directive Principles of State Policy, Rights Protective Mechanisms in India; Right to Education Act 2009; Right to Information 2005.

UNIT III: UNION GOVERNMENT

5

Union Legislature (Parliament), Lok Sabha and Rajya Sabha (with Powers and Functions), Union Executive, President of India (with Powers and Functions), Prime Minister and Council of Ministers (with Powers and Functions), Cabinet and Central Secretariat, Union Judiciary (Supreme Court).

UNIT IV: STATE GOVERNMENT AND LOCAL ADMINISTRATION

5

Governor, Chief Minister and Council of Ministers, State Secretariat – Roles and Responsibilities, District Administration, Head, Municipalities – Mayor and Role of Elected Representatives, Panchayati Raj, Zila Panchayat – Roles and Responsibilities, Block Level and Village Level Organizational Hierarchy

UNIT V: CONSTITUTIONAL INSTITUTIONS

5

Election Commission of India – Powers and Functions, Electoral Process in India, Methods of Constitutional Amendments and their Limitations, Important Constitutional and Emergency Provisions. Case Studies.

CONTACT PERIODS:

Lecture: 25 Periods	Tutorial: - Periods	Practical: - Periods	Project: - Periods	Total: 25 Periods
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TEXTBOOKS:

1. Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India Pvt. Ltd., New Delhi.
2. Subash Kashyap, "Indian Constitution", National Book Trust.

REFERENCES:

1. M. Laxmikanth, "Indian Polity", McGraw Hill Education India, 2013.
2. M. P. Jain, "Indian Constitution Law," 7th Edition, Lexis Nexis, 2014.
3. Raj Kumar, "Ambedkar and Constitution", Commonwealth Publication Pvt. Ltd., New Delhi, 2011


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SEMESTER IV

U25MCC09	Professional Skill Development - II (Common to all programmes)	Category: MCC				
		L	T	P	J	C
		15 Hours				

COURSE OUTCOMES:

- CO 1: Demonstrate technical skill competency through attainment of industry-relevant certifications, participation in competitions, internships, and project-based learning activities Apply
- CO 2: Apply research, innovation, and problem-solving skills to develop impactful solutions through projects, publications, patents, and higher education preparation Apply
- CO 3: Exhibit leadership, ethical responsibility, community engagement, and professional digital presence to enhance career readiness and lifelong learning Apply

CO - PO MAPPING:

Particular	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	2	2	-	3	1	-	-	2	2	-	-	-
CO 2	2	3	3	3	2	2	-	-	1	1	-	-	-
CO 3	-	-	3	-	-	2	2	3	3	3	2	-	-

GUIDELINES:

- Certifications and Skill Credentials - Free awareness certs, NPTEL/Coursera, Associate-level, Professional-level, Expert-level
- Competitions, Hackathons, and Technical Challenges - Online, institution, state, national, international competitions and hackathons, Kaggle medals
- GATE Preparation and Performance - Study plan, mock tests, registration, appearing, score percentile
- Academic, Industry, and Innovation Projects - Mini-projects, intermediate projects, industry-grade deployed projects, funded or published projects
- Internships and Industrial Training - Virtual, on-site short, core role, CoE on-campus, PPO, PPO converted to offer
- Research Publications, Patents, Intellectual Property - Reading journals, survey papers, conference papers, Scopus/WoS, Q1/Q2 journals, patents from provisional to granted
- Leadership, Community, Digital Presence - Club membership, event roles, office bearer, president, outreach, LinkedIn, GitHub, portfolio, Google Scholar

CONTACT PERIODS:

Lecture: - Periods Tutorial: - Periods Practical: - Periods Project: - Periods Total: 0 Periods

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