Sri

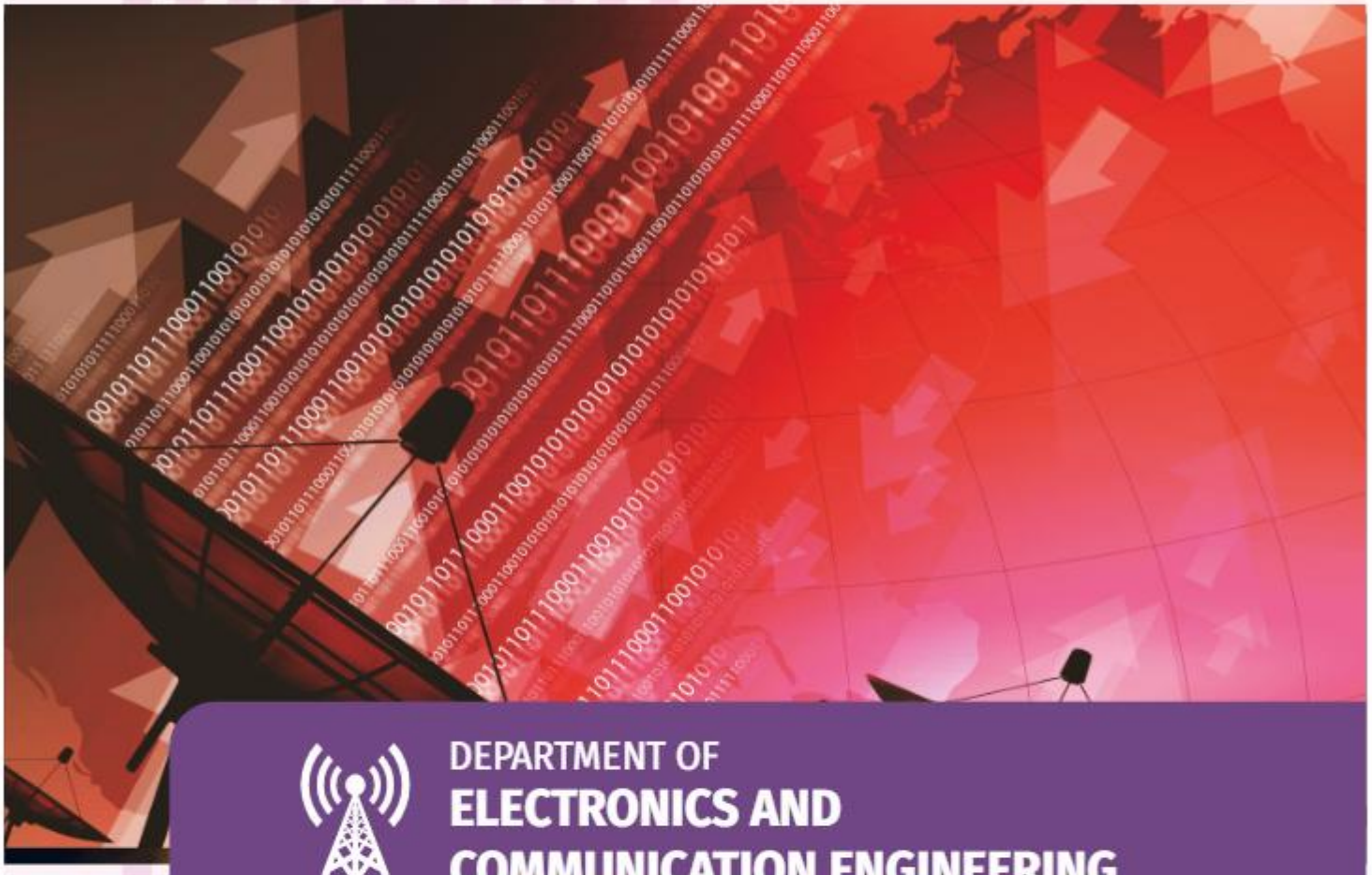
SAI RAM ENGINEERING COLLEGE

An Autonomous Institution

West Tambaram, Chennai - 44

www.sairam.edu.in

Approved by AICTE, New Delhi
Affiliated to Anna University



DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

AUTONOMOUS

CURRICULUM AND

SYLLABUS I - V SEMESTERS

REGULATIONS 2024

Academic Year 2024-25 onwards

SRI SAIRAM ENGINEERING COLLEGE

VISION

To emerge as a "Centre of excellence " offering Technical Education and Research opportunities of very high standards to students, develop the total personality of the individual and instil high levels of discipline and strive to set global standards, making our students technologically superior and ethically stronger, who in turn shall contribute to the advancement of society and humankind..

MISSION

We dedicate and commit ourselves to achieve, sustain and foster unmatched excellence in Technical Education. To this end, we will pursue continuous development of infra-structure and enhance state-of-the-art equipment to provide our students a technologically up-to date and intellectually inspiring environment of learning, research, creativity, innovation and professional activity and inculcate in them ethical and moral values.

Educational Organization Management System (EOMS) Policy

We at Sri Sai Ram Engineering College are committed to empower our students not only to excel academically but also imbibe essential values, enabling them to become exemplary global citizens. We build a better nation by fostering excellence and innovative practices in Engineering, Technology and Management Education. We are dedicated to consistently enhancing our systems, infrastructure and services to meet the needs and expectations of all our stakeholders for sustainable growth

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG.

VISION

To emerge as a "centre of excellence" in the field of Electronics and Communication Engineering and to mould our students to become technically and ethically strong to meet the global challenges. The Students in turn contribute to the advancement and welfare of the society.

MISSION

Department of Electronics and Communication Engineering, SRI SAIRAM ENGINEERING COLLEGE is committed to

M1 Achieve, sustain and foster excellence in the field of Electronics and Communication Engineering.

M2 Adopt proper pedagogical methods to maximize the knowledge transfer.

M3 Enhance the understanding of theoretical concepts through professional society activities

M4 Improve the infrastructure and provide conducive environment of learning and research following ethical and moral values

AUTONOMOUS CURRICULA AND SYLLABI
Regulations 2024

SEMESTER I

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			CONTACT PERIODS	CREDITS
			L	T	P		
		THEORY					
1	24BSMA101	Matrices and Calculus	3	1	0	4	4
2	24HSEN101	Communicative English	3	0	0	3	3
3	24BSPH101	Engineering Physics	3	0	0	3	3
4	24BSCY101	Engineering Chemistry	3	0	0	3	3
5	24ESCS101	Problem Solving and Programming in C	3	0	0	3	3
6	24ESGE101	Engineering Graphics	1	2	0	3	3
7	24HSTA101	Heritage of Tamils	1	0	0	1	1
		PRACTICALS					
1	24BSPL101	Physics and Chemistry Laboratory	0	0	4	4	2
2	24ESPL101	Programming in C Laboratory	0	0	2	2	1
		VALUE ADDITIONS - I					
1	24ENTP101	Functional Life Skills	1	0	1	2	1
2	24ESID101	Idea Engineering Lab - I	0	0	2	2	1
		ONLINE SUPPLEMENTARY					
		Recommended by BoS					
				Total		30	25

SEMESTER II

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			CONTACT PERIODS	CREDITS
			L	T	P		
		THEORY					
1	24BSMA202	Differential Equations, Complex Variables and Transforms	3	1	0	4	4
2	24HSEN201	Professional English	2	0	0	2	2
3	24BSPH201	Physics of Electronic Devices	3	0	0	3	3
4	24BSCY201	Chemistry for Environment and Sustainability	3	0	0	3	3
5	24ECPC201	Circuit Analysis	3	0	0	3	3
6	24HSTA201	Tamils and Technology	1	0	0	1	1
7	24HSNC201	NCC Course Level 1*	2	0	0	2	0
		PRACTICALS					
1	24ESGE102	Engineering Practices Lab	0	0	4	4	2
		VALUE ADDITIONS - II					
1	24ENTP201	Digital Dynamics	0	0	2	2	0
2	24ESID201	Idea Engineering Lab - II	0	0	2	2	1
		ONLINE SUPPLEMENTARY					
	24ESMC201	MS Office (Mandatory - NC) Recommended by BoS					
				Total		24	19

*Elective for NCC cadets

Approved by
Academic Council Meeting
No. 08 Dated: 03.09.2024

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

AUTONOMOUS CURRICULA AND SYLLABI

SEMESTER III Regulations 2024

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			CONTACT PERIODS	CREDITS
			L	T	P		
THEORY							
1	24BSMA301	Statistics and Linear Algebra	3	1	0	4	4
2	24ECPC301	Signals and Systems	3	0	0	3	3
3	24ECPC302	Electromagnetic Fields and Waveguides	3	0	0	3	3
4	24ECPC303	Digital Circuits	3	0	0	3	3
5	24ECPC304	Electronic Circuits	3	0	0	3	3
6	24HSMC301	Universal Human Values - II Understanding Harmony	3	0	0	3	3
7	24HSNC301	NCC course Level 2*	3	0	0	3	0
PRACTICALS							
1	24ECPL301	Analog and Digital Circuits Laboratory	0	0	4	4	2
VALUE ADDITIONS - III							
1	24ECTP301	Aptitude Skills - I	0	0	2	2	1
2	24ECID301	Innovative Design Lab - I	0	0	2	2	1
ONLINE SUPPLEMENTARY							
1	24ESMC301	Joy of Computing using Python (Mandatory - NC)					
				Total		29	23

*only for NCC cadets

SEMESTER IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			CONTACT PERIODS	CREDITS
			L	T	P		
THEORY							
1	24BSMA401	Probability Theory and Random Processes	3	1	0	4	4
2	24ECPC401	Transmission Lines and Antenna Theory	3	0	0	3	3
3	24ECPC402	Analog and Digital Communication	3	0	0	3	3
4	24EIPC404	Control Systems	3	0	0	3	3
5	24xxOExxx	Open Elective - I#	3	0	0	3	3
6	24HSNC401	NCC course Level 3*	3	0	0	3*	0
PRACTICALS							
1	24ECPT401	Microcontrollers and Embedded Systems Lab with Theory	1	0	4	5	3
2	24ECPT402	Linear Integrated Circuits Lab with Theory	1	0	4	5	3
3	24ECPL401	Communication Systems Laboratory	0	0	4	4	2
VALUE ADDITIONS - IV							
1	24ECTP401	Aptitude Skills - II	0	0	2	2	0
2	24ECID401	Innovative Design Lab - II	0	0	2	2	1
ONLINE SUPPLEMENTARY							
		Recommended by BoS (R-Programming)					
				Total		34	25

Sustainable Logistics and Green Supply Chain Management

*only for NCC cadets

Approved by
Academic Council Meeting
No. 08 Dated: 03.09.2024

CHAIRMAN
Board of Studies
Electronics and Communication...

AUTONOMOUS CURRICULA AND SYLLABI
Regulations 2024

SEMESTER V

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			CP	C	PREREQUISITE COURSES
			L	T	P			
THEORY								
1	24ECPC501	VLSI Design	3	0	0	3	3	24ECPC303
2	24ECPC502	Discrete Time Signal Processing	3	1	0	4	4	24ECPC301, 24ECPC303
3	24ECEL5xx	Professional Elective - I	3	0	0	3	3	-
4	24ECEL5yy	Professional Elective - II	3	0	0	3	3	-
5	24HSMG501	Principles of Engineering Management	3	0	0	3	3	-
6	24MGMC501	Constitution of India	2	0	0	2	0	-
PRACTICALS								
1	24ECPL501	VLSI Design Laboratory	0	0	4	4	2	24ECPC303
2	24ECPL502	Discrete Time Signal Processing Laboratory	1	0	4	5	3	-
VALUE ADDITIONS								
1	24ECTP501	Skill Enhancement	0	0	2	2	1	-
2	24ECID501	Prototype Development Lab - I	0	0	2	2	1	-
ONLINE SUPPLEMENTARY								
		As recommended by BOS						
					Total	30	22	4

SEMESTER VI

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			CONTACT PERIODS	CREDITS
			L	T	P		
THEORY							
1	24ECPC601	Communication Networks	3	0	0	3	3
2	24ECPC602	Wireless Communication	3	0	0	3	3
3	24ECEL6xx	Professional Elective - III	3	0	0	3	3
4	24ECEL6yy	Professional Elective - IV	3	0	0	3	3
5	24ECEL6zz	Professional Elective - V	3	0	0	3	3
6	24xxOE9xx	Open Elective - II	3	0	0	3	3
PRACTICALS							
1	24ECPL601	Communication Networks Laboratory	0	0	4	4	2
VALUE ADDITIONS - II							
1	24ECTP601	Technical Skill	0	0	2	2	0
2	24ECID601	Prototype Development Lab - II	0	0	2	2	1
ONLINE SUPPLEMENTARY							
		Recommended by BoS					
					Total	26	21

Approved by
Academic Council Meeting
No. 08 Dated: 03.09.2024

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

AUTONOMOUS CURRICULA AND SYLLABI
Regulations 2024

SEMESTER VII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			CONTACT PERIODS	CREDITS
			L	T	P		
THEORY							
1	24ECPC701	RF and Microwave Engineering	3	0	0	3	3
2	24ECPC702	Optical Communication	3	0	0	3	3
3	24ECEL7xx	Professional Elective - VI	3	0	0	3	3
4	24XXOE9xx	Open Elective - III	3	0	0	3	3
5	24MGEL703	Creative Innovation and Entrepreneurship	2	0	0	2	2
PRACTICALS							
1	24ECPL701	Advanced Communication Laboratory	0	0	4	4	2
2	20ECPJ701	Project Work - Phase I	0	0	8	8	4
VALUE ADDITIONS - VII							
1	24ECTP701	Company Specific Skills	0	0	2	2	1
ONLINE SUPPLEMENTARY							
		Recommended by BoS					
				Total		28	21

SEMESTER VIII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			CONTACT PERIODS	CREDITS
			L	T	P		
THEORY							
1	24ECEL8xx	Professional Elective - VII	3	0	0	3	3
PRACTICALS							
1	24ECPJ801	Project Work - Phase II	0	0	12	12	6
VALUE ADDITIONS - VIII							
1	24ECIN801	Internship	0	0	9	9	3
				Total		24	12

Approved by
Academic Council Meeting
No. 08 Dated: 03.09.2024

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

AUTONOMOUS CURRICULA AND SYLLABI
Regulations 2024

PROFESSIONAL ELECTIVES - I

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN	PREREQUISITE COURSES
1	24ECEL501	Simulation Techniques for Communication	3	Wireless	24ECPC301 24BSMA401 24ECPC402
2	24ECEL502	Digital Communication Techniques	3	Wireless	24ECPC402
3	24ECEL503	Statistical Theory of Communication	3	Wireless	24BSMA301, 24ECPC301
1	24ECEL504	Introduction to VLSI Lifecycle	3	VLSI & EMB	24ECPC303, 24ECPC304
2	24ECEL505	Embedded System Design	3	VLSI & EMB	24ECPC303
3	24ECEL506	Semiconductor Device Modeling	3	VLSI & EMB	24BSPH201, 24ECPC303
1	24ECEL507	Introduction to Photonics	3	RF & GREEN	24ECPC302, 24ECPC303
2	24ECEL508	Remote Sensing Essentials	3	RF & GREEN	24ECPC301, 24ECPC402
3	24ECEL509	Introduction to Reliability Engineering	3	RF & GREEN	24BSPH201, 24ECPC303
1	24ECEL510	Sensors and Measurements	3	SP & BM	24ECPC201, 24BSPH201
2	24ECEL511	Digital Image Processing	3	SP & BM	24BSMA202, 24ECPC301
3	24ECEL512	Advanced Digital Signal Processing	3	SP & BM	24ECPC502, 24ECPT502

PROFESSIONAL ELECTIVES - II

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN	PREREQUISITE COURSES
1	24ECEL513	Information Theory	3	Wireless	24BSMA401, 24ECPC402
2	24ECEL514	Machine Learning for Communication and Signal Processing	3	Wireless	24BSMA401
3	24ECEL515	Communication Technologies for Industry 4.0	3	Wireless	24ECPC304, 24ECPT401
1	24ECEL516	Analog and Digital IC Design	3	VLSI & EMB	24ECPC201, 24ECPC303
2	24ECEL517	Computer Organization and Design	3	VLSI & EMB	24ECPC303
3	24ECEL518	Introduction to Microfabrication	3	VLSI & EMB	24BSPH101, 24BSPH201
1	24ECEL519	Electromagnetic Interference and Compatibility	3	RF & GREEN	24ECPC302, 24ECPC304
2	24ECEL520	Principles and Techniques of Modern Radar Systems	3	RF & GREEN	24ECPC302, 24ECPC402
3	24ECEL521	Computational Electromagnetics	3	RF & GREEN	24ECPC302, 24ECPC401
1	24ECEL522	Medical Electronics	3	SP & BM	24ECPC304, 24ECPT402
2	24ECEL523	Biomedical Signal and Image Processing	3	SP & BM	24ECPC301, 24ECPC502
3	24ECEL524	Neural Signal Processing and its Application	3	SP & BM	24ECPC301, 24ESMC301

Approved by
Academic Council Meeting
No. 08 Dated: 03.09.2024

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

INDUSTRY CONNECTED PROFESSIONAL ELECTIVES
L&T BASKET

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN
1	24ECIE501	Cloud Adoption and Management Techniques	3	Cloud Computing
2	24ECIE502	Industrial Applications of Microcontrollers - A Practice based approach	3	Applied Microelectronics
3	24ECIE503	Applied Industrial IoT	3	Artificial Intelligence and Data Science -
4	24ECIE504	Cyber Physical Systems for Industrial Applications	3	Applied Microelectronics
5	24ECIE505	Chip based VLSI Design for Industrial Applications	3	Applied Microelectronics
6	24ECIE601	AI and Edge Computing	3	Artificial Intelligence and Data Science
7	24ECIE602	Renewable Energy & Power Evacuation	3	Smart Grid Technology
8	24ECIE603	Digital Technologies for Industry 4.0	3	Applied Microelectronics
9	24ECIE604	Integrated Approach to Building Services	3	Interdisciplinary
10	24ECIE701	Project Management for Professionals	3	Interdisciplinary

INDUSTRY CONNECTED PROFESSIONAL ELECTIVES
HCL BASKET

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN
1	24EIIE611	Embedded System For Connected Devices	3	Embedded
2	24CSIE612	C++ For Embedded Systems	3	Embedded
3	24ITIE711	Advanced C++ For Embedded Programming	3	Embedded
4	24EIIE712	Product Development Process	3	Embedded
5	24ECIE712	Project Phase-I	4	Embedded
6	24ECIE811	Internship	3	Embedded
7	24ECIE812	Project Phase-II	6	Embedded

Approved by
Academic Council Meeting
No. 08 Dated: 03.09.2024

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

INDUSTRY CONNECTED PROFESSIONAL ELECTIVES
SPACE TECHNOLOGY

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN
1	24ECIE515	Introduction to Space Science	3	Embedded
2	24ECIE516	Aerospace System Control and Estimation	3	Embedded
3	24ECIE615	Spacecraft System Engineering	3	Embedded
4	24ECIE616	Launch Vehicle Systems and Technologies	3	Embedded
5	24ECIE617	Space Flight Mechanics and Propulsion	3	Embedded
6	24ECIE715	Satellite System Technology	3	Embedded
7	24ECIE716	Space Optical Communications	3	Embedded
8	24ECIE816	National Space Policies and Security	3	Embedded

INDUSTRY CONNECTED PROFESSIONAL ELECTIVES
WIPRO BASKET

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN
1	24ECIE621	System Verilog for Design Verification	3	Embedded
2	24ECIE622	Real Time Operating System using QNX	3	Embedded

Approved by
Academic Council Meeting
No. 08 Dated: 03.09.2024

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1 Acquire strong foundation in Engineering, Science and Technology for a successful career in Electronics and Communication Engineering.

PEO2 Apply their knowledge and skills acquired to solve the issues in real world Electronics and Communication sectors and to develop feasible and viable systems.

PEO3 Be receptive to new technologies and attain professional competence through professional society activities.

PEO4 Participate in lifelong learning, higher education efforts to emerge as expert researchers and technologists.

PEO5 Practice the profession with ethics, integrity, leadership and social responsibilities.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1 Design, implement and test Electronics and Communication systems using analytical knowledge and applying modern hardware and software tools

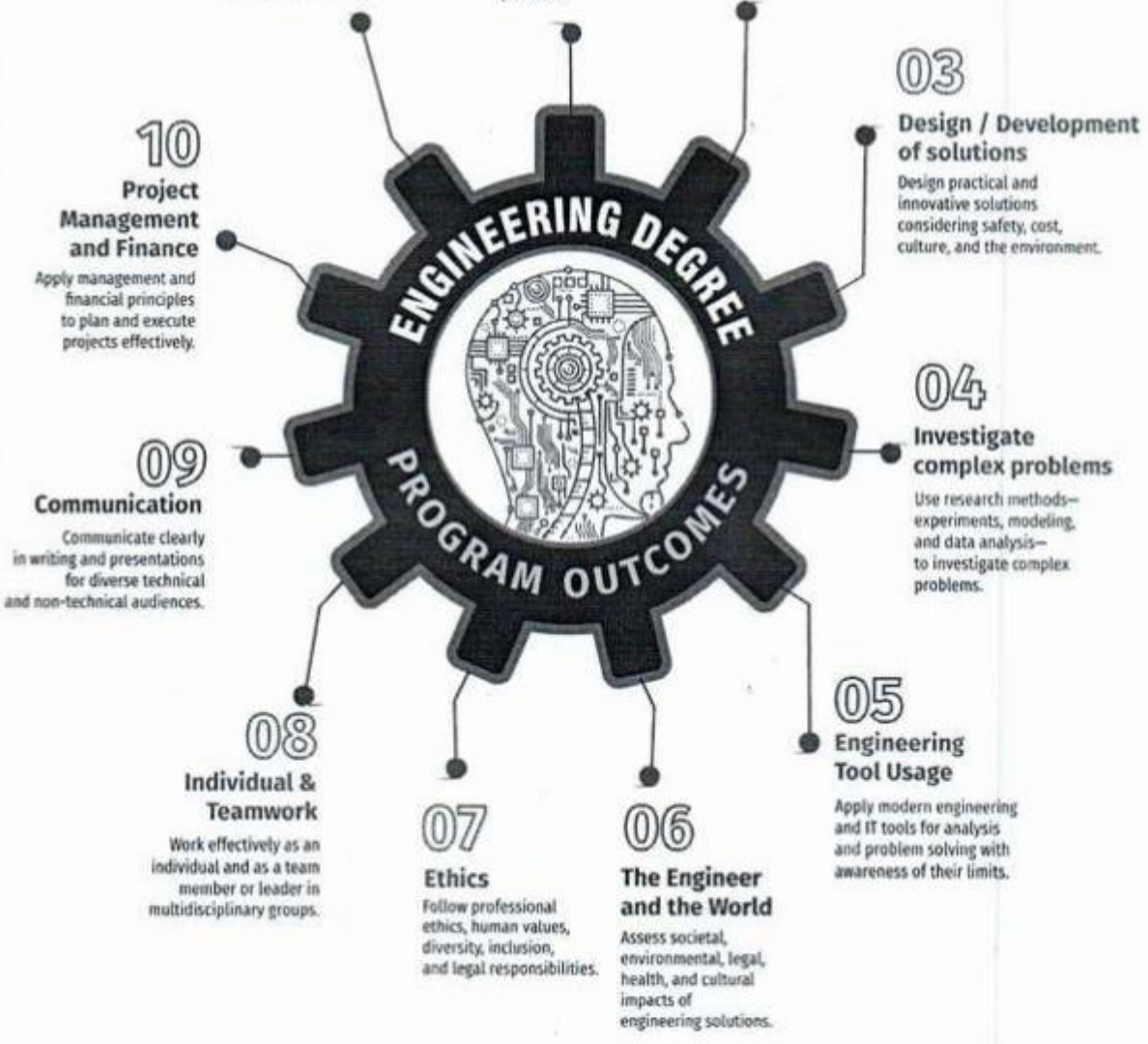
PSO2 Develop their skills to solve problems and assess social, environmental issues with ethics and manage different projects in multidisciplinary areas.

COMPONENTS OF THE CURRICULUM (COC)

Course Component	Curriculum Content (% of total number of credits of the program)	Total number of contact hours	Total Number of credits
Basic Sciences (BS)	18	32	30
Engineering Sciences (ES)	7	15	12
Humanities and Social Sciences (HS)	8	13	13
Professional Electives (EL)	14	23	23
Program Core + Program Lab (PC+PL)	27	56	46
Program theory with Lab (PW) / Program Lab With Theory (PT)	5	15	9
Open Elective (OE)	7	12	12
Training & Placement (TP)	2	14	4
Innovation & Development (ID) / Project (PJ)	10	32	16
Internships (IN)	2	9	3
Mandatory Courses (MC)	NA	4	NA
Total		**225**	**168**

PROGRAMME OUTCOMES(POs)

PROGRAM OUTCOME REPRESENTS THE KNOWLEDGE, SKILLS AND ATTITUDES THAT THE STUDENTS WOULD BE EXPECTED TO HAVE AT THE END OF THE 4 YEAR ENGINEERING DEGREE PROGRAM



01 Engineering Knowledge
Apply math, science, computing, and engineering knowledge to solve complex engineering problems.

02 Problem Analysis
Identify and analyze complex problems using research to draw valid conclusions.

03 Design / Development of solutions
Design practical and innovative solutions considering safety, cost, culture, and the environment.

04 Investigate complex problems
Use research methods—experiments, modeling, and data analysis—to investigate complex problems.

05 Engineering Tool Usage
Apply modern engineering and IT tools for analysis and problem solving with awareness of their limits.

06 The Engineer and the World
Assess societal, environmental, legal, health, and cultural impacts of engineering solutions.

07 Ethics
Follow professional ethics, human values, diversity, inclusion, and legal responsibilities.

08 Individual & Teamwork
Work effectively as an individual and as a team member or leader in multidisciplinary groups.

09 Communication
Communicate clearly in writing and presentations for diverse technical and non-technical audiences.

10 Project Management and Finance
Apply management and financial principles to plan and execute projects effectively.

11 Life-long learning
Engage in independent lifelong learning and adapt to new technologies with critical thinking.

SEMESTER - I

24BSMA101 - SDG NO. 4	MATRICES AND CALCULUS	L	T	P	CP	C
		3	1	0	4	4

OBJECTIVES:

- To develop a strong foundation in matrix algebra and its applications.
- To introduce the concepts of limits, continuity, differentiation, and optimization for functions of several variables.
- To familiarize students with the principles of vector calculus relevant to engineering problems.
- To provide an understanding of double and triple integrals along with their practical applications.
- To impart knowledge of Fourier series and its significance in engineering analysis.

MODULE I MATRICES 12

Eigenvalues and eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Cayley-Hamilton theorem (excluding proof) – Symmetric and orthogonal matrices - Reduce the quadratic to canonical form using orthogonal transformation - Nature of quadratic forms.

MODULE II FUNCTIONS OF SEVERAL VARIABLES 12

Limits, Continuity - Definitions - Partial derivatives - Taylor's series - Jacobians, Maxima and Minima - Method of Lagrange multipliers.

MODULE III VECTOR DIFFERENTIATION 4

Scalar and vector valued functions - Gradient and directional derivatives – Tangent plane - Divergence and curl - Irrotational and solenoidal vector fields - Scalar and vector potentials - Vector identities (without proof).

MODULE IV VECTOR INTEGRATION 8

Line integral over a plane curve - Surface integral - Area of a curved surface - Volume integral - Greens, Gauss divergence and Stoke's theorems - Verification and application in evaluating line, surface and volume integrals. (Cube and Cuboids).

MODULE V MULTIPLE INTEGRALS 12

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Change of variables from cartesian to polar coordinates - Triple integrals – Volume of solids (Spherical and Cylindrical polar coordinates).

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/05/2024

S. Neelakrishnan
Chairman
Board of Studies
Department of Humanities & Sciences

MODULE VI FOURIER SERIES **12**

Fourier series – Convergence of Fourier series - Half range sine and cosine series – Parseval's theorem.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
2. Calculus and Analytic geometry, G.B. Thomas and R.L. Finney, 9th Edition, Pearson, Reprint, 2002.

REFERENCES:

1. Higher Engineering Mathematics, B. V. Ramana, 11th reprint, Tata McGraw-Hill, New Delhi, 2010.
2. Engineering Mathematics for first year, T. Veerarajan, Tata McGraw-Hill, New Delhi, 2008.
3. A text-book of Engineering Mathematics, N.P. Bali and Manish Goyal, 9th Edition, Laxmi Publications, Reprint, 2008.
4. Higher Engineering Mathematics, B. S. Grewal, 40th Edition, Khanna Publishers, New Delhi, 2007.

WEB REFERENCES:

1. https://testbook.com/maths/cayley-hamilton-theorem
2. https://www.iitg.ac.in/rafik/Tutorials/MA-102/2013/lect-10.pdf
3. https://ms.unimelb.edu.au/__data/assets/pdf_file/0007/2516596/functions_sev_var.pdf
4. https://www.mecmath.net/VectorCalculus.pdf
5. https://egyankosh.ac.in/bitstream/123456789/64855/1/Unit4.pdf
6. https://williamsgj.people.charleston.edu/Fourier%20Series.pdf

ONLINE RESOURCES:

1. https://www.youtube.com/watch?v=oJDlt_Xv-mM
2. https://www.youtube.com/watch?v=8h3yY0im5XU
3. https://www.youtube.com/watch?v=LGxE_yZYigI
4. https://www.youtube.com/watch?v=ma1QmE1SH3I
5. https://www.youtube.com/watch?v=QPw4GYz5Unc
6. https://www.youtube.com/watch?v=1mMYaPkXcNI

Recommended by
Board of Studies of H&S dept.
Meeting No. 06 Dated: 31.05.2024

S. Namasivayam
Chairman
Board of Studies
Department of Humanities & Sciences

COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

1. Diagonalize the matrix using orthogonal transformation and apply Cayley Hamilton Theorem to find the inverse and integral powers of a square matrix. (K3)
2. Evaluate the limit, examine the continuity and use derivatives to find extreme values for functions of several variables. (K3)
3. Compute the derivatives of scalar and vector point functions. (K3)
4. Use the vector point function to establish the relation between line, surface and volume integrals. (K3)
5. Apply double and triple integrals to find the area and the volume of a region. (K3)
6. Compute Fourier series expansion of a function. (K3)

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-
CO6	3	-	-	-	-	-	-	-	-	-	-

SEMESTER - I

24HSEN101 - SDG NO. 4	COMMUNICATIVE ENGLISH	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- Develop the basic LSRW skills
- Acquire enhanced knowledge of English grammar
- Improve modern and technical vocabulary
- Enhance the communicative and cognitive skills
- Interpret the texts and write reviews critically

S. Ramakrishnan
Chairman
Board of Studies
Department of Humanities & Sciences

Recommended by
Board of Studies of H&S dept.
Meeting No. 06 Dated: 31.05.2024

MODULE - I COMMUNICATION PROCESS 8

Listening – informal conversations - Speaking – basics in speaking – speaking on given topics & situations – recording speeches and strategies to improve - Reading comprehension – skimming/ scanning/ predicting – question & answers – objective and descriptive answers - Writing – paragraph writing, personal notes - Language Development – parts of speech, prefix, suffix, word formation

MODULE - II LANGUAGE BARRIERS, LEVELS AND CHANNELS 8

Listening –interviews - Speaking – describing a simple process – asking and answering questions - Reading – critical reading – finding key information in a given text – ideation, mind mapping - Writing - dialogue,, instructions – Language Development – regular, irregular verbs, tenses, framing questions,

MODULE - III NARRATION AND SUMMATION 8

Listening - long texts - TED talks - extensive speech on current affairs - Speaking – role plays – asking about routine actions and expressing opinions - Reading- longer texts & making a critical analysis of the given text - Writing – essay (comparative / analytical), jumbled sentences, recommendations - Language Development – writing single sentence definitions, sequence words

MODULE - IV WRITING MECHANICS 7

Listening -debates and discussions – practicing multiple tasks –Speaking - self introduction about friends/ places/ hobbies - Reading -Making inference from the reading passage – Predicting the content of the reading passage - Writing – informal letters, e-mails - accuracy, coherence, brevity – Language Development- single word substitutes, compound words- conditionals

MODULE - V INTERPRETATION SKILLS 7

Listening- popular speeches and presentations - Speaking - impromptu speeches -Reading - articles – magazines - Writing – review writing, channel conversion – bar diagram/ table, poster/ picture interpretation - Language Development – modal verbs, collocations, 21st century vocabulary

MODULE - VI COGENT EXPOSITIONS 7

Listening - Motivational speeches - Speaking - Debates and discussion - Reading - analytical reading - newspapers - Writing - process description - Language Development - voices, sentences expressing purpose, synonyms & antonyms

TOTAL: 45 PERIODS

Recommended by
Board of Studies of H&S dept.
Meeting No. 06 Dated: 31.05.2024

Chairman
Board of Studies
Department of Humanities & Sciences

TEXT BOOKS:

1. Board of Editors. Using English: A Coursebook for Undergraduate Engineers and Technologists. Orient Blackswan Limited, Hyderabad: 2015.
2. A Course in Technical English, D. Praveen Sam and K.N. Shoba, Cambridge University Press, 2020

REFERENCES:

1. Anderson, Paul V. Technical Communication: A Reader – Centered Approach. Cengage, New Delhi, 2008.
2. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason, USA, 2007.
3. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford, 2007.
4. Chauhan, Gajendra Singh and et.al.Technical Communication (Latest Revised Edition). Cengage Learning India Pvt. Limited, 2018.

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc19_hs31/preview
2. https://www.myenglishpages.com/speaking/#google_vignette

ONLINE RESOURCES:

1. https://wwPearson.com/english/catalogue/business-english/technical-english.html
2. https://ww.cambridgeenglish.org/learning-english/free-resources/

OUTCOMES:

Upon completion of the course, the student will be able to:

1. Improve understanding and application of listening, speaking, reading, and writing skills (K2)
2. Demonstrate the ability to write personal notes, clear and coherent paragraphs (K2)
3. Apply analytical skills to write essays, rearrange jumbled sentences, and formulate recommendations (K3)
4. Apply skills to develop email etiquette and construct professional emails and informal letters (K3)
5. Analyze and interpret data to write comprehensive and effective reviews (K3)
6. Enhance vocabulary, improve grammatical accuracy, and confidently engage in debates (K2)

Recommended by
Board of Studies of H&S dept.
Meeting No. 06 Dated: 31.05.2024

S. Ramakrishnan
Chairman
Board of Studies
Department of Humanities & Sciences

CO-PO, PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	3	-	2	-	-
CO3	-	-	-	-	-	-	-	-	3	-	2	-	-
CO4	-	-	-	-	-	-	-	-	3	-	2	-	-
CO5	-	-	-	-	-	-	-	-	3	-	2	-	-
CO6	-	-	-	-	-	-	-	-	3	-	2	-	-

SEMESTER - I

24BSPH101 - SDG NO. 4,7,9,11	ENGINEERING PHYSICS	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To understand the basic concepts of mechanics and its use in engineering applications.
- To understand the concept of waves and lasers and its applications.
- To illustrate the various laws of electromagnetic waves and its applications.
- To apply the concepts of quantum mechanics to engineering studies.
- To understand the basics of crystal for engineering applications.
- To identify the basic principles involved in thermal physics and its applications.

MODULE - I PROPERTIES OF MATTER **8**

Elasticity – Hooke's law- Poisson's ratio - Stress - strain diagram and its uses - Twisting couple - shaft - Torsion pendulum: theory and experiment - bending of beams - bending moment - cantilever: theory and experiment - uniform and non-uniform bending: theory and experiment - I-shaped girders.

MODULE - II MECHANICAL WAVES AND LASERS **7**

Waves on a string – standing waves – traveling waves – Energy transfer of a wave – Reflection and refraction of light waves – interference –Theory of air wedge and experiment - Theory of laser – characteristics – Spontaneous and stimulated emission – Einstein's coefficients – population inversion – Nd-YAG laser, CO2 laser – Basic applications of lasers in industry.

Recommended by Board of Studies of H&S dept. Meeting No. 06 Dated: 31.05.2024

S. Ramasubramanian
Chairman
Board of Studies
Department of Humanities & Sciences

MODULE - III ELECTROMAGNETIC WAVES **8**

The Maxwell's equations – wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field – properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter – polarization – Producing electromagnetic waves – Energy and momentum in EM - Reflection and transmission of electromagnetic waves from a non-conducting medium vacuum interface for normal incidence.

MODULE - IV BASIC AND APPLIED QUANTUM MECHANICS **7**

Black body radiation – Planck's derivation – Electrons and matter waves –The Schrodinger equation (Time dependent and time independent forms) – significance of wave function – Normalization –Free particle – particle in a infinite potential well: 1D, 2D and 3D Boxes; - Barrier penetration and quantum tunneling (qualitative) – Scanning Tunneling Microscope.

MODULE - V CRYSTAL PHYSICS **8**

Single crystalline, Polycrystalline and Amorphous materials - single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal - Miller indices - Interplanar distance - X-Ray diffraction - Calculation of number of atoms per unit cell - Atomic radius - Coordination number – packing. factor for SC, BCC, FCC and HCP structures - Polymorphism and allotropy. Crystal Growth: Chochralski technique - Molecular beam epitaxy.

MODULE - VI THERMAL PHYSICS **7**

Transfer of heat energy - Conduction, Convection and Radiation - Thermal conductivity, Forbe's method and Lee's disc method - Conduction through compound media - series and parallel methods - Heat exchangers - Refrigerators and Solar water heaters.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. D.K. Bhattacharya & T.Poonam, "Engineering Physics". Oxford University Press, 2015.
2. R.K. Gaur & S.L. Gupta, "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. B.K. Pandey & S.Chaturvedi, "Engineering Physics", Cengage Learning India, 2017.
4. V. Rajendran, "Engineering Physics", Mc Graw Hill Publications Ltd. New Delhi, 2014.
5. M.N. Avadhanulu And P.G. Kshirsagar, "A textbook of Engineering Physics", S.Chand&Co Ltd. 2016.

Recommended by
Board of Studies of H&S dept.
Meeting No. 06 Dated: 31.05.2024

S. Ramakrishnan
Chairman
Board of Studies
Department of Humanities & Sciences

REFERENCES:

1. D. Halliday, Resnick & J. Walker, "Principles of Physics", Wiley, 2015.
2. R.A. Serway, & J.W. Jewett, "Physics for Scientists and Engineers", Cengage Learning, 2010.
3. N.K. Verma," Physics for Engineers", PHI Learning Private Limited, 2014.
4. P.A. Tipler & G. Mosca "Physics for Scientists and Engineers", W.H.Freeman, 2020.
5. Brijlal and Subramanyam, "Properties of Matter", S. Chand Publishing, 2018.
6. Shatendra Sharma & Jyotsna Sharma, "Engineering Physics", Pearson, 2018.
7. Arthur Beiser. "Concepts of Modern Physics", McGraw-Hill, 6th Edition. 2003.
8. Charles Kittel, "Introduction to Solid State Physics". John Wiely & Sons. 8th Edition, 2005.

OUTCOMES:

Upon completion of the course, the student will be able to:

1. Apply the concepts of stress, torsion, and bending to study the mechanical behavior of structural elements using theoretical and experimental methods. (K3)
2. Analyze wave phenomena and interference to study energy transfer, and evaluate laser principles with their industrial applications. (K4)
3. Examine Maxwell's equations and electromagnetic wave theory to analyze wave propagation, polarization and reflection-transmission phenomena in different media (K4)
4. Utilize the principles of quantum mechanics to explain black body radiation, matter waves, particle confinement in potential wells and tunneling phenomena. (K3)
5. Examine and compare the characteristics of various crystal structures, polymorphic forms, and crystal growth techniques. (K4)
6. Apply the principles of heat transfer to determine the thermal conductivity and explain the role of heat exchangers in refrigerators and solar water heaters. (K3)

Recommended by
Board of Studies of H&S dept.
Meeting No. 06 Dated: 31.05.2024

Chairman
Board of Studies
Department of Humanities & Sciences

CO-PO, PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-
CO5	-	3	-	-	-	-	-	-	-	-	-
CO6	3	-	-	-	-	-	-	-	-	-	-

SEMESTER - I

24BSCY101 - SDG NO. 4,7,8,9,11,12,17	ENGINEERING CHEMISTRY	L	T	P	CP	C
		3	0	0	4	3

OBJECTIVES:

- To enumerate the importance, synthesis, and applications of polymers.
- To impart basic knowledge of chemistry and the principles involved in electrochemistry, energy storage devices, and their commercial applications.
- To familiarize the fundamental laws and concepts of important photophysical and photochemical processes, as well as spectroscopy.
- To explore the fundamental concepts, laws, and principles of thermodynamics, and apply its derivations to optimize and innovate engineering processes across various disciplines.
- To comprehend the chemistry of fuels and combustion, and their applications across various engineering and industrial processes.
- To gain an understanding of the emergence and challenges of nanomaterials and nanotechnology across various scientific and technological disciplines.

MODULE - I POLYMER CHEMISTRY **8**

Polymers: Definition, Degree of polymerization, Functionality of monomer, Classification of polymer with examples, Types of polymerization, Mechanism of addition polymerization (Free radical mechanism).

Plastics: Definition and Characteristics - Thermoplastics & Thermosets. Preparation, properties and engineering applications of plastics -PVC, Teflon, Kevlar and Bakelite.

Recommended by Board of Studies of H&S dept. Meeting No. 06 Dated: 31-05-2024

S. Nanasekaran Chairman Board of Studies Department of Humanities & Sciences

Fibers: Characteristics fibers - Preparation, properties and applications of Nylon and Dacron. Biodegradable polymers & Conducting Polymers: Characteristics, Classification and their applications.

MODULE - II ELECTROCHEMISTRY AND BATTERY TECHNOLOGY **7**

Electrochemistry: Types of Cells (Electrochemical and Electrolytic cell) – Redox reaction – Single and Standard electrode potential, Reference electrodes - SHE, Calomel electrode, Measurement of Single Electrode Potential, Nerns't equation (Derivation & Problems), Electrochemical series and its significance.

Batteries: Evolution of batteries – Primary and Secondary battery (Lead acid battery), Next Generation Battery Technology (NGBT) - Solid-state batteries (Lithium-ion), Sodium-ion batteries.

MODULE - III PHOTOCHEMISTRY & SPECTROSCOPY **7**

Photochemistry: Laws of photochemistry - Grotthuss–Draper law, Stark–Einstein law and Lambert-Beer Law. Quantum efficiency – determination-Photo processes - Jablonski diagram (Internal Conversion, Intersystem crossing, Fluorescence, Phosphorescence), Chemiluminescence and Photo-sensitization.

Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and Rotational transitions. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram only).

MODULE - IV CHEMICAL THERMODYNAMICS **8**

Terminology of Thermodynamics - Laws of Thermodynamics – I law – Significance – Mathematical formulation and its applications. II law – Need for the II law. Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes, entropy of phase transitions; Clausius inequality. Helmholtz and Gibbs free energy functions, Criteria of spontaneity, Maxwell relations, Gibbs-Helmholtz equation, Van't Hoff Isotherm and Isochore.

MODULE - V FUELS **8**

Fuels: Introduction –Classification of fuels – Coal – Analysis of coal (proximate and ultimate). Carbonization – manufacture of metallurgical coke (Otto Hoffmann method) – Petroleum – manufacture of synthetic petrol (Bergius process). Knocking – Octane number and Cetane number – Gaseous fuels – Compressed natural gas (CNG), Liquefied petroleum gas (LPG). Biofuels – Gobar gas and Biodiesel.

Combustion of fuels: Introduction – Calorific value – Higher and Lower Calorific values – Theoretical calculation of Calorific value(Dulong formula) – Flue gas analysis (ORSAT Method).

Recommended by Board of Studies of H&S dept. Meeting No. 06 Dated: 31.05.2024

S. Ramakrishnan
Chairman
Board of Studies
Department of Humanities & Sciences

MODULE - VI NANOCHEMISTRY 7

Introduction - Types of nanomaterials - Emergence and challenges in nanotechnology- Synthesis routes for nanomaterials: Bottom-up and top-down approaches - Sol-gel, precipitation, Thermolysis, Laser ablation, Chemical Vapour Deposition (CVD), Electro deposition - Properties of nanomaterials- Mechanical properties, Chemical, Optical, Electrical and Magnetic properties-applications of nanomaterials (Gold nanoparticles as an example). Quantum Dots - concept, properties and applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015.
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P)LTD, New Delhi, 2015.
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.
4. Ravikrishnan A, 'Engineering Chemistry', Sri Krishna Hitech Publishing Company Pvt. Ltd, New Edition 2024.

REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi,2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.
4. Chemistry of Nanomaterials Vol.1 S.S.R Kumar Challa (Ed).
5. Advanced chemistry by Phillip Matthews Vol.1 and Vol.2.
6. Chemistry in Engineering and Technology Vol. 1 & 2, J.C. Kuriacose and J. Rajaram.
7. Applied chemistry - A textbook for Engineers and Technologists by H.D. Gesser.
8. Chemical and Electrochemical Energy Systems, R. Narayanan, B. Viswanathan, University Press India Limited.

OUTCOMES:

Upon completion of the course, the student will be able to:

1. Explain the importance of polymers in science and technology, describe their roles in different applications and discuss their impacts on modern advancements. (K3)

Recommended by
Board of Studies of H&S dept.
Meeting No. 06 Dated: 31.05.2024

S. Ramanathan
Chairman
Board of Studies
Department of Humanities & Sciences

2. Recognize the basic principles of electrochemistry and describe their application in battery technologies. (K3)
3. Apply the concepts of key photophysical and photochemical processes, as well as spectroscopy, to develop and optimize various applications. (K3)
4. Describe the principles of the second law of thermodynamics and its derivations to analyze engineering applications across all disciplines. (K3)
5. Categorize the chemistry of fuels and combustion and their applications at various levels. (K3)
6. Demonstrate the knowledge of nanomaterials, including their properties, behavior, interactions and applications across various disciplines of science and technology. (K3)

CO-PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	-	-	2	-	-	-	-	-
CO2	3	3	3	-	-	2	-	-	-	-	-
CO3	3	2	3	-	2	-	-	-	-	-	-
CO4	3	2	3	-	-	1	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-
CO6	2	1	2	-	-	-	-	-	-	-	-

SEMESTER - I

24ESCS101 106105171 SDG NO. 4 & 9	PROBLEM SOLVING AND PROGRAMMING IN C	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- Interpret Mathematical problems using algorithms, flowchart and pseudocode.
- To understand the programming language.
- To develop C Programs using basic Programming Constructs, Loops, Arrays and Strings.
- To develop applications in C using Functions, Pointers and Structures.
- To perform I/O operations and File Handling in C.

Recommended by Board of Studies of CSE dept. Meeting No. 7 Dated: 30.5.24

CHAIRMAN Board of Studies Department of Computer Science and Engineering Sri Sairam Engineering College

MODULE - I INTRODUCTION TO PROGRAMMING AND ALGORITHMS FOR PROBLEM SOLVING 7

Introduction to Problem Solving through programs- Algorithm-Flowchart–Pseudocode-Memory, Variables, Values, Instructions, Programs-compilation process-Syntax and Semantic Errors- The language of C : Phases of developing a running computer program in C - Character set – Constants – Keywords – Primitive data types –Declaration, Type Conversion.

MODULE - II BASICS OF C PROGRAMMING 7

Sequential- Arithmetic Operators, Relational Operators, Logical Operators, Increment Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation, selective – If, Else-If, Switch- repetitive structures-for, while, do while, Nested loops, go to, break, continue –Finding maximum of 3 numbers, Unit converters, Interest calculators, multiplication tables, GCD and LCM, Prime number generation.

MODULE - III ARRAYS AND STRINGS 8

Introduction to Arrays: Declaration, Initialization – One Dimensional Array – Example Program: Computing Mean, Median and Mode - Two Dimensional Arrays – Example Program: Matrix Operations (Addition, Scaling, Determinant and Transpose) - String Operations: Length, Compare, Concatenate - Copy – Selection Sort - Linear and Binary Search.

MODULE - IV FUNCTIONS AND POINTERS 9

Introduction to Functions: Function Prototype, Function Definition, Function Call, Built-in Functions (String Functions, Math Functions) – Recursion – Example Program: Computation of Sine Series - Scientific Calculator using Built-in Functions - Binary Search using Recursive Functions - Factorial and Fibonacci Generation - Towers of Hanoi problem - – Pointers – Pointer Operators – Pointer Arithmetic – Arrays and Pointers –Array of Pointers – Example Program: Sorting of Names – Parameter Passing: Pass by Value - Pass by Reference – Example Program: Swapping of Two Numbers using Pass by Reference.

MODULE - V STRUCTURES 7

Structure - Nested Structures – Pointer and Structures – Array of Structures – Example Program using Structures and Pointers – Self Referential Structures – Dynamic Memory Allocation - Singly Linked List – Typedef.

MODULE - VI FILE PROCESSING 7

Files – Types of File Processing: Sequential Access, Random Access – Sequential Access File - Example Program: Finding Average of Numbers stored in Sequential Access File - Random Access File - Example Program

Recommended by Board of Studies of CSE dept. Meeting No. 7 Dated: 30.5.24

CHAIRMAN Board of Studies Department of Computer Science and Engineering Sri Sairam Engineering College

Transaction Processing Using Random Access Files – Command Line Arguments.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R.G. Dromey, "How to solve it by Computers", Reprint, PHI Publishers, 2011.
2. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2018.
3. Kernighan, B.W and Ritchie D.M, "The C Programming language", Second Edition, Pearson Education, 2015.

REFERENCES:

1. Yashwant Kanetkar, "Let us C", 18th Edition, BPB Publications, 2021.
2. Byron Gottfried, "Programming with C", Fourth Edition, Tata McGraw Hill Education, 2018.
3. Paul Deitel and Harvey Deitel, "C How to Program", Seventh edition, Pearson Publication, 2015.
4. Jeri R. Hanly & Elliot B.Koffman, "Problem Solving and Program Design in C", Pearson Education, 2013.
5. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009.
6. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
7. Hanly J R & Koffman E.B, "Problem Solving and Programme design in C", Pearson Education, 2009.

WEB REFERENCES:

1. https://www.learn-c.org/
2. https://codeforwin.org/
3. https://www.cprogramming.com

ONLINE RESOURCES:

1. https://www.linuxtopia.org/online_books/programing_books/gnu_c_programming_tutorial
2. https://nptel.ac.in/courses/106105171
3. https://swayam.gov.in/nd1_noc19_cs42/preview

Recommended by
Board of Studies of CSE dept.
Meeting No. 7 Dated: 30.5.24

CHAIRMAN
Board of Studies
Department of Computer Science and Engineering
Sri Sairam Engineering College

OUTCOMES:

Upon completion of the course, the student will be able to:

1. Solve basic problems using algorithms, flowcharts, and pseudo code.(K3)
2. Analyze the various programming constructs for basic computational problems.(K4)
3. Implement simple C programs using arrays and strings. (K3)
4. Use functions, recursion, and pointers to perform calculations, searching, and sorting.(K3)
5. Apply structures and dynamic memory allocation in handling complex programming tasks. (K3)
6. Organize sequential and random file processing techniques to provide solutions for real-world computational problems. (K4)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	2
CO2	-	3	-	-	-	-	-	-	-	-	-	2	2
CO3	3	-	-	-	-	-	-	-	-	-	-	1	2
CO4	-	3	-	-	-	-	-	-	-	-	-	2	2
CO5	-	3	-	-	-	-	-	-	-	-	-	2	3
CO6	-	-	3	-	-	-	-	-	-	-	-	3	3

SEMESTER - I

24ESGE101 - SDG NO. 4,6,7,9,12, 14 & 15	ENGINEERING GRAPHICS	L	T	P	CP	C
		1	2	0	3	3

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
- To visualize the job in three dimensions.
- To have a clear conception and appreciation of the shape, size, proportion and design.
- To expose the student community to existing national standards related to technical drawings.

Recommended by Board of Studies of MECH dept. Meeting No. 08 Dated: 01.06.2024

CHAIRMAN Board of Studies Mechanical Engineering

MODULE - I PLANE CURVES 6+4

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid on Horizontal Surfaces – Drawing of tangents and normal to the above curves.

MODULE - II PROJECTION OF POINTS, LINES AND PLANES 6+4

Projection of Points (Concept only). Projection (Elevation and Plan) of straight lines, inclined to both reference planes by rotating line method. Projection of plane surfaces, inclined to one of the reference planes by rotating object method.

MODULE - III PROJECTION OF SOLIDS 6+4

Projection of regular solids (Prisms, Pyramids, Cylinder and cone) in first quadrant, by rotating object method when the axis is inclined to one of the reference planes.

MODULE - IV ORTHOGRAPHIC PROJECTION 6+4

Orthographic Projection - Principles of orthographic projections, Orthographic projection of objects from pictorial view.

MODULE - V SECTION AND DEVELOPMENT OF LATERAL SURFACE 6+4

Projection of sectioned solids (Prisms, Pyramids, Cylinder and cone) and true shape of the sections, when the axis of the solid is perpendicular to HP alone and cutting plane inclined to HP only. Development of lateral surfaces of sectioned regular vertical solids (Prisms, Pyramids, Cylinder and Cone) with cutting plane inclined to HP only.

MODULE - VI ISOMETRIC PROJECTIONS 6+4

Isometric projection – Principle, isometric scale, Isometric views and Isometric projections of truncated solids - Prisms, Pyramids, Cylinder and Cone in simple vertical positions only.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2011.
2. T. Jeyapoovan, "Engineering Graphics using AUTOCAD", Vikas Publishing House Pvt Ltd, 7th Edition.

Recommended by
Board of Studies of MECH dept.
Meeting No. 08 Dated: 01.06.2024

CHAIRMAN
Board of Studies
Mechanical Engineering

REFERENCES:

1. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
2. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
3. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.

WEB REFERENCES:

1. https://archive.nptel.ac.in/courses/112/102/112102304/

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/105/104/105104148/
2. https://nptel.ac.in/courses/112/103/112103019/

OUTCOMES:

Upon completion of the course, the student will be able to:

1. Perform free hand drawing of conical sections and cycloids. (K3)
2. Sketch the orthographic projection of lines and plane surfaces of rectangle, square, pentagon and Hexagon. (K3)
3. Draw the orthographic projection of regular solids like prism, pyramids, cylinder and cone using change of position method. (K3)
4. Draw plan, elevation and side views for the 3dimensional isometric drawing by using the concepts of orthographic projection. (K3)
5. Draw the section and development of lateral surfaces for the regular solids like Prism, Pyramid, Cylinder and Cone for the axis perpendicular to HP. (K3)
6. Draw the isometric view, projection for regular and truncated solids like Prism, Pyramid, Cylinder and Cone. (K3)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	2	-	-	-	3
CO2	3	-	-	-	-	-	-	-	2	-	-	-	3
CO3	3	-	-	-	-	-	-	-	2	-	-	-	3
CO4	3	-	-	-	-	-	-	-	3	-	-	-	3
CO5	3	-	-	-	-	-	-	-	2	-	-	-	3
CO6	3	-	-	-	-	-	-	-	3	-	-	-	3

Recommended by
Board of Studies of MECH dept.
Meeting No. 08 Dated: 01.06.2024

CHAIRMAN
Board of Studies
Mechanical Engineering

SEMESTER - I

24HSTA101 - SDG NO. 4	HERITAGE OF TAMILS	L	T	P	CP	C
		1	0	0	1	1

OBJECTIVES:

- Develop interest for classical language and literature to promote Tamil heritage
- Understand the ancient Tamil sculptures, folk and martial arts and contribution of Tamil to the freedom of India

அலகு ஐ மொழி மற்றும் இலக்கியம்

இந்திய மொழிக் குடும்பங்கள் — திராவிட மொழிகள் — தமிழ் ஒரு செம்மொழி — தமிழ் செவ்விலக்கியங்கள் — சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை — சங்க இலக்கியத்தில் பகிர்தல் அறம் — திருக்குறளில் மேலாண்மைக் கருத்துகள்

UNIT I LANGUAGE AND LITERATURE 5

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

அலகு II இடைகால மற்றும் நவீன இலக்கியங்கள்

தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம்- பக்தி இலக்கியம் — ஆழ்வார்கள் மற்றும் நாயன்மார்கள் — சிற்றிலக்கியங்கள் — தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி — தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு

Unit II MEDIEVAL AND MODERN LITERATURE 5

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.

அலகு III மரபு ஓ பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை

நடுகல் முதல் நவீன சிற்பங்கள் வரை — ஐம்பொன் சிலைகள் — பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் — தேர் செய்யும் கலை — சுடுமண் சிற்பங்கள் — நாட்டுப்புறத் தெய்வங்கள் — குமரிமுனையில் திருவள்ளுவர் சிலை — இசைக் கருவிகள் — மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் — தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

UNIT III HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 5

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures> Village deities> Thiruvalluvar Statue at Kanyakumari - Making of musical instruments - Mridhangam> Parai> Veenai> Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

Rockfort Board of Studies of H&S dept. Meeting No. 06 Dated: 31.05.2024

S. Ramakrishnan
Chairman
Board of Studies
Department of Humanities & Sciences

அலகு IV நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

UNIT IV FOLK AND MARTIAL ARTS 5

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

அலகு V தமிழர்களின் திணைக் கோட்பாடுகள்

தமிழகத்தின் தாவரங்களும், விலங்குகளும் — தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் — தமிழர்கள் போற்றிய அறக்கோட்பாடு — சங்க காலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் — சங்ககால நகரங்களும் துறைமுகங்களும் — சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி — கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

UNIT V THINAI CONCEPT OF TAMILS 5

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.

அலகு VI இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு — இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் — சுயமரியாதை இயக்கம் — இந்தியமருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு — கல்வெட்டுகள், கையெழுத்துப்படிகள் — தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

UNIT VI CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 5

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

TOTAL: 30 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு — மக்களும் பண்பாடும் — கே.கே. பிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியில் பணிகள் கழகம்)
2. கணினித் தமிழ் — முனைவர் இல.சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி — வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை — ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

Recommended by
Board of Studies of H&S dept.
Meeting No. 06 Dated: 21.05.2024

S Ramakrishnan
Chairman
Board of Studies
Department of Humanities & Sciences

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

OUTCOMES:

Upon completion of the course, the learners will be able to:

1. மொழிக் குடும்பங்களின் வரலாறு மற்றும் தமிழ் இலக்கியங்களை மதிப்பிடுகிறார்கள் Students evaluate the history of language families and Tamil literatures (K3)
2. பக்தி மரபுகளின் தாக்கம் பெற்ற தமிழ் இலக்கியங்களைப் புரிந்துகொள்கிறார்கள் Students understand Tamil literatures influenced by Philosophical and religious traditions (K3)
3. தமிழகத்தின் பாறை, சிற்பம், ஓவியம்- கலை மரபுகளைப் பகுப்பாய்வு செய்கிறார்கள் Students analyze the artistic traditions of Tamil Nadu such as rock art, sculpture, and painting (K3)
4. தமிழக நாட்டுப்புறக் கலைகள் மற்றும் தற்காப்புக் கலைகளின் மாண்புகளை உணர்ந்து கொள்கிறார்கள் Students realize the significance of Tamil Nadu's folk arts and martial arts (K3)
5. பழந்தமிழரின் திணையியல் வாழ்வியலை மீளாய்வு செய்கிறார்கள் Students re-examine the ecological lifestyle (Thinai-based life) of the ancient Tamils (K3)
6. தேசிய இயக்கம் மற்றும் இந்தியப் பண்பாட்டில் தமிழர்களின் பங்களிப்பினை நினைவுகூர்கிறார்கள் Students recall the contribution of Tamils to the National Movement and Indian culture (K3)

Recommended by
Board of Studies of H&S dept.
Meeting No. 06 Dated: 31.05.2024

S. Ramakrishnan
Chairman
Board of Studies
Department of Humanities & Sciences

CO-PO, PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	3	-	-	-	-	-	-	-	2	2	2
CO2	2	3	3	-	-	-	-	-	-	-	2	2	2
CO3	2	3	3	-	-	-	-	-	-	-	2	2	2
CO4	2	3	3	-	-	-	-	-	-	-	2	2	2
CO5	2	3	3	-	-	-	-	-	-	-	2	2	2
CO6	2	3	3	-	-	-	-	-	-	-	2	2	2

SEMESTER - I

24BSPL101 - SDG NO. 6,11,12,17	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	CP	C
		0	0	4	4	2

PHYSICS LABORATORY (Any Five Experiments to be conducted)

OBJECTIVES:

- Demonstrate the wave nature of light using diffraction and interference properties.
- Study the thermal conductivity of a bad conductor.
- Verify experimentally the elastic properties of materials.

Sl.No.	Name of the Experiment
1	(a) Determination of wavelength of Laser (b) Determination of numerical aperture and acceptance angle in an optical fiber. (c) Determination of particle size using laser source.
2	Determination of thermal conductivity of a bad conductor – Lee's Disc method.
3	Determination of Young's modulus by non-uniform bending method.

Recommended by Board of Studies of H&S dept. Meeting No. 06 Dated: 31.05.2024

S. Narasimhan
Chairman
Board of Studies
Department of Humanities & Sciences

4	Determination of the period of oscillation of a given torsional pendulum for a fixed length and find the rigidity modulus of the wire.
5	Find out the thickness of the given wire by air wedge method.
6	Calculation of lattice cell parameter – X-ray diffraction method.
7	Determination of Planck's constant.
8	Determination of wavelength of mercury spectrum – spectrometer grating.
9	Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
10	Determination of band gap of a semiconductor.
11	Determination of Hall coefficient by Hall Effect experiment.
12	Determination of solar cell characteristics.

CHEMISTRY LABORATORY (Any Five Experiments to be conducted)

OBJECTIVES:

- To acquaint students with practical knowledge of the basic concepts of chemistry that they will encounter during their studies and in the industry and engineering fields.
- To acquaint students with the determination of the molecular weight of a polymer by viscometry.
- To develop and understand the basic concepts of acidic and basic nature using pH.

Sl.No.	Name of the Experiment
1	Conductometric titration of strong acid vs strong base.
2	Determination of chloride content of water sample by Argentometric method.
3	Determination of strength of acids in a mixture of acids using conductivity meter.
4	Determination of total, temporary & permanent hardness of water by EDTA method.
5	Estimation of iron content of the given solution using potentiometer.
6	Determination of DO content of water sample by Winkler's method.
7	Determination of strength of given hydrochloric acid using pH meter.
8	Estimation of iron content of the water sample using spectrophotometer (1,10- Phenanthroline / thiocyanate method).

Recommended by Board of Studies of H&S dept. Meeting No. 06 Dated: 31.05.2024

S. Narasakshmaiah
Chairman
Board of Studies
Department of Humanities & Sciences

9 Estimation of Sodium and Potassium in the given sample of water using Flame Photometer.

10 Determination of molecular weights of polymer samples using Ostwald's Viscometer.

11 Synthesis of nano-CdS by precipitation. (Demonstration only)

12 Corrosion experiment-weight loss method.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Engineering Physics Lab, Dr. G. SenthilKumar, VRB publishers. (2019)
2. Engineering Physics Practical, Dr. P. Mani, Dhanam Publications. (2020)

TEXTBOOK:

1. Vogel's Textbook of Quantitative Chemical Analysis (8th edition,2014).
2. Practical Physical chemistry by B. Viswanathan, P. S. Raghavan (Vivabooks), 2009.
3. Foundation of Experimental Chemistry by Jubaraj B. Baruah, ParikshitGogoi, 2010.

OUTCOMES:

Upon completion of the course, the student will be able to:

1. Apply the principles of elasticity and thermal physics to evaluate the various modulus of elasticity and conductivity of a bad conductor. (K3)
2. Explicate the properties of semiconductors by evaluating the band gap, I-V characteristics of solar cells and Hall effect of the materials. (K3)
3. Describe multiple measurement techniques, including volumetric titrations, conductivity, pH, redox potential and optical density measurements, used to estimate the amount of substance present in a solution. (K3)
4. Apply spectroscopic techniques, viscometry, synthesize nanoparticles, analyze the corrosion behavior of materials in different environments. (K3)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	-	2	-	-	-	-	-	2
CO2	3	3	-	-	2	-	-	-	-	-	2
CO3	3	3	-	-	2	-	-	-	-	-	2
Co4	3	3	-	-	2	-	-	-	-	-	2

Recommended by Board of Studies of H&S dept.
Meeting No. 06 Dated: 31.05.2024

Chairman
Board of Studies
Department of Humanities & Sciences

SEMESTER - I

24ESPL101 - SDG NO. 4 & 9	PROGRAMMING IN C LABORATORY	L	T	P	CP	C
		0	0	2	2	1

OBJECTIVES:

- To develop programs in C using basic Programming Constructs.
- To develop applications in C using Arrays and Strings.
- To design and implement applications in C using Functions, Structures.
- To develop applications in C using Files.

LIST OF EXPERIMENTS

1. Write a program using I/O statements and expressions.
2. Write programs using decision-making constructs.
3. Write a program to find whether the given year is a leap year or not? (Hint: not every century is a leap. For example 1700, 1800 and 1900 is not a leap year).
4. Write a program to perform the Calculator operations, namely, addition, subtraction, multiplication, division and square of a number.
5. Write a program to check whether a given number is an Armstrong number or not.
6. Write a program to check whether a given number is odd or even.
7. Write a program to find the factorial of a given number.
8. Write a program to find out the average of 4 integers.
9. Write a program to print half pyramid of *.
10. Write a program to display array elements using two dimensional arrays.
11. Write a program to perform swapping using a function.
12. Write a program to display all prime numbers between two intervals using functions.
13. Write a program to solve towers of Hanoi using recursion.
14. Write a program to get the largest element of an array using the function.
15. Write a program to concatenate two strings.
16. Write a program to find the length of String.
17. Write a program to find the frequency of a character in a string.
18. Write a program to store Student Information in Structure and Display

Recommended by
Board of Studies of CSE dept.
Meeting No. 7 Dated: 30.5.24

CHAIRMAN
Board of Studies
Department of Computer Science and Engineering
Sri Sairam Engineering College

19. The annual examination is conducted for 10 students for five subjects. Write a program to read the data and determine the following:

(a) Total marks obtained by each student.

(b) The highest marks in each subject and the marks of the student who secured it.

(c) The student who obtained the highest total marks.

20. Write a program to demonstrate file operations (e.g. count the number of characters, words and lines in a file, replace a specific word with the given word in the same file).

TOTAL: 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Stand alone desktops with C compiler 30 Nos. (Or)
   Server with C compiler supporting 30 terminals or more.

OUTCOMES:

Upon completion of the course, the student will be able to:

1. Apply basic constructs, arrays, strings,functions and recursion for executing C programming applications.(K3)
2. Analyze C programs involving pointers and structures.(K4)
3. Evaluate applications using sequential and random access files.(K5)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	2	-	-	-	-	-	-	1	1
CO2	-	-	3	-	-	-	-	-	-	-	-	1	2
CO3	-	-	3	-	-	-	-	-	-	-	-	2	2

SEMESTER - I

24ENTP101 - SDG NO.4	FUNCTIONAL LIFE SKILLS	L	T	P	CP	C
		1	0	1	2	1

OBJECTIVES:

- Resolve common communication problems
- Observe the effectiveness of nonverbal messages
- Communicate precisely through the digital media
- Understand the importance of empathetic listening
- Explore reading and speaking processes

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/05/2024

S. Narrakishnan
Chairman
Board of Studies
Department of Humanities & Sciences

MODULE - I LISTENING **5**

Techniques of effective listening
Listening and comprehending
Probing questions
Barriers to listening
Reflection from listening

MODULE - II SPEECH MECHANICS **5**

Pronunciation
Enunciation
Vocabulary
Fluency
Common errors

MODULE - III READING SKILLS **5**

Techniques of effective reading
Kinds of reading
Gathering ideas and information from the text
Evaluating the ideas and information
Interpreting the text from multiple angles

MODULE - IV WRITING ASPECTS **5**

Writing process
Effective writing strategies
Different modes of writing
Optimizing the use of resources
Editing

MODULE - V PRESENTATION SKILLS **5**

Types of presentations
Nonverbal communication
Understanding the purpose and the audience
Beginning and closure of presentations
Presentation tools and strategies

MODULE - VI ARTICULATION ASPECTS **5**

Perform exercises
Slow speeches
Long speeches

Recommended by
Board of Studies of H&S dept.
Meeting No. 06 Dated: 31.05.2024

S. Narasakrishnan
Chairman
Board of Studies
Department of Humanities & Sciences

Monologues, Dialogues and Conversation
Feedback necessity

TOTAL : 30 PERIODS

REFERENCES:

1. Sen, Madhuchanda.2010, An Introduction to Critical Thinking, Delhi, Pearson.
2. Effective Communication Skills Strategies for Success. Edited by Nitin Bhatnager and Mamta Bhatnager. 2023, Pearson
3. Technical Communication: Principles and Practice, Meenakshi Raman and Sangeeta Sharma. Oxford University Press, 2015

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_hs31/preview
2. https://www.myenglishpages.com/speaking/#google_vignette

OUTCOMES:

Upon completion of the course, the student will be able to:

1. Employ reading, writing, and listening skills to communicate clearly in academic and professional contexts.
2. Demonstrate confident oral communication and presentation skills using appropriate tools and techniques.
3. Interpret ethical, inclusive, and culturally aware communication in team and societal settings

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	3	-	2	-	-
CO3	-	-	-	-	-	-	-	3	2	-	2	-	-

Recommended by
Board of Studies of H&S dept.
Meeting No. 06 Dated: 31.05.2024

S. Ramakrishnan
Chairman
Board of Studies
Department of Humanities & Sciences

SEMESTER - I

24ESID101 - SDG NO. 1-17	IDEA ENGINEERING LAB - I	L	T	P	CP	C
		0	0	2	2	1

OBJECTIVES:

- To understand the significance of Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs) of the United Nations
- To familiarize with SDG targets and indicators
- To identify the Constitutional implementation pertaining to SDGs in Panchayat Raj
- To acquire knowledge of the State and the Central government welfare schemes
- To recognize the role of educational Institutions in community development
- To develop critical thinking skills to address complex societal challenges through an immersion program

MODULE - 1 United Nations Sustainability and the Sustainable Development Agenda **3**

- Introduction to Sustainability
- Indian Rural Environment: Necessity and Sustainability
- Millennium Development Goals (MDGs)
- United Nations Sustainable Development Goals (SDGs) & the Agenda
- Overview of the Sustainable Development Goals (SDGs)

MODULE - 2 Universal SDG Targets **4**

- SDG Framework
- Key Components
- Pillars of the SDGs
- Targets of the Goals
- Indicators of the Targets

MODULE-3 SDG and Indian Gram Panchayat **3**

- Gram Panchayat
- Salient Features of Constitutional Amendments
- Transition from SDGs to LSDGs (Localizing Sustainable Development Goals)

Recommended by Board of Studies of H&S dept. Meeting No. 06 Dated: 31.05.2024

S. Ramakrishnan
Chairman
Board of Studies
Department of Humanities & Sciences

MODULE-4 Government Schemes 4

- Introduction to State and Central Government Schemes
- Overview of Government Schemes
- Localization and Implementation at the Regional Level
- Impact on Local Communities

MODULE-5 Community Engagement 4

- Key Recommendations of the National Education Policy
- Guidelines for Fostering Social Responsibility
- Awareness
- Participation
- Collaboration

MODULE-6 Idea Generation 12

- Immersion Program
- Focus Areas
- Channelizing Ideas
- Forming Working Teams for SDGs (Sustainable Development Goals)

TOTAL: 30 PERIODS

REFERENCES:

1. Joy Elamon and Ms. Mariamma Sanu George,"The Handbook on Sustainable Development Goals and Gram Panchayats" , State Institute for Rural Development (SIRD).
2. Dr.C.R.Rene Robin, Dr.PA.Shanthi , Dr.B.Thanuja & Dr.V.Yuvaraj ,"Sairam SDG Idea Engineering Lab I", Sri Sairam Engineering College.

WEB REFERENCES

1. UN Sustainable Development Goals
2. https://srmuniv.digimat.in/nptel/courses/video/109106200/L30.html
3. https://avcce.digimat.in/nptel/courses/video/109106200/L26.html

OUTCOMES:

Upon completion of the course, the student will be able to:

1. Analyse and apply the concepts of sustainability,Rural environment,Gram panchayat and various government schemes to design innovative practical solutions that address real life rural challenges. (K2)
2. Compare MDG's,SDG's and LSDG's to analyse village topology and identify specific development targets to propose innovative rural solutions. (K4)

Recommended by Board of Studies of H&S dept. Meeting No. 06 Dated: 31.05.2024

Chairman Board of Studies Department of Humanities & Sciences

3. Analyse the attainment levels of SDG's and write a reflective report on local community.(K4)
4. Formulate problem statement based on local community needs and propose innovative ideas for community development. (K4)
5. Perform an individual presentation of field observation by mapping them with relevant SDG's and justify their significance for rural development. (K4)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	1	-	-	-	2	-	-	1	-	2
CO4	-	2	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	1	-	3	2	3	1

Recommended by
Board of Studies of H&S dept.
Meeting No. 06 Dated: 31.05.2024

C. Namakrishnan
Chairman
Board of Studies
Department of Humanities & Sciences

SEMESTER - II

24BSMA202 - SDG NO. 4	DIFFERENTIAL EQUATIONS, COMPLEX VARIABLES AND TRANSFORMS	L	T	P	CP	C
		3	1	0	4	4

OBJECTIVES:

- The objective of this course is to familiarize the prospective engineers with techniques in Ordinary differential equations, Complex variables, Z - Transforms, Fourier Transforms and Laplace transforms. It aims to equip the students to deal with advanced levels of mathematics and applications that would be essential for their disciplines.

MODULE - I ORDINARY DIFFERENTIAL EQUATIONS **12**

Second and Higher order linear differential equations with constant coefficients - Method of variation of Parameters -Homogeneous equation of Euler's and Legendre's type - System of simultaneous first order linear differential equations with constant coefficients.

MODULE- II COMPLEX VARIABLES **9**

Analytic functions – Necessary and sufficient conditions for analyticity in cartesian and polar coordinates (without proof)- Properties- Harmonic Conjugate-Construction of analytic functions-Conformal mapping -Bilinear transformation (w=1/z).

MODULE - III COMPLEX INTEGRATION **9**

Cauchy- Goursat theorem (without proof) - Cauchy Integral formula (without proof) - Zeroes of Analytic functions - Singularities - Laurent's Series - Residues – Cauchy Residue theorem (without proof).

MODULE - IV LAPLACE TRANSFORMS **12**

Existence conditions – Transforms of elementary functions – Transform of Unit step function and Unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives – Transform of Periodic functions - Inverse Laplace Transforms - Initial and Final value theorems – Convolution theorem (excluding proof) –- Application of solution of linear second order ordinary differential equations with constant coefficients.

MODULE - V FOURIER TRANSFORMS **9**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Convolution theorem – Parseval's identity.

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/08/24

S. Narasimhan
Chairman
Board of Studies
Department of Humanities & Sciences

MODULE - VI Z-TRANSFORMS 9

Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Advanced Engineering Mathematics, Erwin Kresizg, 9th Edition, John Wiley & Sons, 2006.
2. Advanced Modern Engineering Mathematics, Glyn James, 3rd Edition, Pearson Education, 2010.

REFERENCES:

1. Higher Engineering Mathematics, Dass, H.K., and Er. Rajnish Verma, Reprint, S. Chand Private Ltd., 2011.
2. Higher Engineering Mathematics, B.S. Grewal, 44th Edition, Khanna Publishers, 2023.
3. Advanced Engineering Mathematics, Peter V. O'Neil, 7th Edition, Cengage learning, 2012.
4. An Introduction to Ordinary Differential Equations, E. A. Coddinton, 1st Edition, Prentice Hall, 1961.
5. Higher Engineering Mathematics, Ramana. B.V., 11th Reprint, Tata McGraw-Hill, New Delhi, 2010.
6. A Text Book of Engineering Mathematics, N. P. Bali and Manish Goyal, Reprint, Laxmi Publications, 2008.

WEB COURSES:

1. http://archive.nptel.ac.in/courses/111/106/111106100/
2. https://nptel.ac.in/courses/111105134/ (Week-3 Complex Differentiation)
3. https://nptel.ac.in/courses/111105134 (Week 4 Complex Integration)
4. https://archive.nptel.ac.in/courses/111/106/111106111/
5. http://www.nptelvideos.com/course.php?id=90

ONLINE RESOURSES:

1. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video-lectures/lecture-1-introduction/
2. https://ocw.mit.edu/courses/18-04-complex-variables-with-applications-spring-2018/

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/05/2024

S Narasimhaiah
Chairman
Board of Studies
Department of Humanities & Sciences

COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

1. Solve ordinary differential equations of second and higher order with constant coefficients, variable coefficients and simultaneous linear differential equations. (K3)
2. Construct an analytic function and apply the properties of analytic functions to check for harmonic and orthogonal functions and find the images of circle and straight lines under the standard transformations. (K3)
3. Use Cauchy's integral theorem, formula and Cauchy's Residue theorem to evaluate complex and real integrals, find the Taylor's and Laurent's series expansion. (K3)
4. Apply Laplace and inverse Laplace Transforms to solve the linear ordinary differential equations with constant coefficients. (K3)
5. Find Fourier transforms and Fourier sine and cosine transforms of simple functions. (K3)
6. Solve difference equations using Z-transforms. (K3)

CO-PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	-	-	-	-	-	-	-	-	-	-	3	-
CO6	3	-	-	-	-	-	-	-	-	-	-	3	-

SEMESTER - II

24HSEN201 - SDG NO.4	PROFESSIONAL ENGLISH	L	T	P	CP	C
		2	0	0	2	2

OBJECTIVES:

- Acquire techniques for comprehending and critically analyzing passages
- Improve the communicative competence
- Enhance learners' ability to read and write complex texts, summaries, definitions and reports
- Write effective formal letters and reports

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/08/2024

S. Narasimhaiah
Chairman
Board of Studies
Department of Humanities & Sciences

- Develop skills for preparing effective job application

MODULE - I EFFECTIVE COMMUNICATION 6

Listening – Listening to conversations – Speaking – making conversations in real life occurrences – Reading - short stories, happenings - Writing – autobiographical writing, preparation of checklist – communication and types of communication – Language Development –- subject - verb agreement, commonly confused words – spellings

MODULE - II BASICS OF TECHNICAL WRITING 5

Listening – listening to advertisements and products – Speaking - creating greetings/wishes/excuses and thanks – Reading – articles/novels - Writing - summary of articles, writing modes, formats, compositions - Language Development - reported speech, numerical adjectives

MODULE - III REPORT WRITING 4

Listening – listening to podcasts – Speaking - practicing telephonic conversations – observing and responding. Reading – regular columns of newspapers/magazines - Writing – reports – feasibility, accident, preparation of agenda and minutes – Language Development - cause & effect expressions, discourse markers

MODULE - IV DIVERSE WRITING SKILLS 5

Listening – documentaries, anecdotes and short stories - Speaking – expressing opinions using verbal and non-verbal communication – Reading biographies/autobiographies, travelog, – Writing – formal letters – inviting guests – acceptance/declining letters - Language Development- degrees of comparison – embedded sentences - acronyms and abbreviations

MODULE - V CAREER COMPETENCIES 6

Listening – expert talks – recommending suggestions & solutions – Speaking – Debate- participating in a group discussion – learning GD strategies – Reading – innovations, ideations - Writing – Job application, resume, – proposals – Language Development – verbal analogies – phrasal verbs

MODULE - VI LEXICAL ENHANCEMENT 4

Listening - technical and general talks - Speaking - oral presentation with visual aids - Reading - successful stories/autobiographies - Writing - writing blogs - Language Development - common errors in English, idiomatic expressions

TOTAL: 30 PERIODS

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/05/2024

S. Narasimhaiah
Chairman
Board of Studies
Department of Humanities & Sciences

TEXT BOOKS:

1. Board of editors. Fluency in English: A Course book for Engineering and Technology. Orient Blackswan, Hyderabad 2016.
2. Raman, Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford University Press.

REFERENCES:

1. Bailey, Stephen. Academic Writing: A Practical Guide for Students. Routledge, New York,2011.
2. Raman, Meenakshi, Sharma, Sangeeta. Technical Communication. Principles and Practice. Oxford University Press, New Delhi, 2014.
3. Muralikrishnan & Mishra Sunitha, Communication skills for Engineers 2nd ed. Pearson, Tamil Nadu, India 2011. P. Kiranmai and Rajeevan, Geetha. Basic Communication Skills, Foundation Books, New Delhi, 2013.
4. Vesilind Aarne P., Public Speaking and Writing Skills for Engineering Students (2nd Ed), Lakeshore press, 2007
5. Richards, Jack C. Interchange Students' Book – 2. Cambridge University Press, New Delhi, 2015.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc20_hs21/preview
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/109106122/lec1.pdf
3. https://takelessons.com/en-in/search?service=English&sort=1&utm_

ONLINE RESOURCES:

1. https://www.coursera.org/specializations/improve-english?
2. https://www.fluentu.com/blog/educator-english/business-english-conversation-topics/

OUTCOMES:

Upon completion of the course, the student will be able to:

1. Demonstrate an understanding of various types of communication and prepare effective checklists.(K2)
2. Summarize articles/ write ups (K2)
3. Construct feasibility reports, accident reports, survey reports and meeting minutes (K3)
4. Apply skills to compose official letters with emphasis and clarity (K3)

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/08/2019

S. Narasimhaiah
Chairman
Board of Studies
Department of Humanities & Sciences

5. Compose job applications and technical proposals (K3)
6. Demonstrate the ability to express opinions in both oral and written forms of communication (K2)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	-	3	-	-
CO2	-	-	-	-	-	-	-	-	3	-	3	-	-
CO3	-	-	-	-	-	-	-	-	3	-	3	-	-
CO4	-	-	-	-	-	-	-	-	3	-	3	-	-
CO5	-	-	-	-	-	-	-	1	3	-	3	-	-
CO6	-	-	-	-	-	-	-	1	3	-	3	-	-

SEMESTER - II

24BSPH201 - SDG NO. 4,7,9	PHYSICS OF ELECTRONIC DEVICES	L	T	P	CP	C
		3	0	0	4	3

OBJECTIVES:

- To acquaint the electrical properties of materials.
- To enlighten the basic principles of semiconductor physics.
- To acquaint the applications of semiconductor devices.
- To introduce the optical properties of materials.
- To educate the properties of magnetic and dielectric materials and their uses.
- To illustrate the properties and applications of nano devices.

MODULE - I ELECTRICAL PROPERTIES OF MATERIALS **8**

Classical free electron theory - Expression for electrical conductivity - Thermal conductivity expression - Wiedemann-Franz law - Success and failures - electrons in metals - Fermi- Dirac statistics - Density of energy states - Electron in periodic potential- Energy bands in solids – tight binding approximation - Electron effective mass- concept of hole.

MODULE - II SEMICONDUCTOR AND TRANSPORT PHYSICS **7**

Semiconductors – Energy band diagram – direct and indirect band gap semiconductors –Intrinsic semiconductor– Carrier concentration in intrinsic

Recommended by Board of Studies of HAS dept. Meeting No. 6 Dated: 31/05/2024

S. Narayanan Chairman Board of Studies Department of Humanities & Sciences

semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Variation of carrier concentration with temperature – Carrier transport in Semiconductors:, Mobility ,Drift and Diffusion Current densities.

MODULE - III SEMICONDUCTOR SWITCHING DEVICES **8**

PN Junction Diode - Construction ,Working and Characteristics - Transistor - NPN, PNP working - Early effect - Current equations - Input and Output Characteristics of CB, CE and CC configurations - JFET and its characteristics - MOSFET and its characteristics - Construction and Working of D-MOSFET - UJT, SCR - CCD and Optocoupler. IoT concept and use in industry.

MODULE - IV OPTICAL PROPERTIES OF MATERIALS **7**

Classification of optical materials - optical absorption and emission process in materials - charge carrier generation and recombination - optical absorption loss and gain.– Optoelectronic devices - Solar cells – LED – OLED - Nonlinear optics- Modulators, switching devices Plasmonics (Qualitative)

MODULE - V MAGNETIC AND DIELECTRIC PROPERTIES OF MATERIALS8

Magnetism in materials - Magnetic field and induction - Magnetization - permeability and susceptibility - Types of magnetic materials - microscopic classification of magnetic materials Ferromagnetism - Domain Theory - Hysteresis phenomenon - Dielectric materials – Introduction - Types of Polarization (qualitative) - internal field - Clausius-Mossotti relation – dielectric loss - dielectric breakdown (definitions) - Dielectric constant measurement by Schering bridge method.

MODULE - VI NANO DEVICES **7**

Quantum Confinement - Quantum structures - Density of states in quantum well, wires, and dots (Quantitative) - Band Gap of Nano materials - Tunnelling - Single electron phenomena - Single electron transistor - Quantum DOT lasers - Conductivity of metallic nano wires - Carbon Nano Tubes (CNT): Structures, properties and applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S.O. Kasap. Principles of Electronic Materials and Devices, McGraw Hill Education (Indian Edition), 2020.
2. R.F.Pierret. Semiconductor Device Fundamentals. Pearson (Indian Edition), 2006.
3. G.W.Hanson. Fundamentals of Nanoelectronics. Pearson Education (Indian Edition), 2009.

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/05/2019

S. Narasakkumar
Chairman
Board of Studies
Department of Humanities & Sciences

4. Dr.P.Mani. Physics for Electronic Devices, Dhanam Publications, 2024.

REFERENCES:

1. Laszlo Solymar, Walsh, Donald, Syms and Richard R.A., Electrical Properties of Materials, Oxford Univ. Press (Indian Edition) 2015.
2. Jasprit Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Education (Indian Edition), 2019.
3. Mark Fox, Optical Properties of Solids, Oxford Univ.Press, 2001.
4. N.Gershenfeld. The Physics of Information Technology. Cambridge University Press, 2011.

OUTCOMES:

Upon completion of the course, the student will be able to:

1. Explore the basic concepts of free electron theory of solids and apply it to determine the conducting properties, carrier concentration and effective mass of an electron in conductors (K3)
2. Analyze the band structures and carrier concentrations of semiconductors, study their variations with temperature, and examine carrier transport mechanisms (K4)
3. Apply the working principles of semiconductor devices and use IoT concepts in practical applications (K3)
4. Examine the optical processes in materials and analyze the operation of optoelectronic devices (K4)
5. Demonstrate the magnetic and dielectric properties of materials and their applications (K3)
6. Analyze quantum confinement and quantum structures, examine the working principles of quantum devices, and explore the applications of carbon nanotubes (K4)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-
CO4	-	3	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-
CO6	3	-	-	-	-	-	-	-	-	-	-

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/05/2024

S. Narasimha Murthy
Chairman
Board of Studies
Department of Humanities & Sciences

SEMESTER - II

24BSCY201 - SDG NO.4	CHEMISTRY FOR ENVIRONMENT AND SUSTAINABILITY	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To gain a comprehensive understanding of environmental science, the intricate relationships within ecosystems, and the crucial role of biodiversity conservation..
- To introduce the structure and components of the atmosphere, and provide an overview of the photochemical reactions involved.
- To foster a sound understanding of water quality parameters and water treatment techniques.
- To explore the various components of soil and understand the steps involved in Solid Waste Management (SWM).
- To advocate the benefits of renewable energy and promote awareness of sustainable energy practices. .
- To implement the principles of Green Chemistry in alignment with the Sustainable Development Goals (SDGs).

MODULE - I INTRODUCTION TO ENVIRONMENTAL SCIENCE 8

Environment: Definition, concept of environment and its components - scope and importance of environment – need for public awareness.

Ecosystem: Structure and functions: Structures - Biotic and Abiotic components. Functions - Energy flow in ecosystems, food chains and food webs. Biogeochemical cycles(C,N&P), Ecological succession.

Biodiversity and its conservation: Definition, types, importance of biodiversity, values and threats to biodiversity. Endangered and endemic species - concept and basis of identification of 'Hotspots'; hotspots in India. Strategies for biodiversity conservation: in situ, ex situ and in vitro conservation.

MODULE - II ATMOSPHERIC CHEMISTRY 7

Atmospheric Chemistry - Composition and structure of atmosphere. Climate change - greenhouse effect - role of greenhouse gases (CO_2, CH_4, N_2O, CFCs) on global warming. Chemical and photochemical reactions in the atmosphere - Formation of smog, PAN, acid rain (causes, effect and control measures). Oxygen and ozone chemistry - Ozone layer depletion (causes, effect and control measures).

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/05/2024

Chairman
Board of Studies
Department of Humanities & Sciences

MODULE - III WATER CHEMISTRY **8**

Importance and scope of water chemistry - Sources and impurities in water - Water Quality Parameters - Specifications as per WHO/BIS standards. Hardness of water, types, numerical problems on hardness of water. Softening of water - Internal treatment (Lime-soda, Phosphate, Calgon, Sodium Aluminate and Colloidal conditioning). External treatments: Ion exchange and Zeolite processes. Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination). Desalination of brackish water by Reverse osmosis. Sustainable water management practices (water recycling and rainwater harvesting)

MODULE - IV SOIL CHEMISTRY AND SOLID WASTE MANAGEMENT **7**

Soil Chemistry: Chemical composition of soil, Acid-Base and Ion-Exchange Reactions in Soil, Soil acidity and salinity. Importance of NPK in Soil Fertility. Modern agriculture - Impacts of both excessive and insufficient fertilizer use, alongside the effects of pesticides on soil chemistry and the environment. Sustainable agriculture - Approaches to improve soil salinity (leaching, soil amendments, crop rotation), Design and use of green pesticides for sustainable farming.

Solid Waste Management System: Sources and types of solid waste, Elements of solid waste management, Methods of residential and commercial waste collection, Treatment / processing - Incineration, Composting, Landfill - Dumpsite rehabilitation.

MODULE - V ENERGY AND ENVIRONMENT **8**

Energy sources – Renewable and non-renewable energy sources. Principle and generation of solar energy (solar collectors, photo-voltaic modules, solar ponds), wind energy, geothermal energy; tidal energy, OTEC energy from biomass, biofuels, Nuclear energy - fission and fusion, Nuclear fuels, Nuclear reactor – principles and types. Need for energy efficiency, Energy conservation and sustainability - action strategies for sustainable energy management from a future perspective.

MODULE - VI GREEN CHEMISTRY AND SUSTAINABILITY **7**

Green Chemistry: Introduction to green chemistry, Principles of Green Chemistry (12-principles), the concept of atom economy and chemical synthesis, Important techniques used in green chemistry. Application of green chemistry, viz. replacement of ozone depleting substances including CFCs, manufacture of biodegradable polymers, use of H2O2 as benign bleaching agents in the paper industry.

Sustainable Development: Definition and concepts of sustainable development; Need for sustainable development; Sustainable development goals – 17 SDG goals.

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/05/2024

C. Narasakkumar
Chairman
Board of Studies
Department of Humanities & Sciences

Sustainable practices: Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment and Environmental Impact Assessment.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
3. Ravikrishnan A, 'Environmental Science and Engineering', Sri Krishna Hitech Publishing Company Pvt. Ltd, Revised Edition 2020.
4. Vogel's Textbook of Quantitative Chemical Analysis (8th edition,2014).

REFERENCES:

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hyderabad, 2015.
3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
4. Chemistry for Environmental Engineering, Clair N. Sawyer, Perry L. Mc Carty, Gene F. Parkin, 4th Edition, McGraw-Hill.
5. Environmental Chemistry - Stanley Manahan, 11th Edition, CRC Press.

OUTCOMES:

Upon completion of the course, the student will be able to:

1. Develop a foundational understanding of environmental science, the interactions within ecosystems, the significance of biodiversity, and the importance of conservation strategies for maintaining ecological balance. (K3)
2. Identify the primary components of the atmosphere, explain the causes of atmospheric pollution, and propose basic strategies to promote a sustainable and clean atmosphere. (K3)
3. Demonstrate complex water quality parameters, and develop innovative methods for producing cost-effective soft water suitable for both industrial use and potable consumption. (K3)
4. Describe the composition and functions of soil components, analyze the sources and characteristics of solid wastes, and evaluate the methods and strategies employed in solid waste management (SWM). (K3)

Recommended by Board of Studies of HAS dept. Meeting No. 6 Dated: 31/05/2024

S. Narayanan
Chairman
Board of Studies
Department of Humanities & Sciences

5. Explain renewable and non-renewable resources, describe various methods for harnessing energy from different sources and explain their applications in various contexts. (K3)
6. Illustrate a comprehensive understanding of green chemistry principles and their alignment with sustainable development goals, preparing them to contribute to environmentally friendly and sustainable practices in their future careers.(K3)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-
CO4	2	2	1	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-
CO6	3	3	-	2	1	-	-	-	-	-	-

SEMESTER - II

24ECPC201 SDG NO. 4 & 9	CIRCUIT ANALYSIS	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To learn the concepts and behavior of DC and AC circuits using basic laws.
- To develop the ability to analyze electrical circuits using mesh and nodal analysis techniques.
- To understand various methods of circuit analysis using network theorems, duality and topology.
- To learn the concepts of resonance and coupling in circuits.
- To study the transient and steady state response of the circuits subjected to DC and AC with sinusoidal excitations.
- To become familiar with the concepts of two port networks.

Recommended by
Board of Studies of ECE dept.
Meeting No. 07 Dated: 22.02.2024

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - I BASIC CIRCUIT ANALYSIS **9**

Ohm's Law – Kirchhoff's laws –Mesh current and node voltage method of analysis for D.C and A.C. circuits.

MODULE - II NETWORK TOPOLOGY **5**

Network reduction: voltage and current division, source transformation – star delta conversion.Network terminology – Graph of a network - Incidence and reduced incidence matrices – Trees –Cut sets - Fundamental cut sets – Cut set matrix – Tie sets - Link currents and Tie set schedules -Twig voltages and Cut set schedules, Duality and dual networks.

MODULE - III NETWORK THEOREMS FOR DC AND AC CIRCUITS **9**

Network theorems -Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Millman's theorem, and Maximum power transfer theorem.

MODULE - IV RESONANCE AND COUPLED CIRCUITS **7**

Resonance - Series resonance - Parallel resonance - Variation of impedance with frequency -Variation in current through and voltage across L and C with frequency – Bandwidth - Q factor -Selectivity. Self-inductance - Mutual inductance - Dot rule - Coefficient of coupling

MODULE - V TRANSIENT ANALYSIS **9**

Natural response-Forced response - Transient response of RC, RL and RLC circuits to excitation by Step Signal, Impulse Signal and exponential sources - Complete response of RC, RL and RLC Circuits to sinusoidal excitation.

MODULE - VI TWO PORT NETWORKS **6**

Two port networks, Z parameters, Y parameters, Transmission (ABCD) parameters, Hybrid (H) Parameters, Interconnection of two port networks, Symmetrical properties of T and π networks.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Jr William H. Hayt, Jack E. Kemmerly, Jamie D. Phillips, Steven M. Durbin, "Engineering Circuit Analysis", McGraw Hill education, 10th Edition, 2024.
2. Charles, Sadiku, Mathew N.O Alexander, "Fundamentals of Electric Circuits", McGraw Hill, 6th Edition, 2022.
3. Joseph Edminister and Mahmood Nahvi, "Electric Circuits", Schaum's Outline Series", Tata McGraw Hill Publishing Company, New Delhi, 7th Edition Reprint 2017.

Recommended by
Board of Studies of ECE dept.
Meeting No. 07 Dated: 22.02.2024

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

REFERENCES:

1. Robert.L. Boylestead, "Introductory Circuit Analysis", Pearson Education India, 14th Edition, 2023.
2. A. Nagoor kani., "Circuit Analysis", The McGraw Hill Education, 2nd Edition, 2018.
3. Allan H. Robbins, Wilhelm C. Miller, —Circuit Analysis Theory and Practice, Cengage Learning, Fifth Edition, 1st Indian Reprint 2013.
4. John O'Malley, Schaum's Outlines "Basic Circuit Analysis", The McGraw Hill companies, 2nd Edition, 2011.

WEB RESOURCES:

1. https://www.circuitlab.com/
2. https://www.coursera.org/courses?query=circuit%20analysis
3. https://hogonext.com/how-to-circuit-analysis-resources-books-websites-and-courses/

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_ee99/preview
2. https://onlinecourses.nptel.ac.in/noc24_ee14/preview
3. https://archive.nptel.ac.in/courses/108/106/108106172/

OUTCOMES:

At the end of the course, the student should be able to:

1. Apply Ohm's Law, Kirchhoff's Laws, Mesh Current Method, and Node Voltage Method to analyze and solve DC and AC circuits for voltages, currents, and power. (K3)
2. Analyze and solve electrical circuits using network reduction techniques such as voltage/current division, source transformations, star-delta conversions, and graphical representations. (K4)
3. Evaluate DC and AC electrical circuits using network theorems such as Superposition, Thevenin's, Norton's, Reciprocity, Millman's, and Maximum Power Transfer. (K4)
4. Analyze the frequency response of resonance circuits and apply concepts of inductance and coupling to solve electrical circuits. (K4)
5. Analyze the transient response of RL, RC and RLC circuit for standard test signals like step, impulse, exponential and sinusoidal signals. (K4)
6. Implement two port Z, Y, ABCD and h parameter equivalent models for electric circuits and compare the symmetrical properties of T and π Networks. (K3)

Recommended by
Board of Studies of ECE dept.
Meeting No. 07 Dated: 22.02.2024

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	3	3	2	3	-	-	-	3	3	3
CO2	3	3	2	3	3	2	3	-	-	-	3	3	3
CO3	3	3	2	3	3	2	3	-	-	-	3	3	3
CO4	3	3	2	3	3	2	3	-	-	-	3	3	3
CO5	3	3	2	3	3	2	3	-	-	-	3	3	3
CO6	3	3	2	3	3	2	3	-	-	-	3	3	3

SEMESTER - II

24HSTA201 - SDG NO. 4	TAMILS AND TECHNOLOGY	L	T	P	CP	C
		1	0	0	1	1

OBJECTIVES:

- Understand the techniques that help for a better livelihood
- Identify the methods used for scientific Tamil computing

அலகு-I நெசவு மற்றும் பானைத் தொழில்நுட்பம்

சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.

UNIT-I WEAVING AND POTTERY (CERAMIC) TECHNOLOGY 5

Weaving Industry during Sangam Age - Ceramic technology - Black and Red-ware Potteries (BRW) - Graffiti on Potteries.

அலகு -II சங்ககாலவடிவமைப்புகள்

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள்ரூசங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு -சங்க காலத்தில் கட்டுமான பொருட்களும்நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள்.

UNIT-II SANGAM AGE DESIGNS 5

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

Recommended by Board of Studies Meeting No. 6 Dated: 31/05/24

S. Narasimhan Chairman Board of Studies Department of Humanities & Sciences

அலகு -III பழங்காலகட்டிடத் தொழில்நுட்பம்

மாமல்லபுரச்சிற்பங்களும், கோவில்களும் - சோழர்காலத்துப்பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத்தலங்கள் - நாயக்கர்காலக்கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டுவீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக்கட்டிடக் கலை.

UNIT-III ANCIENT CONSTRUCTION TECHNOLOGY 5

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.

அலகு- IV உற்பத்தித் தொழில்நுட்பம்

கப்பல் கட்டும் கலை -உலோகவியல் -இரும்புத் தொழிற்சாலை இரும்பை உருக்குதல், எஃகு - வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் சங்கு மணிகள் -எலும்புத்துண்டுகள் - தொல்லியல்சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

UNIT-IV MANUFACTURING TECHNOLOGY 5

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 - Archaeological evidences - Gem stone types described in Silappathikaram.

அலகு - V வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம்

அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக்குமுழித்தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காகவடிவமைக்கப்பட்டகிணறுகள்- வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள்- கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.

UNIT-V AGRICULTURE AND IRRIGATION TECHNOLOGY 5

Dam, Tank, Ponds, Sluice, Significance of KumizhiThoompu of Chola Period> Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries - Pearl - Conch diving -Ancient Knowledge of Ocean - Knowledge Specific Society.

அலகு-VI அறிவியல்தமிழ்மற்றும்கணித்தமிழ்

அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக்கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/05/2019

S. Ramakrishnan
Chairman
Board of Studies
Department of Humanities & Sciences

UNIT-VI SCIENTIFIC TAMIL & TAMIL COMPUTING 5

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

TOTAL: 30 PERIODS

TEXT-CUM-REFERENCE BOOKS

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

OUTCOMES:

Upon completion of the course, the learners will be able to:

1. சங்ககால நெசவு மற்றும் பானைத்தொழில்நுட்பங்களைப் பற்றி அறிந்து கொள்ளுதல்
   To learn about the weaving and pottery (ceramic) technologies during the Sangam Age.(K2)
2. சங்ககாலவடிவமைப்புகள் மற்றும் கட்டுமானக்கலையைப் புரிந்து கொள்ளுதல்
   To understand the designs and structural constructions during the Sangam period.(K2)
3. பண்டைய கால கட்டிடக்கலையின்நுட்பங்கள் மற்றும் கட்டிடவடிவமைப்புகளை ஆராய்தல்.
   To explore the techniques and architectural patterns of ancient Tamil structures.(K2)
4. உற்பத்தி மற்றும் உலோகவியல்தொழில்நுட்பங்களைப் பற்றி அறிதல்.

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/Oct/2019

S. Ramakrishnan
Chairman
Board of Studies
Department of Humanities & Sciences

To gain knowledge on manufacturing and metallurgical technologies of ancient Tamils.(K3)

5. வேளாண்மை, நீர்ப்பாசனம் மற்றும் கடல்சார்தொழில்நுட்பங்களைப் பற்றி அறிந்து கொள்ளுதல்.
   To understand agricultural> irrigation> and marine technologies of ancient Tamil society.(K3)
6. அறிவியல்தமிழ் மற்றும் கணித்தமிழின்வளர்ச்சியையும் அதன் கணினி பயன்பாடுகளையும் புரிந்து கொள்ளுதல்.
   To understand the development of Scientific Tamil and its applications in Tamil computing.(K3)

CO-PO, PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	1	2	2
CO2	3	3	3	2	-	-	-	-	-	-	1	2	1
CO3	3	3	3	3	-	-	-	-	-	-	1	2	1
CO4	3	2	3	3	-	-	-	-	-	-	1	2	2
CO5	3	3	3	3	-	-	-	-	-	-	1	2	1
CO6	3	3	3	3	-	-	-	-	-	-	1	2	2

SEMESTER - II

24HSNC201 - SDG NO. 4	NCC COURSE LEVEL 1	L	T	P	CP	C
		2	0	0	2	0

ARMY WING

NCC GENERAL 6

NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2

NATIONAL INTEGRATION AND AWARENESS 4

NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/08/2024

Chairman
Board of Studies
Department of Humanities & Sciences

PERSONALITY DEVELOPMENT		**7**
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
LEADERSHIP		**5**
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		**8**
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1
	TOTAL: 30 PERIODS	

NAVAL WING

NCC GENERAL		**6**
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2
NATIONAL INTEGRATION AND AWARENESS		**4**
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1
PERSONALITY DEVELOPMENT		**7**
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/08/2019

S. Narasaiah Oleti
Chairman
Board of Studies
Department of Humanities & Sciences

LEADERSHIP 5

L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2

SOCIAL SERVICE AND COMMUNITY DEVELOPMENT 8

SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

TOTAL: 30 PERIODS

ARMY WING

NCC GENERAL 6

NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2

NATIONAL INTEGRATION AND AWARENESS 4

NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1

PERSONALITY DEVELOPMENT 7

PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2

LEADERSHIP 5

L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/05/2024

S. Narasimhan
Chairman
Board of Studies
Department of Humanities & Sciences

SOCIAL SERVICE AND COMMUNITY DEVELOPMENT 8

SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

TOTAL: 30 PERIODS

SEMESTER - II

24ESGE102 SDG NO. 4,9,12	ENGINEERING PRACTICES LABORATORY	L	T	P	CP	C
		0	0	4	4	2

OBJECTIVES:

- To provide exposure to the students with hands-on experience on various basic engineering practices in Electrical and Electronics Engineering, Civil and Mechanical Engineering.

ELECTRICAL ENGINEERING PRACTICE

1. Residential house wiring using switches, fuse, indicator, lamp, and energy meter.
2. Fluorescent lamp wiring.
3. Staircase wiring.
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of electrical equipment.

ELECTRONICS ENGINEERING PRACTICE

1. Study of Electronic components and equipment – Resistor- colour coding, measurement of AC signal parameter (peak-peak RMS, period, frequency) using CRO.
2. Study of logic gates AND, OR, EX-OR, and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components, Devices, and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of Half Wave Rectifier and Full Wave Rectifier.

Recommended by
Board of Studies of MECH dept.
Meeting No. 08 Dated: 01.06.2024

CHAIRMAN
Board of Studies
Mechanical Engineering

6. Simulation of Half Wave Rectifier and Full Wave Rectifier using Tinker CAD.

CIVIL ENGINEERING PRACTICE

Buildings:

Study of plumbing and carpentry components of residential and industrial buildings, safety aspects.

Plumbing Works:

1. Study of pipeline joints, its location and functions: valves, taps, couplings unions, reducers, elbows in household fittings.
2. Study of pipe connections requirements for pumps and turbines.
3. Preparation of plumbing line sketches for water supply and sewage works.
4. Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
5. Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

1. Study of the joints in roofs, doors, windows and furniture.
2. Hands-on-exercise: Wood work, joints by sawing, planning and cutting.

MECHANICAL ENGINEERING PRACTICE

Welding:

1. Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
2. Gas welding demo practice.

Basic Machining:

1. Simple Turning and Taper turning.
2. Drilling Practice.

Sheet Metal Work:

1. Forming & Bending.
2. Model making – Trays and funnels.
3. Different type of joints.

Recommended by
Board of Studies of MECH dept.
Meeting No. 08 Dated: 01.06.2024

CHAIRMAN
Board of Studies
Mechanical Engineering

Demonstration on:

1. Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
2. Foundry operations like mould preparation for gear and step cone pulley.
3. Fitting – Exercises – Preparation of square fitting and V – fitting models.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

ELECTRICAL

1. Assorted electrical components for house wiring	15 Sets
2. Electrical measuring instruments	10 Sets
3. Study purpose items:	
Iron box, fan and regulator, emergency lamp	1 Each
4. Megger (250V/500V)	1 No
5. Power Tools:	
Range Finder	2 Nos
Digital Live-wire detector	2 Nos

ELECTRONICS

1. Soldering guns	10 Nos
2. Assorted electronic components for making circuits	50 Nos
3. Small PCBs	10 Nos
4. Multimeters	40 Nos

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets
2. Carpentry vice (fitted to work bench).	15 Nos
3. Standard woodworking tools.	15 Sets
4. Models of industrial trusses, door joints, furniture joints	5 each
5. Power Tools:	
Rotary Hammer	2 Nos
Demolition Hammer	2 Nos
Circular Saw	2 Nos
Planner	2 Nos
Hand Drilling Machine	2 Nos
Jigsaw	2 Nos

Recommended by
Board of Studies of MECH dept.
Meeting No. 08 Dated: 01.06.2024

CHAIRMAN
Board of Studies
Mechanical Engineering

MECHANICAL

1. Arc welding transformer with cables and holders	5 Nos
2. Arc welding transformer with cables and holders	5 Nos
3. Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos
5. Centre lathe.	2 Nos
6. Hearth furnace, anvil and smithy tools.	2 Sets
7. Moulding table, foundry tools.	2 Sets
8. Power Tool: Angle Grinder.	2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner.	1 each

OUTCOMES:

Upon completion of the course, the student will be able to:

1. Infer the values of resistance, peak to peak RMS values, time period, frequency. [K2]
2. Outline the logic gates, rectifier, timer circuits and soldering practices. [K2]
3. Demonstrate the measurement of electrical parameters such as voltage, current, resistance, power and energy. (K2)
4. Illustrate the residential wiring, staircase wiring and fluorescent lamp wiring.[K2]
5. Prepare the carpentry and plumbing joints. (K2)
6. Perform the basic operations of welding, sheet metal work and basic machining operations in Lathe and Drilling (K2)

CO-PO, PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	2
CO2	3	-	-	-	-	-	-	-	-	-	-	2	2
CO3	3	-	-	-	-	-	-	-	-	-	-	2	2
CO4	3	-		-	-	-	-	-	-	-	-	2	2
CO5	2	-	-	-	-	-	-	-	-	-	-	2	2
CO6	2	-	-	-	-	-	-	-	-	-	-	2	2

Recommended by
Board of Studies of MECH dept.
Meeting No. 08 Dated: 01.06.2024

CHAIRMAN
Board of Studies
Mechanical Engineering

SEMESTER - II

24ENTP201 - SDG NO. 4	DIGITAL DYNAMICS	L	T	P	CP	C
		1	0	1	2	0

OBJECTIVES:

- Explore online communication
- Master computer skills
- Use virtual platforms
- Understand digital ethics and cyber security
- Observe and follow do's and don'ts

MODULE - I DIGITAL CULTURE AND SOCIETY 6

Adapting to changes
Importance in today's digital landscape
Digital identity and self- presentation
Online communities and forums
Digital divide and consequences
Online collaboration and collective action

MODULE - II DIGITAL LITERACY AND ACCESS TO TECHNOLOGY 5

Computer skills
Social and cultural understanding
Social media campaign and Activism
Netiquettes
Trending Technologies
Digital tools and softwares

MODULE - III DIGITAL ETHICS 3

Digital ethics and moral panics
The art of protecting secrets
Overview of digital tools

MODULE - IV CYBER SECURITY 3

Threats, vulnerability and consequences
Data making and usage practice
Importance of security

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/05/2024

S. Narasimhan
Chairman
Board of Studies
Department of Humanities & Sciences

MODULE - V DIGITAL NETWORKING 7

Remote work and virtual teams

Authenticity in digital interactions

Engaging content creation

Tools and and techniques for insightful usage

Balancing online and offline interactions

Collaboration for research and innovation

MODULE - VI BUREAU OF INDIAN STANDARDS (BIS): BASIC CONCEPTS, STANDARDS FORMATION PROCESS AND CHALLENGES 6

Standardization –Basic Concepts:

Basic concepts of standardization

Purpose of standardization, marking and certification of articles and processes

Importance of standards to industry, policy makers, trade, sustainability and innovation

Standards Formulation Process and Challenges:

Objectives, roles and functions of BIS, Bureau of Indian Standards Act, ISO/ IEC Directives

WTO Good Practices for Standardization

World of Standards:

Important Indian and International Standards

TOTAL: 30 PERIODS

REFERENCES:

1. Communication Skills and Soft Skills – an Integrated Approach. Edited by E. Sureshkumar, P. Sreehari and J. Savithri, Pearson.
2. Silvia. P.J.2007. How to Read a Lot. Washington DC, American Psychological Association.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_hs31/preview
2. https://www.sscnasscom.com/ssc-projects/capacity-building-and-development/training/gbfs/

OUTCOMES:

Upon completion of the course, the student will be able to:

1. Apply online communication techniques and collaboration skills (K3)
2. Demonstrate the principles of digital ethics in online interactions (K2)
3. Understand the importance of Bureau of Indian Standards (BIS). (K2)

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/08/2024

S. Narayanasamy
Chairman
Board of Studies
Department of Humanities & Sciences

CO-PO, PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	3	-	2	-	-
CO3	-	-	-	-	-	-	-	3	2	-	2	-	-

SEMESTER - II

24ESID201 SDG NO. 1-17	IDEA ENGINEERING LAB - II	L	T	P	CP	C
		0	0	2	2	1

OBJECTIVES:

To impart the basics of technologies that are used to identify sustainable solutions to societal problems

- To Provide awareness on Printed Circuit Board (PCB) design using ORCAD software.
- To Raise awareness of at least three Internet of Things (IoT) projects and their applications.
- To Upskill learners through practical experience with 3D printing and scanning technologies.
- To prepare the learners to correctly align the ideas to SDGs
- To comprehensive knowledge on entrepreneurship and effective idea presentation techniques.
- To evaluate the effectiveness of SDGs and implementation strategy

MODULE-1 BASICS OF DESIGN THINKING IN ELECTRICAL AND ELECTRONIC COMPONENTS 4

- Awareness Session on Basics of Design Thinking
- Study of Active & Passive Electronic Components
- Study of Basic AC & DC Electrical Circuits
- Study of Microprocessors & Microcontrollers
- Demonstration of Arduino Board, ESP 32 Board ,Raspberry Pi Board & PCB design software-Eagle
- Demonstration of PCB design using the software's Orcad, Eagle etc.

MODULE-2 EMBEDDED SYSTEMS, IOT AND ROBOTICS 4

- Study of sensors and transducers
- Study of embedded protocols, IOT Protocols & Embedded C

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/08/2024

S. Ramakrishnan
Chairman
Board of Studies
Department of Humanities & Sciences

- Demonstration of Robotics & Drone models

MODULE-3 BASICS OF MECHANICAL ENGINEERING **4**

- Study of Mechanical Modeling using Fusion 360
- Demonstration of 3D Scanner,3D Printer, Laser Cutter &RD Works Software
- Study of Slicer Software & Master Cam Software

MODULE 4 ALIGNMENT AND MAPPING OF IDEAS **4**

- **Project Title:** Justification of SDG and SAP - Problem Statement & Solution

MODULE-5 ENTREPRENEURSHIP SKILLS **4**

- Startup Awareness
- Entrepreneurship Opportunities
- Mock Presentations
- Innovation
- Novelty
- Feasibility
- Presentation Skills

MODULE-6 SCOUT for SDG IDEATHON **12**

Evaluation Stages:

- First Round
- Second Round
- Idea Pitching

TOTAL: 30 PERIODS

REFERENCES:

1. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering", McGraw Hill Education (India) Private Limited, Second Edition, 2020
2. S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019
3. Elements of Mechanical Engineering by N M Bhatt and J R Mehta, Mahajan Publishing House
4. Basic Mechanical Engineering by Pravin Kumar, Pearson Education
5. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.
6. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2017.

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/08/2024

S. Narasakkoshaey
Chairman
Board of Studies
Department of Humanities & Sciences

7. JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.

WEB REFERENCES

1. https://onlinecourses.nptel.ac.in/noc24_ee112/preview
2. https://onlinecourses.nptel.ac.in/noc24_cs115/preview
3. https://onlinecourses.nptel.ac.in/noc24_me104/preview
4. https://onlinecourses.nptel.ac.in/noc24_me88/preview

OUTCOMES:

Upon completion of the course, the student will be able to:

1. Gain the knowledge on Basic Electronics & Electrical Circuits (K2)
2. Understand the Basics of Embedded systems,IOT & Robotics (K1)
3. Explore the the Basics of Mechanical Modeling (K2)
4. Interpret the mapping of SDGs to ideas. (K4)
5. Illustrate the ideas in the Ideathon event emphatically .(K4)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	-	-	-	1	-	-	-	-	-	-
CO2	1	-	-	-	1	-	-	-	-	-	-
CO3	1	-	-	-	1	-	-	-	-	-	-
CO4	-	-	-	-	-	2	-	3	3	-	2
CO5	-	-	-	-	-	3	-	3	3	-	2

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/08/2024

S. Narasimhan
Chairman
Board of Studies
Department of Humanities & Sciences

SEMESTER - III

24BSMA301 - SDG NO. 4	STATISTICS AND LINEAR ALGEBRA	L	T	P	CP	C
		3	1	0	5	4

OBJECTIVES:

- The main objective of this course is to provide students with the foundations of statistics and linear algebra mostly used in varied applications in engineering.

MODULE - I BASIC STATISTICS 9

Measures of Central tendency – Dispersion - Moments, Skewness and Kurtosis - Correlation and regression – Rank correlation

MODULE - II TESTS OF SIGNIFICANCE FOR LARGE SAMPLES 9

Sampling distributions - Statistical hypothesis - large sample test for single proportion, difference of proportions, single mean, difference of means.

MODULE - III TESTS OF SIGNIFICANCE FOR SMALL SAMPLES 9

Tests based on t-distribution - single mean, Difference of means -paired t test, F test -Chi-square test for independence of attributes and Goodness of fit.

MODULE - IV VECTOR SPACES 9

Vectors and Linear combinations – Vector spaces (Definitions and examples)– Subspaces (Definitions and examples) – Linear independence and linear dependence – Bases and dimensions.

MODULE - V LINEAR TRANSFORMATION AND DIAGONALIZATION 12

Linear transformation - Null spaces and ranges - Dimension theorem (Statement only) - Matrix of a linear transformation - Eigenvalues and eigenvectors - Diagonalizability- Test for Diagonalization.

MODULE - VI INNER PRODUCT SPACES 12

Inner product- norms - Gram Schmidt orthogonalization process - Adjoint of linear operator - Least square approximation.

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Basic Statistics, Agarwal B. L., 5th Edition, New Age International (P) Ltd., 2022.

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 21/05/2022

S. Narayanamoorthy
Chairman
Board of Studies
Department of Humanities & Sciences

2. Linear Algebra, Stephen Friedberg, Arnold Insel and Lawrence Spence, 5th Edition, Pearson, 2018. .
3. Elementary Linear Algebra, Howard Anton and Chris Rorres, 11th Edition, Wiley Publications, 2014 (Units - IV, V & VI).
4. Linear Algebra and Learning from Data, Gilbert Strang, 1st Edition, Wellesley-Cambridge Press, 2019

REFERENCES:

1. Schaum's Outline on Probability and Statistics, Spiegel M. R., Schiller J. and Srinivasan R. A., 2nd Edition, McGraw-Hill Education, 2000.
2. Probability and Statistics for Engineers and Scientists, Walpole R. E., Myers R. H., Myers S. L. and Ye K., 8th Edition, Pearson Education, Asia, 2007.
3. Linear Algebra - A Geometric Approach, Kumaresan S., Reprint, Prentice – Hall of India, New Delhi, 2010.
4. Advanced Engineering Mathematics, Kreyszig E. , 8th Edition, John Wiley, 1999.

WEB REFERENCES:

1. https://nptel.ac.in/courses/111105041/
2. https://www.imsc.res.in/~svis/Algebra/Sunder-LinearAlg-notes.pdf

ONLINE RESOURCES:

1. https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/video-lectures/
2. https://www.khanacademy.org/math/statistics-probability/significance-tests-one-sample/more-significance-testing-videos/v/hypothesis-testing-and-p-values

COURSE OUTCOMES

Upon completion of the course, the student should be able to:

1. Compute measures of central tendency, dispersion, moments, skewness, kurtosis, correlation, regression, and rank correlation for given data sets using appropriate statistical methods. (K3)
2. Formulate and analyze the null and alternative hypothesis for large samples using proportions and means of samples. (K4)
3. Analyze the null and alternative hypothesis for small samples using t-tests, F-test, and Chi-square tests. (K4)
4. Determine the bases and dimension of vector spaces and subspaces . (K3)

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/05/2019

S. Narayanan
Chairman
Board of Studies
Department of Humanities & Sciences

5. Analyze the matrix of a linear transformation for its rank, nullity and diagonalizability. (K4)
6. Apply the Gram-Schmidt orthogonalization process to construct an orthonormal basis from a given set of vectors and solve least squares approximation problems. (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	2
CO2	-	3	-	-	-	-	-	-	-	-	-	2	2
CO3	-	3	-	-	-	-	-	-	-	-	-	2	2
CO4	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	-	3	-	-	-	-	-	-	-	-	-	3	2
CO6	3	-	-	-	-	-	-	-	-	-	-	3	2

SEMESTER - III

24ECPC301 108104100 SDG NO. 3, 4, 11	SIGNALS AND SYSTEMS	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To apply the fundamental concepts and properties of signals & systems.
- To examine the continuous-time signals in the frequency domain using the Fourier transform and the Laplace transform.
- To characterize continuous-time linear time-invariant systems in the time domain and frequency domain.
- To examine the discrete-time signals in the frequency domain using the Fourier transform and Z transform.
- To characterize discrete-time linear time-invariant systems in the time domain and the frequency domain.
- To realize the real-time signals and systems.

Recommended by Board of Studies of ECE dept. Meeting No. 08 Dated: 17-02-2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - I CLASSIFICATION OF SIGNALS AND SYSTEMS 8

Standard signals - step, ramp, pulse, impulse, real and complex exponentials and sinusoids, Representation of continuous and discrete time signals, Classification of signals – Continuous-time (CT) and Discrete-Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals, Classification of systems - CT systems and DT systems, Linear & Non-linear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

MODULE - II FREQUENCY TRANSFORMATION OF CONTINUOUS-TIME SIGNALS 7

Fourier Transform of continuous-time aperiodic signals and periodic signals - properties of continuous-time Fourier transform - Laplace Transforms and properties.

MODULE - III LINEAR TIME INVARIANT CONTINUOUS-TIME SYSTEMS 8

Impulse response - Convolution Integrals, Properties of continuous-time linear time-invariant system, Differential Equation - Causal continuous time linear time-invariant system described by differential equations - Analysis of continuous-time systems using Fourier and Laplace transforms.

MODULE - IV FREQUENCY TRANSFORMATION OF DISCRETE-TIME SIGNALS 7

Baseband signal sampling, Fourier Transform of discrete-time signals – Properties of discrete-time Fourier transform - Z Transform & Properties.

MODULE - V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 8

Impulse response – Convolution Sum Properties of discrete-time LTI system, Difference equations - Causal discrete-time LTI system described by difference equations - Analysis of discrete-time systems using Discrete time Fourier Transform and Z Transform.

MODULE - VI REALIZATION OF SIGNALS AND SYSTEMS 7

Interconnection of CT and DT systems connected in series and parallel. Recursive & Non-Recursive systems. Structural Realization of continuous time and discrete time systems- Direct Form I, Direct form II, Cascade and parallel - Case Study: Acquisition and analysis of real-time signals.

TOTAL : 45 PERIODS

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

TEXT BOOKS:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson, 2015.
2. Haykin, S., & Van Veen, B. (2007). Signals and systems. John Wiley & Sons.

REFERENCES:

1. B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford, 2009.
2. R. E. Zeimer, W. H. Tranter and R.D.Fannin, "Signals & Systems - Continuous and Discrete", Pearson, 2007.
3. John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2007.

WEB RESOURCES:

1. https://www.tutorialspoint.com/signals_and_systems/index.htm
2. https://www.khanacademy.org/science/electrical-engineering/signals-and-systems
3. https://www.geeksforgeeks.org/signals-and-systems/

ONLINE RESOURCES:

1. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/
2. https://onlinecourses.nptel.ac.in/noc20_ee15/preview
3. https://onlinecourses.nptel.ac.in/noc21_ee28/preview

OUTCOMES

Upon completion of the course, the student will be able to:

1. Examine the continuous and discrete time signals to classify as periodic & aperiodic signals, deterministic & random signals, energy & power signals, and determine the linearity, time-invariance, causality and stability of a system. (K3)
2. Apply the Fourier and Laplace transforms to continuous-time signals and characterize the properties of these transforms in signal analysis. (K3)
3. Analyse the continuous time signals in the time and frequency domain and obtain the response of the system. (K4)
4. Apply the Fourier and Z transforms to discrete-time signals and characterize the properties of these transforms in signal analysis. (K3)
5. Analyse the discrete-time signals in the time and frequency domain and obtain the response of the system. (K4)

Recommended by Board of Studies of ECE dept. Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

6. Realize the systems using direct form I, direct form II, cascade, parallel and analyze the real-time signals to identify the signal behavior using signal processing techniques. (K4)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	1	1	2
CO2	3	2	1	-	-	-	-	-	-	-	1	1	2
CO3	3	3	1	-	-	-	-	-	-	-	1	1	2
CO4	3	2	1	-	-	-	-	-	-	-	1	1	2
CO5	3	3	1	-	-	-	-	-	-	-	1	1	2
CO6	3	3	2	2	-	-	-	-	-	-	1	1	2

SEMESTER - III

24ECPC302 - SDG NO. 3,4,7,15	ELECTROMAGNETIC FIELDS AND WAVEGUIDES	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To build a foundational understanding of vector calculus and coordinate systems for modeling and analyzing electromagnetic fields using key theorems and mathematical tools
- To understand Maxwell's equations and boundary conditions for analyzing static and time-varying electromagnetic fields
- To analyze electrostatic fields and potentials using fundamental laws and apply them to conductors, dielectrics, and capacitors.
- To understand magnetic fields and forces using laws such as Biot–Savart, Ampere's, and Gauss's, and apply them to analyze magnetic flux, field intensity, and vector potential
- To study wave propagation in various media and analyze power flow using the wave equation and Poynting vector
- To analyze waveguide modes, parameters, and power transmission in rectangular and circular waveguides

Recommended by Board of Studies of ECE dept. Meeting No. 08 Dated: 17.02.2025

CHAIRMAN Board of Studies Electronics and Communication Engg.

MODULE - I MATHEMATICAL FOUNDATIONS FOR ELECTROMAGNETIC THEORY 9

Electromagnetic model, Units and constants, Review of vector algebra, Rectangular, cylindrical and spherical coordinate systems, Line, surface and volume integrals, Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stoke's theorem, Null identities, Helmholtz's theorem

MODULE - II ELECTROSTATIC FIELDS 9

Electric charge, Coulomb's law, Electric field due to Line, Surface, Volume charge densities, Electric flux, Electric flux density, Gauss's law and applications, Electric potential, Potential gradient-Conductors in static electric field, Dielectrics in static electric field, Electric flux density and dielectric constant, Point form of Ohm's law, Electromotive force and Kirchhoff's voltage law, Equation of continuity and Kirchhoff's current law, Poisson's and Laplace's equations, Capacitance, Parallel, cylindrical and spherical capacitors,

MODULE - III MAGNETOSTATIC FIELDS 8

Lorentz force equation, Law of no magnetic monopoles, Ampere's law, BiotSavart law and applications, Magnetic field intensity, Magnetic flux density, Gauss's law, Magnetic vector potential.

MODULE - IV TIME VARYING FIELDS AND MAXWELL'S EQUATIONS 5

Boundary conditions for electrostatic and magnetostatic fields, Faraday's law, Lenz's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions,

MODULE - V WAVE PHENOMENA IN ELECTROMAGNETIC SYSTEMS 5

Wave Equation and Solutions, Plane waves in lossless media, Plane waves in lossy media (low-loss dielectrics and good conductors), Group velocity, Electromagnetic power flow and Poynting vector

MODULE - VI WAVEGUIDES 9

Introduction to Rectangular and Circular Waveguides, Solutions of field Equations in Rectangular Coordinates, TEmn & TMmn Modes in Rectangular Waveguides, solutions of a field equations in cylindrical coordinates, TEmn & TMmn Modes in Circular Waveguides, Impossibility of TEM waves in Rectangular waveguides, Waveguide Parameters, Cut-off wavelength, Guide wavelength, Free space Wavelength, Phase velocity, Group velocity, Dominant

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

and Degenerated Modes, Power Transmission and Power losses in Rectangular and Circular Waveguides

TOTAL : 45 PERIODS

TEXT BOOKS:

1. D.K. Cheng, "Field and Wave Electromagnetics", 2 Edition, Pearson (India), 1989.
2. John. D. Ryder, "Network Lines and Fields", 2 Edition, PHI Learning,2005

REFERENCES:

1. D.J. Griffiths, "Introduction to Electrodynamics", 4 Edition, Pearson (India), 2013.
2. M.N.O. Sadiku and S.V. Kulkarni, "Principles of Electromagnetics", 6 Edition, Oxford (Asian Edition), 2015.
3. E. C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall of India, 2006
4. Annapurna Das, Sisir K Das, "Microwave Engineering", 2 nd Ed., 2006, Tata McGraw Hill

WEB RESOURCES :

1. https://ocw.mit.edu/resources/res-6-002-electromagnetic-fieldtheory-a-problem-solving-approach-spring-2008/textbook-contents/

ONLINE RESOURCES :

1. https://freevideolectures.com/course/2340/electromagnetic-fields
2. 2.https://ocw.mit.edu/resources/res-6-001-electromagnetic-fields-andenergy-spring-2008/index.htm

OUTCOMES:

At the end of the course, the student should be able to:

1. Apply fundamentals of Vector analysis in 3D coordinate systems. (K3)
2. Apply the principles of electrostatics to analyze electric fields, flux, potential, capacitance, and related laws in static electric systems. . (K3)
3. Calculate and demonstrate magnetic field quantities and forces by applying fundamental magnetic laws and principles (K3)
4. Derive Maxwell's equations and wave equations for static and time varying fields (K3)
5. Discuss propagation of Electromagnetic waves in lossy and lossless mediums (K2)

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

6. Analyze the characteristics of TE and TM waves in rectangular and cylindrical waveguides (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	3	2
CO2	3	3	1	-	-	-	-	-	-	-	-	3	2
CO3	3	3	1	-	-	-	-	-	-	-	-	3	2
CO4	3	3	1	-	-	-	-	-	-	-	-	3	2
CO5	3	3	1	-	-	-	-	-	-	-	-	3	2
CO6	3	3	1	-	-	-	-	-	-	-	-	3	2

SEMESTER - III

24ECPC303 108105113 SDG NO. 4 & 9	DIGITAL CIRCUITS	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To introduce basic postulates of Boolean algebra and the correlation between Boolean expressions.
- To outline the procedures for the analysis and design of combinational circuits and sequential circuits.
- To illustrate the concept of synchronous sequential circuits
- To illustrate the concept of asynchronous sequential circuits
- To educate on the basic principles of Hardware Description Language and its application in Combinational and Sequential circuits
- To introduce the concept of memories and programmable logic devices

MODULE - I NUMBER SYSTEM AND CODES 9

Binary Number base conversion, Octal and Hexadecimal numbers, complements, binary codes- BCD codes, gray codes. Boolean Algebra and Logic gates: Boolean postulates and Laws – De-Morgan's Theorem - Principle of Duality, Boolean function, Canonical and standard forms, Minimization of Boolean functions, Minterm, Maxterm, Sum of Products (SOP), Product of Sums (POS), Karnaugh map Minimization, Don't care conditions, Quine-McCluskey method of minimization.

Recommended by Board of Studies of ECE dept. Meeting No. 08 Dated: 17.02.2025

CHAIRMAN Board of Studies Electronics and Communication Engineering

MODULE - II COMBINATIONAL CIRCUITS 7

Combinational Logic: Combinational Circuits, Analysis and Design procedure; Binary Adder-Subtractor, Binary Multiplier, Code converters, Magnitude comparator, Multiplexers and demultiplexers, Decoders, Encoders.

MODULE - III SYNCHRONOUS SEQUENTIAL CIRCUITS 7

Sequential Circuit, latches, Flip-flop:D,T,RS,JK, Analysis of Clocked Sequential circuits, State Reduction and Assignment, Register and Counters: Shift Register, Ripple Counters, Synchronous Counter, Asynchronous Counter, Ring Counters, Module-n Counters.

MODULE - IV ASYNCHRONOUS SEQUENTIAL CIRCUITS 7

Introduction to asynchronous sequential circuits - fundamental mode and pulse mode circuits - State Diagram and Excitation Table, cycles and races, state reduction, Pulse mode - Design. Hazards, Essential Hazards, Design of Hazard-free Circuits.

MODULE - V VHDL FOR DIGITAL CIRCUITS 7

VHDL Introduction, VHDL Data flow, Structural and Behavioural description, Libraries, VHDL for combinational circuits, Sequential Logic Circuits, Implementing Combinational and Sequential circuits using VHDL.

MODULE - VI MEMORY AND PROGRAMMABLE LOGIC DEVICES 8

Random Access Memory (RAM), Read only Memory (ROM), Flash Memory, Programmable logic array, Sequential Programmable Devices. Register Transfer levels: Register transfer level notion, Algorithm, State machine, Design Example, Digital Integrated logic Circuits: RTL, DTL, TTL, MOS & C-MOS Logic circuits.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", Sixth Edition, Pearson, 2018.
2. S. Salivahanan, S. Arivazhagan, "Digital Circuits and Design", Oxford Press India, Fifth Edition,2018.
3. R P Jain, "Modern Digital Electronics", McGraw Hill India, Fourth Edition, 2009

REFERENCES:

1. Charles H.Roth. "Fundamentals of Logic Design", 6 Edition, Thomson Learning, 2013.

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engin

2. Thomas L. Floyd, "Digital Fundamentals", 10 Edition, Pearson Education Inc, 2011.
3. S.Salivahanan and S.Arivazhagan, "Digital Electronics", I Edition, Vikas Publishing House pvt Ltd, 2012.
4. Anil K.Maini, "Digital Electronics", Wiley, 2014.
5. A.Anand Kumar, "Fundamentals of Digital Circuits", 4 Edition, PHI Learning Private Limited, 2016.
6. Soumitra Kumar Mandal, "Digital Electronics", McGraw Hill Education Private Limited, 2016
7. Donald P Leach, Albert Paul Malvino and GoutamSaha, "Digital Principles th and Applications" McGraw Hill, India – 2014 (8 Edition – SIE).
8. R P Jain, "Modern Digital Electronics", McGraw Hill India, 2009- fourth Edition

ONLINE RESOURCES:

1. https://www.adelaide.edu.au/course-outlines/108280/1/sem-2/ - University of Adelaide
2. http://jjackson.eng.ua.edu/courses/ece480/- The University of Alabama
3. http://www.ee.ic.ac.uk/pcheung/teaching/ee2_digital/index.html - Imperial College London

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc19_ee51/preview
2. http://nptel.ac.in/courses/117106086/1
3. http://web.iitd.ac.in/~shouri/eel201/lectures.php
4. https://www.allaboutcircuits.com/textbook/digital/ 4. http://nptel.ac.in/courses/117103064

OUTCOMES :

Upon completion of the course, the student should be able to:

1. Apply the basic postulates of Boolean algebra and the tabulation method on minimization of Boolean expressions, and implement the expressions using logic gates. (K3)
2. Implement the Gate Level Minimization, Karnaugh map method (limited to 5 variables only) and combinational logic circuit design. (K4)
3. Implement the Synchronous Sequential Circuits with Flip Flops and build Counters and Registers (K3)
4. Apply clocked design procedures to model asynchronous sequential circuits and build a hazard-free circuit for the specifications provided. (K3)

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

5. Describe the basic principles of Hardware Description Language and implement the same through combinational and Sequential Logic circuits (K4)
6. Implement the function, characteristics and structure of various programmable and memory devices and apply the design procedure on combinational circuits (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO3	2	3	3	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	-	-	-	-	-	-	-	3	3	3
CO6	3	3	3	-	-	-	-	-	-	-	3	3	3

SEMESTER - III

24ECPC304 108105158 SDG NO. 4	ELECTRONIC CIRCUITS	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To understand the methods of biasing BJT
- To design and analyze single stage and multistage amplifier circuits
- To impart knowledge about feedback amplifiers and oscillators
- To inculcate knowledge about tuned amplifier
- To explore the characteristics of power amplifier
- To design and analyse the different types of power amplifiers

MODULE - I BIASING **8**

Need for biasing - DC load line analysis of biasing circuits - Operating point- Design of biasing circuits: Fixed bias configuration, Emitter bias configuration, Voltage divider bias configuration- Bias stabilization – Stability factors.

MODULE - II SINGLE AND MULTI STAGE AMPLIFIERS **9**

AC load line - BJT small signal h-parameter model- Analysis of CE, CB, CC amplifier-Gain and frequency response-FET small signal model-Analysis of CS

Recommended by Board of Studies of ECE dept. Meeting No. 08 Dated: 17.02.2025

CHAIRMAN Board of Studies Electronics and Communication

and Source Follower-Gain and frequency response-High frequency analysis-Need of multistage amplifier-Cascade, Cascode and Differential amplifier.

MODULE - III FEEDBACK AMPLIFIERS 7

Basic principles and types of feedback-Gain of an amplifier employing feedback-Effect of feedback (negative) on gain, stability, distortion and bandwidth of an amplifier. Voltage series, voltage shunt, Current series and current shunt Feedback configurations.

MODULE - IV OSCILLATORS 7

Use of positive feedback- Barkhausen criterion for oscillations-Different oscillator circuits-Hartley, Colpitts, RC-Phase shift, Wien Bridge and Crystal oscillator.

MODULE - V TUNED AMPLIFIERS 7

Small signal tuned amplifiers – Analysis of capacitor coupled single tuned amplifier – double tuned amplifier - effect of cascading single tuned and double tuned amplifiers on bandwidth – Stagger tuned amplifiers - Stability of tuned amplifiers – Neutralization - Hazeltine neutralization method.

MODULE - VI LARGE SIGNAL AMPLIFIERS 7

Difference between voltage and Power amplifier- Importance of impedance matching in amplifiers- Class A, Class B, Class AB and Class C amplifiers -Single ended power amplifiers-Push pull amplifier and Complementary symmetry push-pull amplifier.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Robert L. Boylestad and Louis Nashelsky ,"Electron Devices and Circuits: Theory and Practice", Prentice Hall of India; 11th Edition, 2010.
2. David A. Bell, "Electronic Devices and Circuits", Prentice Hall of India, 5th Edition, 2008.
3. Adel S.Sedra and Kenneth Smith ,"Microelectronic Circuits", Oxford University Press, 7th edition,2014.

REFERENCES:

1. Millman and Halkias.C, "Integrated Electronics", Tata McGraw Hill, 2nd Edition, 2018.
2. Millman. J and Taub H, "Pulse Digital and Switching Waveforms", Tata McGraw Hill, 3rd Edition, 2011.
3. S.Salivahanan, N.Suresh Kumar, A.Vallavaraj, Electronic Devices and Circuits, Tata McGraw Hill ltd., 5th Edition, 2022.

Recommended by Board of Studies on [illegible] Meeting No. 08 Dated: 17.02.2025

CHAIRMAN Board of Electronics and Communication

4. Thomas.L.Floyd, "Electronic Devices: Conventional Current version", Pearson, 10th Edition, 2021.
5. B. Visvesvara Rao, K.Raja Rajeswari, P.Chalam Raju Pantulu and K.Bhaskara Rama, "Electronic Circuit Analysis", Pearson,1st Edition, 2012.

WEB RESOURCES:

1. https://nptel.ac.in/courses/108107142
2. https://www.digimat.in/nptel/courses/video/108102095/L41.html
3. https://nptel.ac.in/courses/108102095/

ONLINE RESOURCES:

1. https://www.coursera.org/learn/transistor-field-effect transistor bipolar- junction-transistor
2. https://www.tutorialspoint.com/amplifiers/tuned_amplifiers.htm
3. https://www.udemy.com/course/introduction-to-semiconductordiodes-and-transistors/
4. https://www.electronics-tutorials.ws/amplifier/amp_1.html

OUTCOMES:

At the end of the course, the student should be able to:

1. Apply the concept of biasing circuit and design the various biasing circuit using BJT. (K3)
2. Analyse the small signal h-parameter model to construct multi stage amplifier using BJT and FET and demonstrate the Output response. (K4)
3. Apply the principles of feedback, its impact on amplifier performance, and the different feedback configurations. (K3)
4. Apply Barkhausen criteria to design oscillators such as Hartley, Colpitts, Wien Bridge, and Crystal oscillators. (K3)
5. Examine the performance of different tuned amplifiers and compare the output response . (K4)
6. Classify the different power amplifiers and explain the techniques to enhance the efficiency. (K3)

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-	1	-
CO2	3	2	-	2	-	-	-	-	-	-	-	2	1
CO3	3	2	1	2	-	-	-	-	-	-	-	2	1
CO4	3	1	1	2	2	-	-	-	-	-	-	2	1
CO5	3	2	2	2	2	-	-	-	-	-	-	2	1
CO6	3	1	1	2	1	-	-	-	-	-	-	2	1

SEMESTER - III

24HSMC301 - SDG NO. 4 & 9	UNIVERSAL HUMAN VALUES – II UNDERSTANDING HARMONY	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Developing clarity with harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.
- Recognizing the potential of excellence than competition

SYLLABUS:

The course has 28 lectures and 14 practice sessions in 6 modules:

MODULE - I COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION (5+2)

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration-what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self- exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly-A critical appraisal of the current scenario

Recommended by Board of Studies of ECE dept. Meeting No. 08 Dated: 17.02.2025

CHAIRMAN Board of Studies Electronics and Communication Engineering

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

MODULE - II UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF (5+2)

6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.
7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

MODULE - III UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY HARMONY IN HUMAN-HUMAN RELATIONSHIP (6+2)

12. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values ofrelationship
13. Understanding the meaning of Trust; Difference between intention and competence
14. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
15. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - IV UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE (6+2)

16. Understanding the harmony in the Nature
17. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self- regulation in nature
18. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
19. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion ofresources and role of technology etc.

MODULE - V IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS (4+4)

20. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family
21. Natural acceptance of human values
22. Definitiveness of Ethical Human Conduct
23. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
24. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

MODULE - VI UNIVERSAL HUMAN ORDER (4+3)

25. Programs to ensure Sanyam and Health
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc

TOTAL : 45 PERIODS

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Stu...
Electronics and Communica...

TEXT BOOKS:

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 3rd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.

REFERENCES:

1. AICTE Model Curriculum in Humanities, Social Science and Management Courses (UG Engineering & Technology)Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values,A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence-JC Kumarappa
8. Bharat Mein Angreji Raj- Pandit Sunderlal
9. Rediscovering India- by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda- Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

OUTCOMES

Upon completion of the course, the student will be able to:

1. Express the harmony of relationship among human being, family, society, nature and existence with right understanding and right feeling. (K2)
2. Develop the responsibility of handling problems by finding holistic and sustainable solutions based on the natural acceptance for maintaining mutual human relationships. (K2)
3. Develop a holistic perspective of life based on self-exploration about self, family, society and nature/existence. (K2)
4. Elucidate a critical ability for dedicative commitment towards human values, relationships and society. (K2)
5. Implement the process of verification and validation of learning in daily life. (K2)
6. Develop self reflection, commitment and courage to act in life challenging situations. (K2)

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	3	3	2	-	-	3
CO2	-	1	-	-	-	3	3	2	-	-	-
CO3	-	-	3	-	-	3	3	2	-	-	-
CO4	-	-	-	-	-	3	3	2	-	2	3
CO5	-	-	-	-	-	3	3	-	-	-	3
CO6	-	-	-	-	-	3	3	-	-	3	2

SEMESTER - III

24HSNC301 - SDG NO. 4	NCC COURSE LEVEL 2	L	T	P	CP	C
		3	0	0	3	0

ARMY WING

PERSONALITY DEVELOPMENT **9**

PD 3 Group Discussion: Change your mindset, Time Management, Social Skills 6

PD 5 Public Speaking 3

LEADERSHIP **7**

L 2 Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965 7

DISASTER MANAGEMENT **13**

DM 1 Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation 3

DM 2 Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters 9

DM 3 Fire Service & Fire Fighting 1

ENVIRONMENTAL AWARENESS & CONSERVATION **3**

EA 1 Environmental Awareness and Conservation 3

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

GENERAL AWARENESS **4**

GA 1 General Knowledge 4

ARMED FORCES 6

AF 1 Armed Forces, Army, CAPF, Police 6

ADVENTURE 1

AD 1 Introduction to Adventure Activities 1

BORDER & COASTAL AREAS **2**

BCA 1 History, Geography & Topography of Border/Coastal areas 2

TOTAL: 45 PERIODS

NAVAL WING

PERSONALITY DEVELOPMENT **9**

PD 3 Group Discussion: Change your mindset, Time Management, Social Skills 6

PD 5 Public Speaking 3

LEADERSHIP 7

L 2 Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965 7

DISASTER MANAGEMENT **13**

DM 1 Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation 3

DM 2 Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters 9

DM 3 Fire Service & Fire Fighting 1

ENVIRONMENTAL AWARENESS & CONSERVATION **3**

EA 1 Environmental Awareness and Conservation 3

GENERAL AWARENESS **4**

GA 1 General Knowledge 4

NAVAL ORIENTATION 6

AN 1 Armed Forces and Navy Capsule 3

EEZ 1 EEZ Maritime Security and ICG 3

Recommended by Board of Studies of ECE dept. Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

ADVENTURE 1

AD 1	Introduction to Adventure Activities	1

BORDER & COASTAL AREAS 2

BCA 1	History, Geography & Topography of Border/Coastal areas	2

TOTAL: 45 PERIODS

AIR FORCE WING

PERSONALITY DEVELOPMENT 9

PD 3	Group Discussion: Change your mindset, Time Management, Social Skills	6
PD 5	Public Speaking	3

LEADERSHIP 7

L 2	Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965	7

DISASTER MANAGEMENT 13

DM 1	Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation	3
DM 2	Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters	9
DM 3	Fire Service & Fire Fighting	1

ENVIRONMENTAL AWARENESS & CONSERVATION 3

EA 1	Environmental Awareness and Conservation	3

GENERAL AWARENESS 4

GA 1	General Knowledge	4

GENERAL SERVICE KNOWLEDGE 6

GSK 1	Armed Forces & IAF Capsule	2
GSK 2	Modes of Entry in IAF, Civil Aviation	2
GSK 3	Aircrafts - Types, Capabilities & Role	2

ADVENTURE 1

AD 1	Introduction to Adventure Actitivities	1

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

BORDER & COASTAL AREAS 2

BCA 1 History, Geography & Topography of Border/Coastal areas 2

TOTAL :45 PERIODS

SEMESTER - III

24ECPL301 - SDG NO. 4	ANALOG AND DIGITAL CIRCUITS LABORATORY	L	T	P	CP	C
		0	0	4	4	2

OBJECTIVES:

- To introduce fundamental principles of analog and digital electronics.
- To study the Frequency response of CE, CB and CC amplifiers.
- To study the Transfer characteristics of the differential amplifier.
- To perform a SPICE simulation of Electronic Circuits.
- To design and implement the Combinational and sequential logic circuits.
- To simulate the digital circuits using VHDL.

LIST OF EXPERIMENTS

1. Frequency Response of CE, CB and CC amplifiers.
2. Differential Amplifiers – Transfer characteristics, CMRR Measurement.
3. Frequency Response of Single-Tuned Amplifiers.
4. Frequency Response of Cascode and Cascade amplifiers using Pspice.
5. Analysis of Frequency Response of BJT and FET using Pspice.
6. Design of RC Phase Shift Oscillator using PSPICE combinational circuits.
7. Design and implementation of Adder and Subtractor using logic gates and simulation using VHDL.
8. Design and implementation of code converters using logic gates

(i) BCD to excess-3 code and vice versa.

(ii) Binary to gray code and vice versa.

9. Design and implementation of Multiplexer and De-multiplexer using logic gates.
10. Design and implementation of Encoder and Decoder.
11. Design and implementation of flip-flops.
12. Design and implementation of Synchronous and Asynchronous counters.

TOTAL: 45 PERIODS

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engg.

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS/ 2 STUDENTS PER EXPERIMENT:

S.No.	Equipments	Quantities
1.	CRO/DSO (30MHz)	15
2.	Signal Generator /Function Generators (3 MHz)	15
3.	Resistors, Capacitors, Inductors, Transistor Bc107	sufficient quantities
4.	BreadBoards	15Nos
5.	Standalone desktop PCs with PSPICE software	10Nos
6.	Dual power supply/ single mode power supply	15Nos
7.	IC Trainer Kit	15Nos
8.	ICs : 7400/ 7402 / 7404 / 7486 / 7408 / 7432 / 7483 / 74150 / 74151 / 74147 / 7445 / 7476/ 7491/ 555 / 7494 / 7447 / 74180 / 7485 / 7473/ 74138 / 7411 / 7474	each 50 Nos

OUTCOMES:

At the end of the course, the student should be able to:

1. Design and Analyze the Transfer characteristics of Differential Amplifiers, Frequency Response of CE, CB and CC amplifiers. (K4)
2. Simulate and analyze RC Phase Shift Oscillator, BJT, FET, Frequency Response of cascode and cascade amplifiers using PSpice.(K4)
3. Design and simulate the combinational circuits and sequential circuits. (K4)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	2	3	2
CO2	3	3	2	-	2	-	-	-	-	-	2	3	2
Co3	3	3	3	-	-	-	-	-	-	-	2	3	2

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

SEMESTER - III

24ECTP301 - SDG NO. 4	APTITUDE SKILLS - I	L	T	P	CP	C
		0	0	2	2	1

APTITUDE & COGNITIVE SKILLS – PHASE 1

OBJECTIVES:

- Enrich students on quantitative ability, reasoning ability, and verbal ability
- Build a strong foundation for solving recruitment-based problems with speed and accuracy.
- Enhance creative thinking skills and Strengthen problem-solving skills.

MODULE - I QUANTITATIVE ABILITY **22**

Number Properties, Speed Math, HCF and LCM, Percentages, Time and Work, Time Speed and Distance, Ratio Proportion and Variations, Averages Mixtures and Alligation

MODULE - II QUANTITATIVE ABILITY AND REASONING ABILITY **16**

Profit and Loss, Simple Interest and Compound Interest, Blood Relation, Directions, Coding and Decoding, Series, Ranking and Arrangements

MODULE - III VERBAL ABILITY **7**

Verbal Analogy – Vocabulary building – Sentence Structures - Comprehension – correct usage of words – Error deduction

TOTAL: 45 PERIODS

REFERENCES:

1. Quantitative Aptitude for Competitive Examinations – R.S. Aggarwal
2. A Modern Approach to Logical Reasoning – R.S. Aggarwal
3. High School English Grammar & Composition – Wren & Martin
4. Word Power Made Easy – Norman Lewis.
5. Fast Track Objective Arithmetic – Rajesh Verma

LIFE SKILLS, RANGER AND ROVER & BIS STANDARDS – PHASE 2

OBJECTIVES:

- Understand team building and acquire leadership skills.
- Gain Scouting spirit.
- Familiarize with the standards relevant to ECE.

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - I JEEVAN KAUSHAL 2.0 – TEAM SKILLS AND LIFE SKILLS **12**

Trust and Collaboration: Importance of Trust in Creating a Collaborative Team- Agree to Disagree and Disagree to Agree – Spirit of Teamwork - Understanding Fear of Being Judged and Strategies to Overcome.

Brainstorming: Basics and the process – Effective technique for ideation – Types – Importance and Benefits

Internal Communication: Internal Communication – Meaning and the Need, Use of Various Channels for Transmitting Information to Team Members including Digital and Physical.

Leadership Skills: Leadership concept - Leadership skills – Leadership moralities – Leadership models

MODULE - II RANGER AND ROVER **10**

Four Bonds of BSG: Sign, Salute, Left Handshake, Moto and Good Turn.

Discipline and Uniform: Uniform of Rovers and Rangers, 14 Programme ideals.

Knowledge of Merit: Know about Knowledge of Merit Badges (Proficiency Badge).

Sustainability E-learning: (Online Course Available in WOSM Learning Zone).

Activating the Earth Tribe Initiative in your Community: (Online Course Available in WOSM Learning Zone)

MODULE - III ELECTROMAGNETIC COMPATIBILITY (EMC) AND ELECTROMAGNETIC INTERFERENCE **8**

Introduction to the concept of Electromagnetic compatibility of electrical and/or electronic equipment, between themselves and with electrical power networks including electromagnetic interference and measurement and calculation methods to assess human exposure to electric, magnetic and electromagnetic fields. Discussion on IS 14700/ IEC 61000 series of Standards.

TOTAL: 30 PERIODS

REFERENCES:

1. Curriculum and Guidelines for Life Skills (Jeevan Kaushal) 2.0, UGC, New Delhi.
2. A World Built on Standards: A Textbook for Higher Education, Published by: Danish Standards Foundation, 2015.
3. SO / IEC Guide 59, BIS Standards Formulation Manual, 2nd Revision, 2022.

Recommended by
Board of Studies of ECE dept.
Meeting No. 02 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

ONLINE RESOURCES

1. https://www.cambridgeenglish.org/learning-english
2. https://lms.scout.org/course_items/show/1172182?course_id=214307#course-item-id=1172182
3. https://lms.scout.org/courses/show/214123?force_course_hub=true

OUTCOMES

Upon completion of this course, the students will be able to:

1. Apply quantitative aptitude for solving numerical problems [K3]
2. Describe logical reasoning to tackle emotional challenges. [K2]
3. Use verbal communication and comprehension skills through grammar and language exercises. [K3]
4. Apply critical thinking and problem-solving skills in various cognitive scenarios. [K3]
5. Interpret language nuances in diversified situations and exhibit scouting spirits amidst communities. [K2]
6. Explain the basic principle of BIS Standards relevant to EMC and EMI. [K2]

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	1	-	-
CO2	-	-	-	-	-	2	-	-	-	-	1	-	-
CO3	-	-	-	-	-	-	-	-	2	-	1	-	-
CO4	-	2	-	-	-	-	-	-	-	-	1	-	-
CO5	-	-	-	-	-	-	-	2	3	-	1	-	-
CO6	-	-	-	-	-	3	-	-	-	-	1	-	-

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

SEMESTER - III

24ECID301 - SDG NO. 4,11,15	INNOVATIVE DESIGN LAB - I	L	T	P	CP	C
		0	0	2	2	1

OBJECTIVES:

- To provide opportunities for students to develop an entrepreneurial mindset and explore real-world problem-solving through a startup-centric approach.
- To enable hands-on experience in identifying market needs
- To enable development of skill sets for designing, validating, and realizing a Minimum Viable Product (MVP) for an entrepreneurial venture.
- To guide students in validating market opportunity, and formulating a solution with realistic constraints.
- To inculcate ethical research practices, foster a commitment to lifelong learning, and promote the development of socially responsible and sustainable innovations aligned with relevant Sustainable Development Goals (SDGs).
- To prepare students to design sustainable business models and present entrepreneurial ideas through structured, outcome-driven business pitches using core startup frameworks.

COURSE METHODOLOGY:

1. This initiative is designed to inculcate ethical principles of research and to get involved in a life-long learning process for the students, specifically through the lens of entrepreneurship and innovation.
2. The project work must involve identifying a problem, validating market opportunity, and developing a solution with realistic constraints, culminating in a business plan and prototype/MVP. It must also include appropriate elements of the following: market research, competitive analysis, value proposition design, business model development, financial feasibility, go-to-market strategy, and potentially software/hardware development for the MVP.
3. Project can be individual work or a group project, with a maximum of 3 students. In case of a group project, the individual project report of each student should specify the individual's contribution to the group project. The roles and responsibilities of all team members must be well-defined and documented.
4. On completion of the project, the student shall submit a detailed project report outlining their entrepreneurial journey, solution development, and business plan. The project should be reviewed and the report shall be evaluated, and the students shall appear for a viva-voce oral

Recommended by Board of Studies of ECE dept. Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

examination on the project approved by the Coordinator and the project guide.

EVALUATION:

1. First evaluation (Milestone 1 - Week 4): 20 marks (Focus on Problem Identification, Opportunity Discovery, Customer & Markets, Value Proposition)
2. Second evaluation (Milestone 2 - Week 8): 30 marks (Focus on Competitive Advantage, Business Model, and MVP Development)
3. Final evaluation (Milestone 3 & 4 - Last week of the semester): 50 marks (Focus on Financial Feasibility, Go-to-Market Strategy, Growth and Scale, Funding Strategy, and Overall Project Report & Viva-Voce)

Note: All three evaluations are mandatory for course completion and for awarding the final grade.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

1. Apply entrepreneurial thinking to identify and articulate real-world problems and explore market needs using structured approaches. (K3)
2. Develop skill sets to design potential solutions and validate market opportunities within realistic constraints. (K4)
3. Evaluate sustainable, ethical, and responsible innovation strategies, and communicate business models effectively. (K5)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	-	-	-	2	-	-	-	2	2
CO2	3	3	2	-	-	-	-	2	-	-	-	2	2
Co3	3	3	2	-	-	-	-	2	-	-	-	2	2

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

SEMESTER - IV

24BSMA401 - SDG NO. 4	PROBABILITY THEORY AND RANDOM PROCESSES	L	T	P	CP	C
		3	1	0	4	4

OBJECTIVES:

- To understand and obtain the knowledge of Random variables.
- To provide understanding of standard discrete and continuous distributions.
- To familiarize the students with the concepts of covariance, correlation and regression.
- To impart the knowledge of classification of random processes, properties of Markov, Poisson processes.
- To understand and gain the knowledge of spectral densities.
- To acquaint the students with the concepts of linear random input and output.

MODULE - I RANDOM VARIABLES 9

Probability – Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions.

MODULE - II STANDARD DISTRIBUTIONS 12

Binomial, Poisson, Geometric, Uniform, Exponential and Normal Distributions - Functions of Random variables.

MODULE - III TWO - DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

MODULE - IV RANDOM PROCESSES 9

Classification – Stationary process – Markov process - Markov chain - Poisson process.

MODULE - V CORRELATION AND SPECTRAL DENSITIES 9

Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties.

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/08/2024

S. Narasimhan
Chairman
Board of Studies
Department of Humanities & Sciences

MODULE - VI LINEAR SYSTEMS WITH RANDOM INPUTS 9

Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Fundamentals of Applied Probability and Random Processes, Ibe O.C., 1st Indian Reprint, Elsevier, 2007. Module I (Sections 1.3,1.7) Module II Chapter-2, Chapter-3 (Sections 3.1 - 3.5), Chapter-4 (Sections 4.1 -4.8, 4.10 & 4.11), Chapter 6 (sec 6.2); Module III Chapter 5 (Sections 5.1 - 5.7) Chapter 6 (6.8 & 6.10); Module IV Chapter-8 (8.1 - 8.6, 10.5 - 10.5.4, 10.5.5, 10.5.6, 10.6, 10.7); Module V Chapter 10 (Section 10.2, 10.4, 10.5 (10.5.1 - 10.5.6), 10.6, 10.7); Module VI Chapter 9 (Sections 9.1 - 9.3).
2. Probability and Random Processes With Applications to Signal Processing and Communications, Scott Miller & Donald Childers, 2nd Edition, Elsevier Science, 2004.

REFERENCES:

1. Probability, Random Variables and Random Signal Principles, Peebles P. Z., 4th Edition, Tata Mc Graw Hill, New Delhi, 2002.
2. Probability and Statistics, Random Processes and Queueing theory, Veerarajan T., 3rd Edition Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi, 2018.
3. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis and S Unni Krishna Pillai, PHI, 4th Edition, 2002.
4. Probability and Random Processes for Scientists and Engineers, Davenport, 1st Edition, McGraw-Hill, 1970.
5. Probability, Random Processes and Estimations Theory for Engineers, H . Stark & J.W. Woods, 2nd Edition, Prentice Hall, 1994.
6. Introduction to Random Processes, E. Wong, 1st Edition, Springer Verlag, 1983.
7. Introduction to Random Processes, W. A. Gardner, 2nd Edition, McGraw Hill, 1990.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_ma30/preview
2. https://nptel.ac.in/courses/111102111/
3. https://archive.nptel.ac.in/courses/111/103/111103158/
4. https://archive.nptel.ac.in/courses/111/102/111102014/
5. https://www.ee.iitb.ac.in/~bsraj/courses/ee325/

Recommended by
Board of Studies of HAS dept.
Meeting No. 6 Dated: 31/08/2019

S. Narasimhan
Chairman
Board of Studies
Department of Humanities & Sciences

ONLINE RESOURCES:

1. https://freevideolectures.com/course/2324/probability-and-random-processes
2. http://www.nptelvideos.com/course.php?id=572
3. https://archive.nptel.ac.in/courses/117/105/117105085

COURSE OUTCOMES:

At the end of the course, the student should be able to:

1. Apply the concepts of probability and random variables to solve engineering problems involving uncertainty.(K3)
2. Analyze and interpret the characteristics of standard discrete and continuous probability distributions for practical applications. (K4)
3. Apply the concepts of joint, marginal, and conditional distributions to analyze relationships between random variables, and interpret correlation and regression.(K3)
4. Classify the different types of random processes (stationary, Markov, Poisson) and apply them to real-world systems. (K3)
5. Examine correlation functions and spectral density measures to understand the frequency-domain behaviour of random signals.(K4)
6. Analyse the response of linear systems to random inputs using autocorrelation, cross-correlation, and system transfer functions.(K4)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	-	-	-	-	-	-	-	-	-	-	3	-
CO6	3	-	-	-	-	-	-	-	-	-	-	3	-

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/08/2024

Chairman
Board of Studies
Department of Humanities & Sciences

SEMESTER - IV

24ECPC201 - SDG NO. 3,4,7,15	TRANSMISSION LINES AND ANTENNA THEORY	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To study about transmission lines, their parameters, and behavior, including lossless lines, reflection coefficients, and voltage/current distributions at high frequencies
- To study transmission line characteristics and matching techniques using the Smith chart
- To study antenna radiation concepts, key parameters, and analyze antennas like dipoles and Yagi-Uda
- To study the design and principles of various antenna arrays, including phased and smart antennas
- To study radiation mechanisms and applications of various antennas, including horn, reflector, and microstrip antennas
- to study frequency-independent and modern antennas, including spiral, helical, and reconfigurable antennas, along with their applications

MODULE - I TRANSMISSION LINE THEORY 9

Concept and definition, Different kinds of transmission lines, Applications, Equivalent circuit, Primary constants- R, L, C and G, Secondary constants – Propagation constant and Characteristic Impedance, General transmission line equations. Attenuation and phase constant. Wavelength, phase velocity and group velocity. The lossless transmission line, The infinite long transmission line, The distortion less transmission line, Properties of Transmission lines at UHF, Reflection coefficient, Standing waves, Distribution of voltages and currents on loss less line

MODULE - II IMPEDANCE MATCHING 6

Characteristics of half wave, Quarter-wave and one eighth wave lines. Construction and applications of Smith chart. Transmission line matching. Single and double stub matching using Smith Chart.

MODULE - III FUNDAMENTALS OF RADIATION 7

Concept of radiation - Types of antennas - Current distribution - Fundamental parameters: Radiation Pattern-Radiation Power Density - Radiation Intensity - Beamwidth - Gain - Directivity-Bandwidth Polarization - Antenna efficiency - Effective aperture -Friis transmission equation - Field regions separation -Half wave dipole: Field components - Total radiated power - Radiation resistance - Folded dipole, Yagi Uda Antenna

Recommended by Board of Studies of ECE dept. Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - IV ANTENNA ARRAYS 6

Need for antenna arrays - Design of two element array - Multiplication of pattern - N-element linear array : Uniform amplitude and spacing - Design of broadside & end fire arrays : Non-uniform amplitude and equal spacing - Design of binomial array - Phased array design - Concept of smart antenna

MODULE - V APERTURE AND SLOT ANTENNAS 8

Radiation from rectangular apertures, Uniform and Tapered aperture, Horn antenna, Reflector antenna, Aperture blockage, Feeding structures, Slot antennas, Microstrip antennas – Radiation mechanism – Applications

MODULE - VI SPECIAL ANTENNAS 9

Principle of frequency independent antennas – Spiral antenna Helical antenna, Log periodic. Modern antennas- Reconfigurable antenna, Active antenna, Dielectric antennas, Electronic band gap structure. and applications

TOTAL : 45 PERIODS

TEXT BOOKS:

1. C.A.Balanis, "Antenna Theory: Analysis and Design", John Wiley & Sons Inc., Fourth Edition, 2015.
2. John. D. Ryder, "Network Lines and Fields", 2 Edition, PHI Learning,2005

REFERENCES:

1. John D.Kraus, Ronald J.Marhefka, Ahmad S Khan, "Antennas and Wave Propagation" Tata McGraw Hill, Fourth Edition 2010.
2. Warren L. Stutzman, Gary A. Thiele, "Antenna theory and design", John Wiley and Sons Ltd., Third Edition, 2013.
3. Edward C.Jordan and Keith G.Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall of India, 2006.
4. R.E.Collin, "Antennas and Radio Wave Propagation", McGraw Hill 1985..
5. A.R.Harish, M.Sachidananda, "Antennas and Wave Propagation", Oxford University Press, 2007.
6. S.Drabowitch, A.Papiernik, J. Encinas, H,Griffiths and G.Smith, "Modern Antennas", Springer Science, 2013.
7. Handbooks/ Manuals of Simulation software packages like HFSS, CST and ADS.

WEB REFERENCES:

1. https://www.itu.int/dms_pub/itu-r/opb/hdb/R-HDB-59-2014-PDF-E.pdf

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/108/101/108101092/

OUTCOMES:

At the end of the course, the student should be able to:

1. Explain the characteristics of transmission lines and its losses (K2)
2. Apply the knowledge of transmission line parameters to analyze and interpret SWR, reflection coefficient, and impedance matching and use the smith chart to solve the impedance matching problems. (K3)
3. Applying basic principles, analyze and measure the performance characteristics of antennas (K3)
4. Derive and Determine Array factor, Beam width & null angles of N-element linear arrays with uniform and non uniform amplitude and spacing. - (K3)
5. Analyze the radiation from wire, aperture and slots. (K3)
6. Apply the principles of frequency-independent and modern antenna designs to explain their operational characteristics and applications in communication systems(K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	3	2
CO2	3	3	1	-	-	-	-	-	-	-	-	3	2
CO3	3	3	1	-	-	-	-	-	-	-	-	3	2
CO4	3	3	1	-	-	-	-	-	-	-	-	3	2
CO5	3	3	1	-	-	-	-	-	-	-	-	3	2
CO6	3	3	1	-	-	-	-	-	-	-	-	3	2

Recommended by

Board of Studies of ECE dept.

Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication

SEMESTER - IV

24ECPC402 - SDG NO. 4,8,9	ANALOG AND DIGITAL COMMUNICATION	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To introduce Amplitude Modulation Schemes
- To impart knowledge in Angle modulation methods.
- To impart knowledge in Demodulation techniques
- To introduce the importance of Sampling & Quantization
- To compare the performance of Digital modulation techniques.
- To familiarize the concept of Information theory and Coding techniques

Pre-Requisites: Basic tools for communication, Fourier Series/Transform, and Properties. Autocorrelation, Energy Spectral Density, Parseval's Relation

MODULE - I AMPLITUDE MODULATION 9

Elements of Communication systems – Need for Modulation - Amplitude Modulation- DSBSC, DSBFC, SSB, ISB, VSB - Modulation index, Spectra, Power relations and Bandwidth of AM – AM Generation – Square law and Switching modulator, DSBSC Generation – Balanced and Ring Modulator, SSB Generation – Filter, Phase Shift, VSB Generation – Filter Method. Comparison of different AM techniques.

MODULE - II ANGLE MODULATION 7

Phase and frequency modulation, Narrow Band and Wide band FM – Modulation index, Spectra, Power relations and Transmission Bandwidth of FM – PM to FM Conversion – and FM to PM Conversion – FM Generation: Direct and Indirect methods.

MODULE - III ANALOG DEMODULATORS 7

AM Demodulators: Envelope Detector, Coherent Detection of DSB – SC, SSB – SC – Costas Receiver – Frequency Translation - Super Heterodyne Receiver. FM Demodulation – FM to AM conversion, FM Discriminator – Balanced Slope Detector, Foster Seeley Discriminator, Ratio Detector.

MODULE - IV SAMPLING AND QUANTIZATION 6

Introduction to Sampling, Spectrum of Sampled Signal, Aliasing, Nyquist Criterion, Signal Reconstruction from Sampled Signal, Quantization, Uniform Quantizers, Mid rise and Midtread, Quantization noise, Lloyd Max Quantization Algorithm, Non uniform Quantizers.

Recommended by Board of Studies of ECE dept. Meeting No. 08 Dated: 17.02.2025

CHAIRMAN Board of Studies Electronics and Communication

MODULE - V DIGITAL MODULATION SCHEMES **10**

PAM, PTM – Line coding – PCM, DPCM, DM & ADM Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase shift keying – BPSK, QPSK, 8 PSK, QAM-8 QAM, 16 QAM – Comparison of various digital communication systems, Inter Symbol Interference – Eye pattern.

MODULE - VI INFORMATION THEORY AND SOURCE CODING TECHNIQUES **6**

Measure of information, entropy, Channel capacity and Shannon's theorems; Source Coding Techniques - Shannon Fano coding and Huffman Coding.

TOTAL : 45 PERIODS

REFERENCES:

1. S.Haykin, "Digital Communications", John Wiley, 2005
2. J.G.Proakis, M.Salehi, "Fundamentals of Communication Systems", Pearson Education, 2014
3. Simon Haykin, "Communication Systems", Fourth Edition, Wiley, 2014.
4. B. Sklar, "Digital Communication Fundamentals and Applications", Second Edition,Pearson Education, 2009
5. B.P.Lathi, "Modern Digital and Analog Communication Systems", Third Edition, Oxford University Press, 2007
6. H P Hsu, "Schaum Outline Series – Analog and Digital Communications",Tata McGraw Hill Company, 2006
7. Proakis, J.G., Salehi, M., "Digital Communications", 5th 2008 Ed.,McGraw-Hill International
8. Roden, M.S., "Analog and Digital Communication Systems", 5th 2005 Ed., Discovery Press.
9. Couch II, L.W., "Modern Communication Systems: Principles and Applications", Prentice-Hall 1998
10. Couch II, L.W., "Digital and Analog Communication Systems", 7th 2009 Ed.,Pearson
11. Carlson, A.B., Crilly, P.B. and Rutledge, J.C., "Communication Systems: An Introduction to Signals and Noise in Electrical Communication", 4th 2002 Ed., McGraw-Hill

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc20_ee16/preview
2. https://nptel.ac.in/courses/117102059/

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

3. https://onlinecourses.nptel.ac.in/noc25_ee68/preview

ONLINE RESOURCES

1. https://freevideolectures.com/course/2590/introduction-to-communication-theory

OUTCOMES

On completion of this course, the student should be able to

1. Analyze the Performance of various Amplitude Modulation Schemes for specific applications.(K4)
2. Estimate the performance metrics of Angular Modulation schemes correlating FM and PM.(K4)
3. Illustrate the concept of Heterodyning in the AM and FM receivers.(K4)
4. Evaluate the conditions for perfect reconstruction of signal in sampling process and minimum quantization error using Lloyd Max Quantization Algorithm.(K4)
5. Interpret the digital transmission using Pulse Modulation and Shift Keying Variants.(K3)
6. Estimate the impact of Source and Channel coding schemes on efficiency of transmission in digital communication.(K4)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	1	-	1	1	1
CO2	3	2	2	1	-	-	-	-	1	-	1	1	1
CO3	3	3	2	1	1	-	-	-	1	-	1	1	1
CO4	3	3	3	2	2	-	-	-	1	-	1	1	1
CO5	3	3	3	2	2	-	-	-	1	-	1	1	1
CO6	3	3	3	2	2	-	-	-	1	-	1	1	1

Recommended by

Board of Studies of ECE dept.

Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

SEMESTER - IV

24EIPC404 107106081 SDG NO. 4,9	CONTROL SYSTEMS	L	T	P	CP	C
		3	1	0	4	3

OBJECTIVES:

- To develop transfer function models for various physical systems using mathematical representations.
- To analyze time-domain and frequency-domain responses of control systems.
- To apply stability analysis techniques to determine system behavior.
- To design compensators for feedback systems using frequency-domain techniques.
- To develop state-space representations and analyze system properties using state-variable methods.
- To apply appropriate control strategies to meet system performance requirements.

MODULE - I MATHEMATICAL MODELLING OF SYSTEM **8**

Open loop and closed loop systems - Physical system - Linear and Non-Linear systems Transfer function Mathematical modeling of Electrical and Mechanical systems Analogous systems - Block diagram representation - Signal flow graphs and their properties Mason's gain formula.

MODULE - II TIME DOMAIN ANALYSIS **8**

Standard test signals-Time response of first order and second order feedback control system to step input-Time domain specifications-Steady state error-Static error constants - Dynamic error coefficients - Introduction to P, PI, PID modes of feedback control.

MODULE - III FREQUENCY DOMAIN ANALYSIS **8**

Frequency domain specifications - Correlation between frequency domain and time domain specifications Bode plot - Polar plot - Determination of closed loop response from open loop response.

MODULE - IV STABILITY ANALYSIS **8**

Concepts of Stability: Necessary conditions for stability Routh Hurwitz stability criterion - Relative stability analysis. Root locus: Concepts of root - locus construction of root locus Determination of open loop gain for a specified damping of the dominant roots.

Recommended by
Board of Studies of E&I dept.
Meeting No. 06 Dated: 05.06.2024

K. Rangarajan
CHAIRMAN
Board of Studies
Electronics and Instrumentation Engineering

MODULE - V DESIGN OF FEEDBACK CONTROL SYSTEM 6

Design specifications: Lead, Lag and Lag-Lead compensators using Bode plot techniques.

MODULE - VI STATE VARIABLE METHODS 7

Concept of state variables – State models for linear and time invariant Systems – Solution of state and output equation in controllable canonical form – Concepts of controllability and observability – Effect of state feedback

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Benjamin C. Ku and Farid Golnaraghi, "Automatic Control Systems", 10th edition McGraw-Hill Education, 2017.
2. Nagarath, I.J. and Gopal, M., "Control Systems Engineering", 7th edition New Age International Publishers, 2017.

REFERENCES:

1. M.Gopal, "Control System–Principles and Design", Tata McGraw Hill,4th Edition, 2012.
2. Richard C.Dorf and Bishop, R.H., "Modern Control Systems", Pearson Education, 13th impression 2017
3. John J.D., Azzo Constantine, H. and Houpis Stuart, N Sheldon, "Linear Control System Analysis and Design with MATLAB", CRC Taylor & Francis Reprint, 2014
4. Katsuhiko Ogata, "Modern Control Engineering", PHI Learning Private ltd, PEARSON 5th edition 2015.
5. NPTEL Video Lecture Notes on "Control Engineering "by Prof. S. D. Agashe, IIT Bombay.

WEB REFERENCES:

1. https://nptel.ac.in/courses/108106098/
2. https://nptel.ac.in/courses/108101037/

ONLINE RESOURCES:

1. https://lecturenotes.in/notes/15854-note-for-control-system-engineering-cse-by-amity-kumar
2. https://lecturenotes.in/notes/23763-note-for-control-system-engineering-cse-by-suman-kumar-acharya

Recommended by
Board of Studies of E&I dept.
Meeting No. 06 Dated: 05.06.2024

K. Rangarajan
CHAIRMAN
Board of Studies
Electronics and Instrumentation Engineering

OUTCOMES

Upon completion of the course, the student will be able to:

1. Apply the mathematical modeling techniques to represent physical, mechanical, and electrical systems. (K3)
2. Apply time-domain analysis to a physical model system to compute steady-state and dynamic errors using error constants (K3)
3. Apply frequency-domain techniques such as Bode and polar plots to the transfer function model and relate the outcomes to time-domain behavior (K3)
4. Apply the Routh-Hurwitz criterion and Root Locus methods to evaluate system stability and gain margins. (K3)
5. Design lead, lag, and lag-lead compensators to satisfy specified performance requirements. (K4)
6. Analyze state-space representations of linear time-invariant systems to evaluate controllability, observability, and the impact of state feedback. (K4)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	1	2
CO2	3	-	-	-	-	-	-	-	-	-	-	1	2
CO3	3	-	-	-	-	-	-	-	-	-	-	1	2
CO4	3	-	-	-	-	-	-	-	-	-	-	2	3
CO5	-	-	3	-	-	-	-	-	-	-	-	2	3
CO6	-	3	-	-	-	-	-	-	-	-	2	2	3

SEMESTER - IV

24HSNC401 - SDG NO. 4	NCC COURSE LEVEL 3	L	T	P	CP	C
		3	0	0	3	0

ARMY WING

PERSONALITY DEVELOPMENT 9

PD 3 Group Discussion: Team Work 2

PD 4 Career Counselling, SSB Procedure & Interview Skills 3

PD 5 Public Speaking 4

Recommended by Board of Studies of ECE dept. Meeting No. 08 Dated: 17.02.2025

CHAIRMAN Board of Studies Electronics and Communication Engineering

BORDER & COASTAL AREAS		**4**
BCA 2	Security Setup and Border/Coastal management in the area	2
BCA 3	Security Challenges & Role of cadets in Border management	2
ARMED FORCES 3		
AF 2	Modes of Entry to Army, CAPF, Police	3
COMMUNICATION		**3**
C 1	Introduction to Communication & Latest Trends	3
INFANTRY		**3**
INF 1	Organisation of Infantry Battalion & its weapons	3
MILITARY HISTORY		**23**
MH 1	Biographies of Renowned Generals	4
MH 2	War Heroes - PVC Awardees	4
MH 3	Study of Battles - Indo Pak War 1965, 1971 & Kargil	9
MH 4	War Movies	6
		TOTAL: 45 PERIODS

NAVAL WING

PERSONALITY DEVELOPMENT		**9**
PD 3	Group Discussion: Change your mindset, Time Management, Social Skills	6
PD 5	Public Speaking	3
LEADERSHIP 7		
L 2	Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965	7
DISASTER MANAGEMENT		**13**
DM 1	Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation	3
DM 2	Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters	9
DM 3	Fire Service & Fire Fighting	1
ENVIRONMENTAL AWARENESS & CONSERVATION		**3**
EA 1	Environmental Awareness and Conservation	3

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

GENERAL AWARENESS		**4**
GA 1	General Knowledge	4
NAVAL ORIENTATION 6		
AF 1	Armed Forces and Navy Capsule	3
EEZ 1	EEZ Maritime Security and ICG	3
ADVENTURE 1		
AD 1	Introduction to Adventure Activities	1
BORDER & COASTAL AREAS		**2**
BCA 1	History, Geography & Topography of Border/Coastal areas	2
		TOTAL: 45 PERIODS
AIR FORCE WING		
PERSONALITY DEVELOPMENT		**9**
PD 3	Group Discussion: Team Work	2
PD 4	Career Counselling, SSB Procedure & Interview Skills	3
PD 5	Public Speaking	4
BORDER & COASTAL AREAS		**4**
BCA 2	Security Setup and Border/Coastal management in the area	2
BCA 3	Security Challenges & Role of cadets in Border management	2
AIRMANSHIP		**1**
A 1	Airmanship	1
BASIC FLIGHT INSTRUMENTS		**3**
FI 1	Basic Flight Instruments	3
AERO MODELLING		**3**
AM 1	Aero Modelling Capsule	3
GENERAL SERVICE KNOWLEDGE		**2**
GSK 4	Latest Trends & Acquisitions	2
AIR CAMPAIGNS		**6**
AC 1	Air Campaigns	6

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication E...

PRINCIPLES OF FLIGHT		**6**
PF 1	Principles of Flight	3
PF 2	Forces acting on Aircraft	3
NAVIGATION		**5**
NM 1	Navigation	2
NM 2	Introduction to Met and Atmosphere	3

TOTAL :45 PERIODS

SEMESTER - IV

24ECPT401 - SDG NO. 4 & 9	MICROCONTROLLERS AND EMBEDDED SYSTEMS LABORATORY WITH THEORY	L	T	P	CP	C
		1	0	4	5	3

OBJECTIVES:

- To understand the architecture and programming of microprocessors.
- To understand the architecture and instruction set of microcontrollers.
- To program the 8051 microcontroller by effectively using SFRs, timers, interrupts, and I/O ports.
- To learn interfacing techniques and peripheral device management.
- To design and implement real-time embedded systems.
- To bridge the theoretical knowledge with practical applications.

MODULE - I INTRODUCTION TO MICROPROCESSOR **8**

Architecture and features of microprocessor (8086). Instruction Set and Addressing modes of 8086.

List of Experiments

1. Basic arithmetic and Logical operation using 8086
2. String manipulations, Sorting and Searching using 8086.

MODULE - II INTRODUCTION TO MICROCONTROLLERS **8**

Architecture and features of microcontrollers (8051). Instruction Set and Addressing modes -Comparison between microcontrollers and microprocessors.

List of Experiments

1. Basic arithmetic and Logical operation using 8051

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engg

MODULE - III PROGRAMMING 8051 **7**

SFR, Timers, Handling timers, interrupts, and I/O ports.

List of Experiments

1. Timer programming using 8051
   Configure and use timers to generate delays or measure time intervals using keilμvision
2. Programming I/O ports to generate square wave using keilμvision

MODULE - IV 8051 INTERFACING TECHNIQUES **7**

Interfacing stepper motor, traffic light controller, ADC & DAC.

List of Experiments

1. Traffic light control system
   Interface LEDs and design a 4 way traffic control system
2. Stepper motor Interfacing
   Interface stepper motor and control speed and direction

MODULE - V INTRODUCTION TO ARM **8**

ARM Architecture Versions, Instruction Set, Features of the LPC214X Family, embedded C programming.

List of Experiments

1. LED Interface using ARM
   Toggle LEDs with different delay time
2. Interfacing keyboard and LCD
   4x4 Keyboard interface with ARM

MODULE - VI EMBEDDED SYSTEM DESIGN **7**

Embedded system design process, Design methodologies, Design flows, Basics of real-time operating systems (RTOS), Design example: Model Train Controller.

List of Experiments

1. Sensor-Based Application :
   Interface a temperature sensor, ADC and DAC to create a basic monitoring system
2. Mini Project:
   Design a simple embedded system integrating multiple peripherals.

TOTAL: 45 PERIODS

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

TEXT BOOKS:

1. Yu-Cheng Liu, Glenn A.Gibson,"Microcomputer Systems: The 8086 / 8088 Family- Architecture, Programming and Design", 2ndEdition, Prentice Hall of India, 2007.
2. Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", 2ndEdition, Pearson education, 2011.
3. Marilyn Wolf, "Computers as Components - Principles of Embedded ComputingSystemDesign",3rdEdition, MorganKaufmann Publisher (An imprint from Elsevier),2012.
4. Jane W.S.Liu, "Real Time Systems", Pearson Education, Third Indian Reprint,2003.

REFERENCES:

1. Doughlas V.Hall, "Microprocessors and Interfacing, Programming and Hardware", TMH,2012.
2. A.K.Ray, K.M.Bhurchandi, "AdvancedMicroprocessorsandPeripherals", 3rdEdition, TataMcGrawHill, 2012.
3. LylaB.Das, "Embedded Systems: An Integrated Approach", Pearson Education,2013.
4. C.M.Krishna, KangG.Shin, "Real-Time Systems", InternationalEditions, McGrawHill,1997.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc20_ee42/preview
2. https://nptel.ac.in/courses/108105102/

ONLINE RESOURCES:

1. https://freevideolectures.com/course/3018/microprocessors-and-microcontrollers
2. http://www.satishkashyap.com/2012/02/video-lectures-on-microprocessors-and.html

OUTCOMES:

At the end of the course, the student should be able to:

1. Apply the architecture, features, instruction set, and addressing modes of the 8086 microprocessor to develop basic assembly language programs. (K3)

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

2. Apply the architecture, features, instruction set, and addressing modes of the 8051 microcontroller and compare its functionalities with the microprocessor for embedded applications. (K3)
3. Develop programs to configure and use SFRs, timers, interrupts, and I/O ports of the 8051 microcontroller for device control and data handling. (K4)
4. Implement interfacing techniques to control external devices such as stepper motors, traffic light controllers, ADC, and DAC using a microcontroller. (K4)
5. Apply the architecture, instruction set, and features of ARM-based LPC214X microcontrollers to develop embedded C programs for simple applications. (K3)
6. Apply embedded system design methodologies and real-time operating system concepts to design embedded applications such as a model train controller. (K4)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	-	-	-	-	-	3	1	-	2	3	2
CO2	3	1	-	-	-	-	-	3	1	-	2	3	2
CO3	3	2	1	1	3	-	-	3	1	-	2	3	2
CO4	3	2	-	-	-	-	-	3	1	-	2	3	2
CO5	3	2	1	1	3	-	-	3	1	-	2	3	2
CO6	3	2	1	1	3	-	1	3	3	-	2	3	2

Lab requirement for batch of 30 students / 2 student per experiment

S.No	Equipment	Quantity
1	8086 Microprocessor Trainer Kits	15
2	8051 Microcontroller Trainer Kits	15
3	ADC and DAC Interface Boards	5
4	Stepper Motor Interface Boards with stepper motor	5
5	Traffic Light Interface Boards	5
6	ARM 7 trainer kit	15
7	Temperature sensor LM35	15
8	Standalone desktop PC with MASM, Keil µVision, Flash magic and UART driver software installed	15

Recommended by Board of Studies of ECE dept. Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

SEMESTER - IV

24ECPT402 - SDG NO. 4 & 9	LINEAR INTEGRATED CIRCUITS LABORATORY WITH THEORY	L	T	P	CP	C
		1	0	4	5	3

OBJECTIVES:

- To provide hands-on experience in designing and implementing circuits using operational amplifiers.
- To familiarize students with various applications of operational amplifiers, including filters, oscillators, and mathematical operations.
- To introduce the working principles of timer IC 555 and its applications in multivibrators.
- To develop an understanding of Phase-Locked Loop (PLL) and Voltage-Controlled Oscillator (VCO) circuits.
- To explore the working and implementation of Digital-to-Analog (D/A) and Analog-to-Digital (A/D) converters.
- To learn about voltage regulators and their role in power supply design.

MODULE - I BASICS OF OPERATIONAL AMPLIFIER **8**

Ideal Operational Amplifier, General operational amplifier stages and internal circuit diagram, DC and AC characteristics.

List of Experiments

1. Design and implement Inverting, Non inverting and difference amplifiers using IC 741

MODULE - II APPLICATIONS OF OPERATIONAL AMPLIFIERS **8**

Adder, Subtractor, Integrator, Differentiator, Filters and Oscillators.

List of Experiments

1. Design and test an Integrator and Differentiator Circuit
2. Design and test Active low-pass, High-pass filter Circuits
3. Implement Phase shift and Wien bridge oscillators using Op-amp
4. Simulate Band pass filter and Wien bridge oscillator using Pspice

MODULE - III BASICS OF TIMER IC AND ITS APPLICATION **8**

Internal block diagram of timer IC555. Astable and Monostable Multi vibrators using Ic555.

List of Experiments

1. Design and implement Astable and Monostable multivibrators using NE555 Timer.
2. Astable and Monostablemultivibrators using Pspice.

Recommended by Board of Studies of ECE dept. Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication En

MODULE - IV INTRODUCTION TO PLL AND VCO 7

Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565.

List of Experiments

1. Demonstrate capture range and lock in range of PLL using IC 565
2. Design and implement PLL as a frequency multiplier using Ic565

MODULE - V D/A AND A/D CONVERTERS 7

D/A converter specifications, weighted resistor type, R-2R Ladder type, A/D Converters specifications, Flash type, Successive Approximation type, Single Slope type, Dual Slope type

List of Experiments

1. R-2R Ladder Type D- A Converter using Op-amp
2. Simulate using PSPICE A/D converter.

MODULE - VI VOLTAGE REGULATORS 7

IC Voltage regulators: Three terminal fixed and adjustable voltage regulators, IC 723 general purpose regulator.

List of Experiments

1. Design DC power supply using LM317 and Lm723.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2018, Fifth Edition.
2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", Fourth Edition, Tata McGraw Hill, 2016.

REFERENCES:

1. Ramakant A.Gayakwad, "OPAMP and Linear ICs", Fourth Edition, Prentice Hall of India / Pearson Education, 2015.
2. S.Salivahanan, V.S.Kanchana Bhaskaran, ""Linear Integrated Circuits", Tata McGraw Hill, Second Edition, Fourth Reprint, 2016.
3. Robert F.Coughlin, Frederick F.Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Sixth Edition, PHI, 2001.
4. B.S.Sonde, "System Design using Integrated Circuits", Second Edition, New Age Pub, 2001.
5. Gray and Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley International, Fifth Edition, 2009.
6. William D.Stanley, "Operational Amplifiers with Linear Integrated Circuits", Pearson Education, Fourth Edition, 2001.

Recommended by Board of Studies of ECE dept. Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc20_ee13/preview
2. https://nptel.ac.in/courses/108108111/
3. http://web.iitd.ac.in/~shouri/eel782/lectures.php

ONLINE RESOURCES:

1. https://freevideolectures.com/course/2915/linear-integrated-circuits
2. https://e-box.co.in/linear-integrated-circuits.shtml

OUTCOMES:

At the end of the course, the student should be able to:

1. Apply the fundamentals of operational amplifiers, including their ideal characteristics, internal structure, and DC/AC performance, and design basic amplifier configurations using IC 741. (K3)
2. Design and implement various applications of operational amplifiers, such as mathematical operation circuits, filters, and oscillators, and simulate them using PSPICE. (K4)
3. Analyze and implement timer circuits using IC 555, including Astable and Monostable multivibrators, both in hardware and simulation. (K4)
4. Explain the working principles of PLL and VCO circuits and demonstrate their applications, such as frequency multiplication using IC 565 in PSPICE. (K3)
5. Analyze and implement D/A and A/D conversion techniques, including R-2R ladder-based D/A converters and simulate A/D converters. (K4)
6. Design regulated power supplies using voltage regulator ICs, such as LM317 and LM723, for stable DC power output. (K4)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	-	-	-	-	-	3	1	-	2	3	2
CO2	3	2	2	1	3	-	-	3	1	-	2	3	2
CO3	3	2	1	1	3	-	-	3	1	-	2	3	2
CO4	3	2	2	2	3	-	1	3	1	-	2	3	2
CO5	3	2	1	1	3	-	-	3	1	-	2	3	2
CO6	3	2	1	1	3	-	-	3	1	-	2	3	2

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

Lab Requirement For a Batch of 30 Students/ 2 Students Per Experiment:

S.No.	EQUIPMENTS	QUANTITY
1.	CRO/DSO (30MHz)	15
2.	Signal Generator/FunctionGenerators (2 MHz)	15
3.	Dual Regulated Power Supply (0– 30V)	15
4.	Digital Multimeter	5
5.	IC tester	2
6.	Standalone desktop PC	15
7.	PSPICE Circuit Simulation Software	15
8.	Consumables : IC 565, IC 741, NE555, LM317, IC 555, LM723. Resistors, Capacitors, Bread Boards, Connecting wires	each 100

SEMESTER - IV

24ECPL401 - SDG NO. 4 & 9	COMMUNICATION SYSTEMS LABORATORY	L	T	P	CP	C
		0	0	4	4	2

OBJECTIVES:

- To visualize the effects of sampling and TDM
- To implement AM & FM modulation and demodulation
- To implement PCM & DM
- To simulate Digital Modulation schemes
- To simulate Error control coding schemes

LIST OF EXPERIMENTS:

1. Signal Sampling and Reconstruction.
2. Time Division Multiplexing.
3. AM Modulator and Demodulator.
4. FM Modulator and Demodulator.
5. Pulse Code Modulation and Demodulation.
6. Delta Modulation and Demodulation.
7. Line coding schemes.
8. Simulation of ASK, FSK and BPSK generation schemes.
9. Simulation of QPSK and QAM generation schemes.
10. Simulation of signal constellations of BPSK, QPSK and QAM.
11. Simulation of ASK, FSK and BPSK detection schemes.
12. Simulation of Linear Block and Cyclic error control coding schemes.
13. Simulation of Convolutional coding scheme.

TOTAL: 45 PERIODS

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Eng

LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS / 3 STUDENTS PER EXPERIMENT

1. Discrete components for AM, FM
2. Kits for Signal Sampling ,TDM, PCM, DM and Line Coding Schemes.
3. CROs / DSOs – 15Nos.
4. Function Generators – 15 Nos.
5. MATLAB or equivalent software package for simulation experiments
6. Pcs - 15 Nos.

OUTCOMES:

At the end of the course, the student should be able to:

1. Perform signal sampling and multiplexing schemes for baseband signals and reconstruct the signals.(K3)
2. Construct, test and simulate the Analog and Digital modulation and demodulation circuits.(K3)
3. Generate various line coding schemes using PCM and DM techniques and implement channel coding schemes.(K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	2	1	-	2	1	2	2	3	2
CO2	3	2	1	1	2	1	-	2	1	2	2	3	2
Co3	3	2	1	1	2	1	-	2	1	2	2	3	2

SEMESTER - IV

24ECTP401 - SDG NO. 4	APTITUDE SKILLS - II	L	T	P	CP	C
		0	0	2	2	0

PROBLEM SOLVING TECHNIQUES USING C PROGRAMMING – PHASE 1

OBJECTIVES:

- Build a strong foundation in C programming concepts and problem-solving techniques.
- Develop the ability to write efficient and modular code.
- Enhance understanding of data structures, memory management, and algorithms for optimized solutions.

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - I FOUNDATIONS OF PROGRAMMING 12

- Understanding Programming Languages: Why they are essential and their various types.
- Operators in C: Exploring assignment, arithmetic, relational, and logical operators.
- Tokens and Identifiers: Learning about keywords, naming conventions, and best practices.
- Control Structures in C: Choosing the right structure for efficient programming:
- Selective Control (Decision-making statements)
- Iterative Control (Loops for repetition)
- Unconditional Control (Jump statements)

MODULE - II DATA TYPES, NUMBER SYSTEMS, AND FUNCTIONS 12

- Operators in Depth: Understanding increment, decrement, and short-circuit operators.
- Number Systems & Conversions: Mastering different number systems, conversions, and format specifiers.
- Data Types in C: Exploring signed and unsigned types (int, float, char) and their usage.
- Functions in C:
- Importance of modular programming.
- Writing and using functions effectively.

MODULE - III POINTERS, ARRAYS, AND PROBLEM-SOLVING 21

- Pointers in C:
- Understanding memory management.
- How pointers enable direct hardware communication.
- Arrays in C:
- Efficiently storing multiple elements.
- Single-dimensional and multi-dimensional arrays.
- Problem-Solving Techniques:
- Tackling challenges related to arrays and strings.
- Optimizing algorithms for efficiency.

TOTAL: 45 PERIODS

REFERENCES:

1. Let Us C – Yashavant Kanetkar
2. Programming in ANSI C – E. Balagurusamy

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

3. The C Programming Language – Brian W. Kernighan and Dennis M. Ritchie
4. C: How to Program – Paul Deitel and Harvey Deitel
5. Problem Solving and Program Design in C – Jeri R. Hanly and Elliot B. Koffman

LIFE SKILLS, RANGER AND ROVER & BIS STANDARDS - PHASE 2

OBJECTIVES:

- Explore core domain BIS standards related to Information security and AI.
- Implement strategies to learn career and managerial skills for career growth.

MODULE - I JEEVAN KAUSHAL 2.0 – CAREER SKILLS AND MANAGERIAL SKILLS **14**

Group Discussion Skills - Meaning and Methods of Group Discussion - Procedure of Group Discussion - Group Discussion - Simulation - Group Discussion - Common Errors.

Managerial Skills - Basic Managerial Skills - Planning for effective management - How to organize teams? - Recruiting and retaining talent - Delegation of tasks - Learn to coordinate - Conflict management - Self-management Skills - Understanding self-concept - Developing self-awareness - Self-examination - Self-reflection and Introspection - Self-regulation.

Entrepreneurial Skills - Basics of Entrepreneurship - Meaning of entrepreneurship – Classification and types of entrepreneurships - Traits and competencies of entrepreneur -. Creating Business Plan - Problem identification and idea generation - Idea validation - Pitch making.

Managing Personal Finance - Budgeting - Setting personal goals - Estimate likely expenses Monitor spending to obtain the most value for the available funds - Saving and Investing - Advantages of saving money - Concept of present and future value of money.

MODULE - II RANGER AND ROVER **10**

Scouting for Boys: Scout Craft, Campaigning.

Knots: Managing of rope, types of ropes and uses, Basic Knots: - Clove Hitch, Reef Knot, Fisherman knot, Sheet bend, Bowline, Sheep shank, whippings.

Growing Together: Understanding the growth context.

Intergenerational Dialogue: How to enhance learning and cooperation across generations.

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - III INFORMATION SECURITY & ARTIFICIAL INTELLIGENCE 6

Information security, network security and privacy protection: Introduction to the standards and concepts related to security [CIA (Confidentiality, Integrity, and Availability)] and privacy.

Software - Quality Assurance, Life Cycle & Testing: Introduction to Software life cycle processes and Software Testing (IS 16124 and IS 11291).

Artificial Intelligence: Introduction to the concepts of Artificial Intelligence and related standards:

- Overview of trustworthiness in artificial intelligence.
- Framework for Artificial Intelligence (AI) Systems Using Machine Learning (ML).
- AI system life cycle processes.
- Data life cycle framework.

TOTAL: 30 PERIODS

REFERENCES:

1. Curriculum and Guidelines for Life Skills (Jeevan Kaushal) 2.0, UGC, New Delhi.
2. A World Built on Standards: A Textbook for Higher Education, Published by: Danish Standards Foundation, 2015.
3. SO / IEC Guide 59, BIS Standards Formulation Manual, 2nd Revision, 2022.

ONLINE RESOURCES

1. https://lms.scout.org/courses/show/214175?force_course_hub=true
2. https://lms.scout.org/courses/show/214194?force_course_hub=true

OUTCOMES

Upon completion of this course, the students will be able to:

1. Understand and apply the fundamentals of C programming for problem-solving. (K2)
2. Utilize control structures, operators, and functions to write modular programs. (K2)
3. Implement pointers and arrays for efficient memory and data management. (K2)
4. Solve real-world problems by designing and optimizing algorithms. (K2)
5. Demonstrate career and managerial skills. (K2)
6. Understand BIS standards for Information security and AI domain. (K2)

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	2	-	-	-	-	-	-	2	-	-
CO2	2	2	2	2	1	-	-	-	1	-	2	-	-
CO3	2	2	2	2	-	-	-	-	1	-	2	-	-
CO4	2	2	2	2	1	-	-	-	1	-	2	-	-
CO5	-	-	-	-	-	3	-	-	1	-	2	2	2
CO6	-	-	-	-	-	3	-	-	1	-	2	2	2

SEMESTER - IV

24ECID401 - SDG NO. 4,11,15	INNOVATIVE DESIGN LAB - II	L	T	P	CP	C
		0	0	2	2	1

OBJECTIVES:

- To empower students to transform innovative ideas into viable venture blueprints through structured entrepreneurial exploration and opportunity framing.
- To provide experiential learning in adaptive product evolution by focusing on user-centric redesign, iterative testing, and technical refinement.
- To develop proficiency in assessing market traction, decoding customer behavior, and aligning product strategy with investment-readiness metrics.
- To instill a foundation of ethical entrepreneurship by integrating inclusive design principles, sustainability values, and responsible leadership.
- To enable data-driven innovation by leveraging field research, applying performance analytics, and integrating emerging technologies for solution optimization.
- To facilitate multidisciplinary problem-solving through advanced engineering integration, MVP systemization, and standards-compliant validation.

COURSE METHODOLOGY:

1. This initiative is designed to inculcate ethical principles of research and to get involved in a life-long learning process for the students, focusing on the practical execution and refinement of entrepreneurial ventures.

Recommended by Board of Studies of ECE dept. Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

2. The project work must involve the continuous development, iterative enhancement, and potential launch of an entrepreneurial solution. It must also include appropriate elements of the following: compliance with advanced engineering standards, iterative design analysis, enhanced prototyping, robust experimentation, real-world user feedback collection, data correlation, and advanced software/hardware development for the solution.
3. Projects can be individual work or group projects, with a maximum of Three students. In case of a group project, each student must submit an individual project report clearly specifying their unique contributions to the collective work.
4. On completion of the project, the student shall submit a detailed project report encompassing the evolution of their venture, technical implementation, market validation, and future roadmap. The project shall undergo a formal review process, after which the report will be evaluated. Students shall appear for a mandatory viva-voce examination on the project, approved jointly by the Coordinator and the respective project guide.

EVALUATION:

1. First evaluation (Immediately after first internal examination): 20 marks (Focus on refined problem statement, advanced MVP design, and detailed development plan)
2. Second evaluation (Immediately after second internal examination): 30 marks (Focus on prototype/MVP implementation, initial testing, and preliminary market validation results)
3. Final evaluation (Last week of the semester): 50 marks (Focus on the complete refined solution, comprehensive market validation, growth strategy, final project report, and viva-voce)

Note: All three evaluations are mandatory for course completion and for awarding the final grade.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

1. Apply structured entrepreneurial exploration to convert innovative ideas into venture blueprints, incorporating user-centric and iterative design approaches. (K4)
2. Assess customer behavior and market traction to align product strategies with ethical and sustainable entrepreneurship principles. (K5)

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication En

3. Integrate multidisciplinary knowledge, field data, and emerging technologies to optimize and validate engineered solutions. (K6)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	-	-	-	2	-	-	-	2	2
CO2	3	3	2	-	-	-	-	2	-	-	-	2	2
CO3	3	3	2	-	-	-	-	2	-	-	-	2	2

Recommended by
Board of Studies of ECE dept.
Meeting No. 08 Dated: 17.02.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

SEMESTER V

COURSE CODE: 24ECPC501	VLSI DESIGN	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 108106191	SYLLABUS VERSION 1.1	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24ECPC303					

OBJECTIVES:

- To study the fundamentals of CMOS circuits and its characteristics
- To design and realize of combinational digital circuits
- To design and realize of sequential digital circuits
- To study the fundamentals of HDL
- To build the arithmetic circuits and to know the design rules

MODULE - I MOS FUNDAMENTALS AND CMOS BASICS 8

MOS Transistor operation – CMOS Inverter – DC characteristics – Ideal and Non-Ideal I-V Characteristics - Delay concepts

MODULE - II VERILOG HDL 7

Verilog basics - Data types and operators - Gate-level and dataflow modelling - Behavioural modelling- Simple testbench.

MODULE - III CMOS LOGIC CIRCUITS 7

Static & dynamic CMOS logic, pass transistor & transmission gate logic, and power dissipation.

MODULE - IV SEQUENTIAL CIRCUITS 8

Latches and Flip-Flops - Registers and pipelining concept - Synchronous design - Timing concepts: Skew, jitter.

MODULE - V ARITHMETIC CIRCUITS 8

Datapaths- Adders: Static adder, mirror adder, carry bypass adder, linear carry select adder, square root carry select adder - Multipliers: Array, Booth and modified booth multiplier - ALU overview - Shifters: Barrel shifter, logarithmic shifter.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - VI VLSI FABRICATION & LAYOUT 7

Basic CMOS fabrication steps—Layout concepts and stick diagrams - Design rules

TOTAL : 45 PERIODS

TEXT BOOK:

1. N.Weste, K.Eshraghian, "Principles of CMOS VLSI DESIGN", A system Perspective, 2nd Edition, Addision Wesley, 2004.
2. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, "Digital Integrated circuits: A Design Perspective", Prentice Hall of India, 2nd Edition, 2003.

REFERENCES:

1. A.Pucknell, Kamran Eshraghian, "BASIC VLSI DESIGN", Prentice Hall of India, 3rd Edition, 2007.
2. M.J. Smith, "Application Specific Integrated Circuits", Addisson Wesley, 1997.
3. R.Jacob Baker, Harry W.LI., David E.Boyee, "CMOS Circuit Design, Layout and Simulation", Prentice Hall of India, 2005.

ONLINE RESOURCES:

1. ttps://freevideolectures.com/course/3507/digital-vlsi-system-design
2. https://www.tutorialspoint.com/vlsi_design/vlsi_design_useful_resources.html

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply MOS transistor operation, CMOS inverter characteristics, DC operating regions, delay concepts, and scaling fundamentals in CMOS circuits. (K3)
2. Analyze digital circuit design using Verilog HDL through gate-level, dataflow modeling, and basic testbench-based functional verification. (K4)
3. Analyze latches, flip-flops, registers, pipelining concepts, and timing constraints such as setup time, hold time, and synchronous design principles. (K4)
4. Analyze arithmetic building blocks such as adders, multipliers, ALU concepts used in digital VLSI systems. (K4)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

5. Apply static CMOS logic, pass transistor logic, transmission gate logic, and basic dynamic logic concepts for simple combinational circuit design with reduced power dissipation. (K3)
6. Analyze CMOS fabrication steps, layout concepts, stick diagrams, and introductory design rules used in VLSI physical implementation. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	1	3	2
CO2	3	3	2	-	-	-	-	-	-	-	1	3	2
CO3	3	3	2	-	-	-	-	-	-	-	1	3	2
CO4	3	3	2	-	-	-	-	-	-	-	1	3	2
CO5	3	2	2	-	-	-	-	-	-	-	1	3	2
CO6	3	3	2	-	-	-	-	-	-	-	1	3	2

SEMESTER V

COURSE CODE: 24ECPC502	DISCRETE TIME SIGNAL PROCESSING	L	T	P	CP	C
		3	1	0	4	4
NPTEL CODE: 108106151	SYLLABUS VERSION 1.1	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24ECPC301, 24ECPC303					

OBJECTIVES:

- Explain the fundamentals of discrete-time signal processing and frequency domain analysis using DFT and FFT.
- Describe the principles of IIR and FIR filter design techniques for digital signal processing applications.
- Explain the effects of finite word length in digital systems and methods to minimize computational errors.
- Describe the architecture and functionalities of digital signal processors.
- Apply multirate signal processing techniques such as decimation, interpolation, and sampling rate conversion for practical signal processing applications.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - I DISCRETE FOURIER TRANSFORM AND FFT 11

Frequency domain sampling, Discrete Fourier Transform (DFT), properties of DFT: periodicity, symmetry, circular convolution. Linear filtering using DFT. Filtering long data sequences - overlap save and overlap add method. Fast Fourier Transform (FFT): Radix-2 DIT and DIF algorithms.

MODULE - II IIR FILTER DESIGN 11

Characteristics of filters, Butterworth and Chebyshev filters. Design of IIR filters using impulse invariance and bilinear transformation. Frequency transformations. Structure of IIR filter - direct form I, direct form II, cascade, parallel realizations.

MODULE - III FIR FILTER DESIGN 11

Symmetric and antisymmetric FIR filters, Linear phase FIR filters, Design using Fourier series and window methods (Rectangular, Hamming, Hanning). FIR filter structures - linear phase structure, direct form realizations

MODULE - IV FINITE WORD LENGTH EFFECTS 9

Fixed and floating point representation, quantization, truncation, rounding. Quantization noise - input / output quantization - coefficient quantization error - product quantization error, overflow, limit cycle oscillations, scaling.

MODULE - V DSP PROCESSORS 9

DSP architecture, circular buffering, addressing modes, MAC operation, fixed vs floating point DSP, Programming - Application examples

MODULE - VI MULTIRATE SIGNAL PROCESSING 9

Introduction to multirate systems, Decimation and Interpolation, Sampling rate conversion by rational factors, Multistage implementation of sampling rate conversion, Applications of Multi Rate Signal Processing.

TOTAL : 60 PERIODS

TEXTBOOKS:

1. John G Proakis and Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", Pearson, Fifth Edition, 2021.
2. A.V.Oppenheim, R.W. Schafer and J.R. Buck, "Discrete Time Signal Processing", Eighth Indian Reprint, Pearson, 2004.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

REFERENCES:

1. Emmanuel C. Ifeachor & Barrie. W. Jervis, "Digital Signal Processing", Second Edition, Pearson Education / Prentice Hall, 2002.
2. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata McGraw Hill, 2007.
3. Multirate Systems and Filter Banks, Vaidyanathan, P. P. (1993). Multirate systems and filter banks. Prentice Hall.
4. B. Venkataramani, M. Bhaskar, "Digital Signal Processors: Architecture, Programming and Application", Tata McGraw Hill Education, 2002.
5. Understanding Digital Signal Processing, Lyons, R. G. (2011). Understanding digital signal processing (3rd ed.). Pearson Education.

WEB REFERENCES:

1. https://ocw.mit.edu/courses/6-341-discrete-time-signal-processing-fall-2005/
2. https://www.mathworks.com/learn/tutorials/signal-processing.html
3. https://www.edx.org/course/discrete-time-signal-processing-4

ONLINE RESOURCES:

1. https://www.nptel.ac.in/courses/108106151
2. https://nptel.ac.in/courses/117102060
3. https://nptel.ac.in/courses/117102063

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply DFT and FFT techniques to analyze discrete-time signals and perform frequency- domain processing. (K3)
2. Analyze and design digital IIR filters using analog prototype methods and evaluate their performance. (K4)
3. Analyze and design digital FIR filters using Fourier series and windowing techniques. (K4)
4. Examine finite word length effects including quantization, rounding, and overflow in digital systems. (K4)
5. Apply DSP processor concepts and programming techniques to implement signal processing algorithms. (K3)
6. Analyze multirate signal processing techniques including decimation, interpolation, and sampling rate conversion. (K4)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	3	1
CO2	3	3	2	-	-	-	-	-	-	-	-	3	1
CO3	3	3	2	-	-	-	-	-	-	-	-	3	1
CO4	3	3	-	-	-	-	-	-	-	-	-	2	2
CO5	2	2	-	-	-	-	-	-	-	-	-	3	2
CO6	2	3	-	-	-	-	-	-	-	-	-	3	2

SEMESTER V

COURSE CODE: 24HSMG501	PRINCIPLES OF ENGINEERING MANAGEMENT	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: -	SYLLABUS VERSION 1.1	SDG NO. 4,8,9,10,12				
PRE-REQUISITE COURSES	-					

OBJECTIVES:

- To Understand the Basic Management Concepts and Principles in Corporate Practices.
- To Apply Management Functions Innovatively in Organizational Practices, globally.

MODULE - I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS **8**

Management – Science or Art – Manager Vs Entrepreneur – types of managers – Engineers as Managers. Evolution of Management – Scientific, human relations, system and contingency approaches – Types of Business organization – Sole proprietorship, partnership, company-public and private sector enterprises – Organization culture and Environment – Current issues and future trends in Management; Industry 5.0 – Engineering management in modern business.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - II PLANNING **8**

Planning, Technology Planning - Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – MBO – process - Principles and functions of engineering management – Planning Tools and Techniques – Decision-making steps and process.

MODULE - III ORGANISING **8**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization, and decentralization – Job Design – Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning, and management.

MODULE - IV DIRECTING AND CONTROLLING **7**

Foundations of individual and group behaviour – Motivation – theories and techniques–Leadership – Level 5 leadership - theories – Leadership as a determinant of Engineering management - Communication – process, and barriers – effective communication – Communication and IT - System and process of controlling – budgetary and non-budgetary control techniques.

MODULE - V INNOVATION AND TECHNOLOGY MANAGEMENT **7**

Innovation management of Products and Services, Role of R & D in Entrepreneurship, Breakthrough Innovation, Disruptive Innovation – Modern approaches in Engineering management – Green management, Lean management, Managing diversity. IPR – Principles of Ethics for Engineering Managers.

MODULE - VI MODERN MANAGEMENT FRAMEWORKS AND AI APPLICATIONS **7**

SWOT Analysis - PESTLE Analysis - Agile Management Principles - Design Thinking for Problem Solving - AI in Workforce Analytics and Performance Management - Generative AI for Knowledge Management and Innovation - Ethical and Responsible AI in Management.

TOTAL : 45 PERIODS

TEXTBOOKS:

1. Tripathy, P.C. and Reddy, P.N., Principles of Management, McGraw-Hill Education, 2023 Edition.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

REFERENCES:

1. Robbins, S.P., Coulter, M.A. and Long, L., Management, 16th Edition, Pearson, 2025.
2. Stoner, J.A.F., Freeman, R.E. and Gilbert, D.R., Management, 6th Edition, Pearson Education.
3. Robbins, S.P., Coulter, M.A. and DeCenzo, D.A., Fundamentals of Management, 11th Edition, Pearson Global Edition, 2026.
4. Kreitner, R. and Mohapatra, M., Management, Cengage Learning India.
5. Koontz, H., Weihrich, H. and Cannice, M., Essentials of Management, 11th Edition, McGraw-Hill.
6. Iansiti, M. and Lakhani, K., Competing in the Age of AI, Harvard Business Review Press.
7. Osterwalder, A. and Pigneur, Y., Business Model Generation, Strategyzer.
8. Lewrick, M., Link, P. and Leifer, L., The Design Thinking Playbook, Wiley.

WEB RESOURCES:

1. https:// www. managementstudyguide. com/ organization-management.htm
2. https://nptel.ac.in/courses/110/105/110105034/
3. https://courses.lumenlearning.com/boundless-management/chapter/principles-of-management/

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/110/105/110105033/

OUTCOMES:

At the end of this course, the students should be able to:

1. Explain the fundamental concepts, theories and evolution of management in engineering organizations. (K2)
2. Apply planning principles and decision-making techniques for organizational problem solving. (K3)
3. Analyze organizational structures and human resource management practices in engineering enterprises. (K4)
4. Demonstrate leadership, communication and control mechanisms for effective organizational performance. (K3)
5. Examine innovation, technology management, sustainability and ethical practices in engineering management. (K4)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

6. Apply modern management frameworks and AI-enabled managerial tools to support strategic and operational decisions. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	1	2	2	2	3	2	-	1
CO2	-	-	1	1	1	1	2	2	2	3	3	-	1
CO3	-	1	2	1	1	1	2	2	2	3	3	-	1
CO4	-	-	1	1	1	1	2	2	3	3	3	-	1
CO5	-	1	1	1	1	2	3	3	2	2	3	-	1
CO6	-	2	2	2	3	1	2	2	2	3	3	1	2

SEMESTER V

COURSE CODE: 24MGMC501	CONSTITUTION OF INDIA	L	T	P	CP	C
		2	0	0	2	0
NPTEL CODE: -	SYLLABUS VERSION 1.1	SDG NO. 4, 9				
PRE-REQUISITE COURSES	-					

OBJECTIVES:

- To know about Indian constitution.
- To know about central government functionalities in India.
- To know about state government functionalities in India.
- To know about Constitution function.
- To Know about Constitutional remedies

MODULE - I INTRODUCTION 5

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05-06-2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT 5

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India.

MODULE - III STRUCTURE AND FUNCTION OF STATE GOVERNMENT 5

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

MODULE - IV CONSTITUTION FUNCTIONS 5

Indian Federal System – Centre – State Relations – President's Rule – Constitutional Amendments – Constitutional Functionaries.

MODULE - V CONSTITUTIONAL REMEDIES 5

Enforcement of fundamental rights - Power of parliament to modify the rights the conferred by this part in their application to forces.

MODULE - VI CONSTITUTIONAL GOVERNANCE IN THE DIGITAL ERA AND CONTEMPORARY ISSUES 5

Constitutional Values and Good Governance – Right to Information (RTI) and Citizen Participation – Digital Governance and e-Governance Initiatives in India – Constitutional Perspectives on Artificial Intelligence (AI) and Emerging Technologies.

TOTAL : 30 PERIODS

TEXT BOOKS:

1. Durga Das Basu, Introduction to the Constitution of India, 27th Edition (2024), LexisNexis Butterworths Wadhwa.
2. M. V. Pylee, An Introduction to the Constitution of India, Latest Revised Edition (2024), Vikas Publishing House.
3. P. M. Bakshi, The Constitution of India, 18th Edition (2025), Universal LexisNexis
4. Brij Kishore Sharma, Introduction to the Constitution of India, 15th Edition (2024), PHI Learning

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

REFERENCE BOOKS:

1. D. D. Basu, Shorter Constitution of India, Latest Revised Edition, LexisNexis
2. Subhash C. Kashyap, Our Constitution: An Introduction to India's Constitution and Constitutional Law, Latest Edition, National Book Trust
3. M. Laxmikanth, Indian Polity, 7th Edition (2025), McGraw Hill Education
4. J. N. Pandey, Constitutional Law of India, Latest Edition (2024), Central Law Agency.
5. V. N. Shukla, Constitution of India, Revised by Mahendra Pal Singh, 14th Edition / Latest Available Edition, Eastern Book Company

ONLINE REFERENCES

1. https://iasexamportal.com/ebook/the-constitution-of-india
2. https://eclass.cc/courses/udemy_basics_of_indian_constitution_a_refresher_course
3. https://ox.libguides.com/c.php?g=422964&p=2888489
4. https://mylaw.net/litigation/constitutional-law-course
5. www.tutorialspoint.com/indian_polity/indian_polity_sources_consitution.htm
6. www.drishtiias.com/gs-special/gs-special-polity/important-sources-of-the-indian-constitution
7. www.india.gov.in/my-government/constitution-india/constitution-india-full-text
8. http://legislative.gov.in/constitution-of-india

MOOC REFERENCES

1. https://www.mooc-list.com/tags/law
2. https://www.udemy.com/course/polity-and-constitution/
3. https://swayam.gov.in/nd2_cec19_hs13/preview
4. https://www.udemy.com/course/basics-of-indian-constitution-a-refresher-course/

OUTCOMES:

At the end of this course, the students should be able to:

1. Explain the historical evolution, philosophy and fundamental principles of the Constitution of India. (K2)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

2. Describe the structure, powers and functions of the Union Government under the Constitution. (K2)
3. Interpret the structure and functioning of State Governments and the judicial system in India. (K2)
4. Analyze federal relations, constitutional amendments and constitutional functionaries. (K4)
5. Examine constitutional remedies and mechanisms for protection of fundamental rights. (K4)
6. Apply constitutional values and principles to contemporary governance, digital rights, AI ethics and emerging societal challenges. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	1	-	-	-	2	1	2	-	-	-	2	2
CO2	-	2	-	-	-	2	2	2	-	-	-	2	2
CO3	-	2	-	-	-	2	2	2	-	-	-	2	2
CO4	-	2	1	-	-	2	2	2	-	-	-	2	2
CO5	-	2	1	-	-	2	2	2	-	-	-	2	2
CO6	-	2	1	-	-	2	2	2	-	-	-	2	2

SEMESTER V

COURSE CODE: 24ECPL501	VLSI DESIGN LABORATORY	L	T	P	CP	C
		0	0	4	4	2
NPTEL CODE: -	SYLLABUS VERSION 1.1	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24ECPL303					

OBJECTIVES:

- To learn Hardware Descriptive Language(Verilog/VHDL)
- To learn the fundamental principles of VLSI circuit design in digital and analog domain
- To familiarize fusing of logical modules on FPGAs
- To provide hands on design experience with professional design (EDA) platforms

Recommended in Board of Studies (BoS) Meeting No. _____ held on _____

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

LIST OF EXPERIMENTS:

1. Design an Adder (Min 8 Bit) using HDL. Simulate it using Xilinx/Altera Software and implement it by Xilinx/Altera FPGA.
2. Design a Multiplier (4 Bit Min) using HDL. Simulate it using Xilinx/Altera Software and implement it by Xilinx/Altera FPGA.
3. Design an ALU using HDL. Simulate it using Xilinx/Altera Software and implement it by Xilinx/Altera FPGA.
4. Design a Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software and implement it by Xilinx/Altera FPGA.
5. Design a Finite State Machine (Moore/Mealy) using HDL. Simulate it using Xilinx/Altera Software and implement it by Xilinx/Altera FPGA.
6. Design Memories using HDL. Simulate it using Xilinx/Altera Software and implement it by Xilinx/Altera FPGA.
9. Design and simulate a 4-bit synchronous counter using Flip-Flops.
10. Design and simulate a CMOS inverter and obtain the transient response and DC transfer characteristics.
11. Design and simulate a differential amplifier and analyze gain, bandwidth, and CMRR by performing schematic simulations.
12. Construct the inverter layout and perform the post-layout simulation.

TOTAL : 30 PERIODS

LAB REQUIREMENTS :

1.	Xilinx ISE/Altera Quartus/ equivalent	10 User License
2.	EDA Tools Xilinx/Altera/equivalent FPGA Boards	10 User License
3.	Cadence/Synopsis/ Mentor Graphics/Tanner/ equivalent EDA Tools	10 User License

Personal Computer 30 nos

OUTCOMES:

At the end of this course, the students should be able to:

1. Construct and implement digital VLSI circuits using HDL, FPGA platforms, and EDA tools for simulation, synthesis, and verification of logic designs. (K5)
2. Analyze and evaluate the performance of analog and digital VLSI circuits through schematic design, layout generation, and post-layout simulations using industry-standard CAD tools. (K5)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

3. Develop integrated VLSI system designs by applying HDL coding, FPGA realization, CMOS layout techniques, and optimization methodologies for practical hardware applications. (K5)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	3	2	3	-	-	3	1	-	1	3	2
CO2	3	3	2	3	3	-	-	3	1	-	1	3	2
CO3	3	2	3	2	3	-	-	3	2	-	1	3	3

SEMESTER V

COURSE CODE: 24ECPL502	DISCRETE TIME SIGNAL PROCESSING LABORATORY	L	T	P	CP	C
		0	0	4	4	2
NPTEL CODE: -	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	-					

OBJECTIVES:

- To apply DFT/FFT techniques, convolution methods, and multirate signal processing operations for discrete-time signal analysis and processing.
- To apply IIR and FIR digital filter design techniques using standard approximation and windowing methods for DSP applications.
- To analyze finite word length effects, quantization errors, overflow characteristics, and DSP processor operations in digital signal processing systems

LIST OF EXPERIMENTS (MATLAB / EQUIVALENT)

1. Frequency analysis of signals using DFT and FFT
2. Linear and circular convolution
3. Design of Butterworth filters
4. Design of Chebyshev filters
5. Design digital IIR filters using Impulse Invariance Mapping and Bilinear Transformation methods

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

6. Design FIR filters - FOURIER Series method
7. Design FIR filters - window techniques
8. Study of quantization effects and noise analysis
9. Comparison of rounding and truncation errors
10. Simulation of overflow and scaling techniques
11. Decimation of signals
12. Interpolation of signals
13. Sampling rate conversion

LIST OF EXPERIMENTS (DSP PROCESSORS)

1. Study of DSP processor architecture using DSP Processors
2. Perform MAC operation using addressing modes using DSP Processors
3. Signal generation (square, triangular, sawtooth) using DSP Processors

TOTAL : 30 PERIODS

LAB REQUIREMENTS:

S.NO	EQUIPEMENTS	QUANTITY
1.	Desktop Computers (with MATLAB / equivalent software - Octave / Python (SciPy)	15
2.	DSP Trainer Kits / DSP Development Boards	10
3.	Digital Storage Oscilloscope (DSO)	5

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply DFT/FFT algorithms, convolution techniques, decimation, interpolation, and sampling rate conversion for discrete-time signal processing applications. (K3)
2. Apply IIR and FIR filter design methods using Butterworth, Chebyshev, Fourier series, and window techniques using MATLAB/equivalent tools. (K3)
3. Analyze finite word length effects, quantization noise, overflow characteristics, scaling techniques, and DSP processor operations in practical DSP systems. (K4)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	2	3	-	-	1	1	-	1	3	1
CO2	3	3	2	2	3	-	-	1	1	-	1	3	1
CO3	3	3	1	3	2	-	-	1	1	-	1	3	2

SEMESTER V

COURSE CODE: 24ECTP501	SKILL ENHANCEMENT	L	T	P	CP	C
		0	0	2	2	1
NPTEL CODE: -	SYLLABUS VERSION 1.1	SDG NO. 4, 9				
PRE-REQUISITE COURSES	-					

APTITUDE & COGNITIVE SKILLS – PHASE 1

OBJECTIVES:

- Educate and enrich students on quantitative ability, reasoning ability, and verbal ability.
- Build a strong foundation for solving recruitment-based problems with speed and accuracy.
- Enhance creative thinking skills.
- Enhance logical problem-solving skills.

MODULE - I QUANTITATIVE ABILITY **22**

Number Properties, Speed Math, HCF and LCM, Percentages, Time and Work, Time Speed and Distance, Ratio Proportion and Variations, Averages Mixtures and Alligation

MODULE - II QUANTITATIVE ABILITY REASONING ABILITY **16**

Profit and Loss, Simple Interest and Compound Interest, Blood Relation, Directions, Coding and Decoding, Series, Ranking and Arrangements

MODULE - III VERBAL ABILITY **7**

Subject-Verb Agreement, Tenses, Prepositions - Concepts, Error Spotting, Sentence Correction, Fill in the Blanks

TOTAL : 45 PERIODS

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

REFERENCES

1. Quantitative Aptitude for Competitive Examinations – R.S. Aggarwal
2. A Modern Approach to Logical Reasoning – R.S. Aggarwal
3. High School English Grammar & Composition – Wren & Martin
4. Word Power Made Easy – Norman Lewis.
5. Fast Track Objective Arithmetic – Rajesh Verma

BIS STANDARDS, RANGER AND ROVER, LIFE SKILLS – PHASE 2

OBJECTIVES

To enable students to,

- Familiarize the team and leadership skills.
- Understand the standards relevant to ECE.

MODULE - I JEEVAN KAUSHAL 2.0 - COGNITIVE SKILLS, INNOVATIVE LEADERSHIP AND DESIGN THINKING, ETHICS AND INTEGRITY **14**

Cognitive and Non-cognitive Skills - Cognitive Skills: Meaning, Types of Cognitive Skills, Strategies to Develop Cognitive Skills- Critical Thinking Skills- Problem-solving skills - Ability to Learn, Non-cognitive Skills: Meaning and Types of Non-cognitive Skills, Strategies to Develop Non-cognitive Skills- Empathy- Creativity- Teamwork- Collaboration- Resilience - Interpersonal Skills- Perseverance- Social Control- Social Skill, Peer Pressure – Stress and Stress Management.

Innovative Leadership and Design Thinking- Concept of emotional and social intelligence, Concept of emotional and social intelligence, Innovative Leadership- Synthesis of human and artificial intelligence, Why does culture matter for today's global leaders? Design Thinking- What is design thinking?, Key elements of design thinking, How to transform challenges into opportunities?, How to develop human-centric solutions for creating social good?

Ethics and Integrity - Learning through Biographies - What makes an individual great?, Understanding the persona of a leader for deriving holistic inspiration, Drawing insights for leadership, How leaders sail through difficult situations? Ethics and Conduct - Importance of ethics, Ethical decision making, Personal and professional moral codes of conduct, creating a harmonious life

MODULE - II RANGER AND ROVER **10**

Scouting for Boys: Camp Life, Trekking Wood Craft.

Community Service: Meaning, Types of Community Service & duration, difference between Community Service and Community Development.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

WOSM / WAGGGS / Govt. of India Initiatives (One Event At least) - Surf Smart, Free Being Me, Messengers of Peace, Scouts of the World Award

Messengers of Peace and Scouts

MODULE - III INTERNET OF THINGS AND ENVIRONMENTAL TESTING OF ELECTRONIC EQUIPMENT PROCEDURES 6

Internet of Things: Brainstorming about the standards pertaining to IoT & Digital Twins, including maritime and underwater IoT i.e; IS/ISO/IEC TR 22417:2017, IS/ISO/IEC 21823 series.

Environmental Testing of Electronics Equipment: Introduction to Standards pertaining to Environmental Test Procedures i.e. IS/IEC 60068 series, IS 9000, IS 9001 and IS 9002 series that are used extensively in the testing of all electronics products.

TOTAL :30 PERIODS

REFERENCES:

1. Curriculum and Guidelines for Life Skills (Jeevan Kaushal) 2.0, UGC, New Delhi.
2. A World Built on Standards: A Textbook for Higher Education, Published by: Danish Standards Foundation, 2015.
3. SO / IEC Guide 59, BIS Standards Formulation Manual, 2nd Revision, 2022.

ONLINE RESOURCES

1. https://lms.scout.org/courses/show/214209?force_course_hub=true
2. https://free-being-me.com/wp-content/media/ABC_OLDER-2.pdf
3. https://www.wagggs.org/en/what-we-do/surf-smart-20/surf-smart-get-involved/

OUTCOMES

Upon completion of this course, the students will be able to:

1. Demonstrate improved quantitative aptitude for solving numerical problems. [K2]
2. Apply logical reasoning to tackle reasoning-based challenges. [K2]
3. Enhance verbal communication and comprehension skills through grammar and language exercises. [K2]
4. Use ethical principles, emotional intelligence, and leadership insights from biographies to practice responsible decision-making and professional conduct. (K3)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

5. Illustrate the objectives and practices of WOSM/WAGGGS and Government of India initiatives such as Messengers of Peace, Surf Smart, and Scouts of the World Award. (K3)
6. Apply the concepts of IoT, Digital Twins, and related standards in identifying applications of connected systems in modern technologies. (K3)

CO - PO - PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	2	-	-	-	-	-	-	2	-	-
CO2	2	2	2	2	1	-	-	-	1	-	2	-	-
CO3	2	2	2	2	-	-	-	-	1	-	2	-	-
CO4	-	-	-	-	-	2	-	3	3	3	-	2	2
CO5	-	-	-	-	-	3	2	2	2	2	1	2	2
CO6	3	2	2	-	3	1	-	-	-	-	-	2	2

SEMESTER V

COURSE CODE: 24ECID501	PROTOTYPE DEVELOPMENT LABORATORY – I	L	T	P	CP	C
		0	0	0	4	1
NPTEL CODE: -	SYLLABUS VERSION 1.1	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24ESID101, 24ESID201, 24SCID301, 24SCID401					

OBJECTIVES:

- To enable students to transform innovative ideas into feasible prototype solutions through structured problem identification, design thinking, and concept development.
- To provide experiential learning in prototype design and development by focusing on user-centric requirements, iterative design, and technical validation.
- To develop proficiency in problem analysis, feasibility assessment, requirement engineering, and prototype implementation.
- To instill a foundation of innovation and entrepreneurship by integrating ethical design principles, sustainability values, and responsible technology development.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

- To enable data-driven solution development through literature survey, user feedback analysis, and technology exploration.
- To facilitate multidisciplinary problem-solving through engineering design, prototype realization, testing, validation, and technical communication.

COURSE METHODOLOGY

- This course is designed to develop innovation-oriented thinking and practical problem-solving abilities through prototype development activities focusing on real-world challenges.
- The project work shall involve the identification of a problem, requirement analysis, feasibility study, solution design, prototype development, testing, validation, and documentation. Students shall apply design thinking principles throughout the development cycle.
- Projects may be carried out individually or in groups with a maximum of three students. In the case of group projects, each student shall submit an individual project contribution report clearly specifying their role and responsibilities.
- Students shall maintain a detailed project portfolio containing problem statements, literature survey findings, design documents, prototype iterations, testing results, and validation reports.
- Periodic reviews shall be conducted to assess progress in prototype development, implementation, testing, and refinement. Students shall demonstrate prototype functionality during review evaluations.
- At the end of the semester, students shall submit a comprehensive project report and present a working prototype for evaluation by the course coordinator and project review committee.

EVALUATION

1. First Evaluation (Immediately after first internal examination): 20 Marks
   (Problem Identification and Validation, Literature Survey, Requirement Analysis, Initial Design Proposal)
2. Second Evaluation (Immediately after second internal examination): 30 Marks
   (Prototype Design Completion, Prototype Development Progress, Initial Testing and Validation Results)
3. Final Evaluation (Last week of the semester): 50 Marks
   (Functional Prototype Demonstration, Innovation and Creativity, Technical Implementation, Project Report, Viva-Voce)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

Note: All three evaluations are mandatory for course completion and for awarding the final grade.

TOTAL : 30 PERIODS

OUTCOMES:

At the end of this course, the students should be able to:

1. Analyze real-world problems, user requirements, and design constraints to formulate innovative prototype solutions using design thinking methodologies. (K4)
2. Evaluate alternative technologies, development approaches, and feasibility aspects for prototype design and implementation. (K5)
3. Create functional prototypes by integrating appropriate tools, technologies, and engineering principles to address identified problems. (K6)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	2	-	-	-	-	-	-	2	3
CO2	3	3	3	--	3	-	-	-	-	-	-	2	3
CO3	3	3	3	-	3	-	-	-	-	-	-	3	3

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24ECEL501	SIMULATION TECHNIQUES FOR COMMUNICATION	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 108103191	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24ECPC301, 24BSMA401, 24ECPC402					

OBJECTIVES:

- To understand the simulation technique for signal representation and noise characterization in communication systems.
- To encourage students to model and analyse analog and digital communication systems around them and to confidently program in MATLAB
- To develop programming models for simulating communication systems.
- Use the libraries on R programming for real time analysis.

MODULE - I FUNDAMENTALS OF SIGNAL SIMULATION 7

Review of signal classification and representation - concept of Time domain and frequency domain analysis - simulation Environment and Programming - Introduction to Arrays, Vectors, and Matrices- Loops, branches, and control-flow- Data Visualization and Plotting -Examples - Generation and analysis of continuous and discrete signals -Signal visualization in time and frequency domains

MODULE - II NOISE CHARACTERIZATION 7

Noise sources – Noise figure, noise temperature and noise bandwidth – Noise in cascaded - systems. Representation of Narrow band noise –In-phase and quadrature components, Envelope and Phase Components – Noise performance analysis in AM & FM systems - Simulation of AM and FM SNR.

MODULE - III RANDOM VARIABLES AND WIRELESS CHANNEL MODELING 8

Review of different distribution functions - Introduction to wireless channels - -Rayleigh Distribution -Rician Distribution - computation of channel matrices- Matrix Operations in Communication Systems - Evaluation of Eigen values and vectors- Simulating Random Variables and distributions - Simulation of fading channels.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Eng

MODULE - IV SPREAD SPECTRUM TECHNIQUES AND VISUALIZATION 7

Direct Sequence spread spectrum- Pseudo Random sequence generator- Frequency hopping spread spectrum - 2-D and 3-D Signal Visualization - Surface Plots for Channel Characteristics - Simulation of spectral analysis

MODULE - V ANALYSIS OF DIGITAL MODULATION TECHNIQUES 8

Review of Digital Modulation Techniques:-BPSK-QPSK-QAM-BER Analysis in AWGN Channels - Simulink-Based Wireless Communication Models - Performance Evaluation using Monte Carlo Simulations - Examples -BPSK over AWGN channel - QPSK over Rayleigh channel -Simulink model of a wireless link

MODULE - VI INTRODUCTION TO R-PROGRAMMING 8

R-Programming - Data types and Structures- Control Statements- Loops - Doing Math and Simulation in R - Correlation and Covariance - Probability density and Distribution functions - Normal Distribution - Binomial Distribution - Poisson Distributions, Graphics- Creating Graphs- The Workhorse of R Base Graphics- the plot ( ) Function - Customizing Graphs- Saving Graphs to Files.

TOTAL : 45 PERIODS

BOOKS AND REFERENCES:

1. Rudra Pratap. Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers. Oxford University Press, Inc., USA, 2009.
2. Proakis, J.G., Salehi, M., Bauch, G., Contemporary Communication Systems Using MATLAB, Third edition, Cengage Learning, 2012.
3. Sheldon M. Ross, Introduction to Probability Models, (Twelfth Edition), Academic Press, 2019.
4. TheArt of R Programming,Norman Matloff,CengageLearning.
5. Lander, "R for Everyone",Pearson

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply MATLAB to develop scripts/functions for signal representation and data visualization. (K3)
2. Analyze the noise characteristics of cascaded communication systems to determine overall system performance using MATLAB. (K4)
3. Analyze and compute channel matrices for wireless systems and interpret their impact on signal transmission and reception using simulation. (K4)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

4. Examine the spectrum of DSSS and FHSS using simulation. (K4)
5. Examine and compare the Error performance of various modulation schemes over AWGN channels using analytical and simulation approaches. (K4)
6. Illustrate the data visualization tools and functions in R programming. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	-	-	1	2	1
CO2	3	3	-	-	3	-	-	-	-	-	1	2	2
CO3	3	2	-	-	3	-	-	-	-	-	1	3	1
CO4	3	3	-	-	3	-	-	-	-	-	1	2	2
CO5	3	2	-	-	3	-	-	-	-	-	2	2	2
CO6	3	-	-	-	3	-	-	-	-	-	2	3	3

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24ECEL502	DIGITAL COMMUNICATION TECHNIQUES	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 117105144	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24ECPC402					

OBJECTIVES:

- To understand the basics of signal-space analysis and digital transmission.
- To understand the coherent and noncoherent receivers, equalizers and its impact on different channel characteristics.
- To understand the different block coded and convolutional coded digital communication systems.
- To understand the basics of Multicarrier, Multiuser Communications. and synchronization Techniques

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 25.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - I COHERENT AND NON-COHERENT COMMUNICATION 8

Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation – Noncoherent receivers in random phase channels; MFSK receivers – Rayleigh and Rician - channels – Partially coherent receivers – DPSK -BER Performance analysis.

MODULE - II CODING FOR DIGITAL COMMUNICATION - I 7

Binary block codes, Shannon's channel coding theorem. Channel capacity – Linear block codes, Cyclic codes, Syndrome calculation – Convolution Coding.

MODULE - III CODING FOR DIGITAL COMMUNICATION - II 7

Hamming Codes, Golay, BCH Reed – Solomon codes, Trellis diagram, Viterbi algorithm, Turbo Coding.

MODULE - IV MULTICARRIER COMMUNICATIONS 8

Single Vs multicarrier modulation, orthogonal frequency division multiplexing (OFDM), Modulation and demodulation in an OFDM system, An FFT algorithmic implementation of an OFDM system, Bit and power allocation in multicarrier modulation, Peak-to-average ratio in multicarrier modulation.

MODULE - V MULTIPLE ACCESS COMMUNICATION SYSTEM AND ARCHITECTURE 8

Multiple Access design flow-Demand Assignment Multiple Access- Access Algorithms – Multiple access Techniques with INTELSAT and LAN.

MODULE - VI SYNCHRONIZATION TECHNIQUES 7

Synchronization in context of digital communication- signal parameter estimation-Carrier Phase Estimation-Symbol Timing Estimation-Joint Estimation of Carrier Phase and symbol Timing-Frame synchronization and Network synchronization.

TOTAL : 45 PERIODS

TEXT BOOK

1. Bernard Sklar, "Digital Communications", second edition, Pearson Education, 2001.
2. Proakis, J. G., & Salehi, M. (2008). Digital communications (5th ed.). McGraw-Hill.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

REFERENCES:

1. M.K.Simon, S.M.Hinedi and W.C.Lindsey, "Digital communication techniques; Signal Design and Detection", Prentice Hall of India, New Delhi, 1995.
2. Richard Van Nee & Ramjee Prasad, "OFDM for Multimedia Communications" Artech House Publication, 2001.
3. Simon Haykin, "Digital communications", John Wiley and sons, 1998.
4. Stephen G. Wilson, "Digital Modulation and Coding", First Indian Reprint, Pearson Education, 2003.
5. Theodore S.Rappaport, 'Wireless Communications", 2nd edition, Pearson Education, 2002.

WEB REFERENCES

1. https://nptel.ac.in/courses/117105144
2. https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_ee58

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply the principles of coherent and noncoherent receivers in digital communication systems. (K3)
2. Analyze the process of syndrome calculation for identifying and correcting transmission errors in coded data. (K4)
3. Examine the structure and working principles of Trellis diagrams, Viterbi coding used in convolution coding techniques. (K4)
4. Examine the principle and operation of Orthogonal Frequency Division Multiplexing (OFDM) for high data rate transmission. (K4)
5. Differentiate various access algorithms based on their channel allocation and performance characteristics. (K4)
6. Examine various signal parameter estimation techniques used in digital communication receivers. (K4)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	3
CO2	3	3	-	-	-	-	-	-	-	-	–	2	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	2	2
CO5	3	2	-	-	-	-	-	-	-	-	-	2	2
CO6	3	3	-	-	-	-	-	-	-	-	-	3	2

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24ECEL503	STATISTICAL THEORY OF COMMUNICATION	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 117105085	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24BSMA301, 24ECPC301					

OBJECTIVES:

- To introduce the fundamental concepts of random processes and noise in communication systems.
- To impart knowledge on generalized harmonic analysis, specifically correlation and power density spectrums.
- To familiarize students with the statistical properties of random variables and ensembles.
- To provide an understanding and design of optimum linear system design for filtering and prediction.

MODULE - I GENERALIZED HARMONIC ANALYSIS **8**

Periodic and Aperiodic Functions: Exponential form of Fourier Series, Fourier Transforms - Correlation and Autocorrelation of periodic and transient functions - Crosscorrelation - Convolution and Correlation relations - Introduction to Random Functions and the Wiener Theorem for Autocorrelation.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - II PROBABILITY AND RANDOM VARIABLES 8

Basic Probability: Outcomes, Measure of Probability, Total and Compound Probability - Random Variables: Discrete and Continuous variables, Probability Densities, and Ensembles - Stationary Ensembles: Description at one and two points in time - Statistically dependent ensembles.

MODULE - III AVERAGES AND DISTRIBUTIONS 8

Statistical Averages: Moments, Variance, and Characteristic Functions - Joint Averages of multiple random variables - Common Distributions: Poisson Distribution and the Normal (Gaussian) Density - Transformation of probability densities - Equivalence of Time and Ensemble Averages (Ergodic Hypothesis).

MODULE - IV RANDOM PROCESSES AND POWER SPECTRUMS 7

Analytical determination of Correlation functions - Power Density Spectrums - Autocorrelation of rectangular waves and pulse-width modulated waves - Detection of periodic signals in noise by autocorrelation and crosscorrelation - Measurement of correlation functions and probability densities.

MODULE - V LINEAR SYSTEMS WITH RANDOM INPUTS 7

Instantaneous Input-Output relations - Unit-Impulse Response and System Function relations - Input-Output relations in Autocorrelation and Power Spectrum - Determination of linear system behavior by crosscorrelation - Sampling Theory: Variance of sample mean for discrete and continuous samples.

MODULE - VI OPTIMUM LINEAR SYSTEMS 8

The Filter Problem and the Mean-Square-Error Criterion - Minimization of the functional and the Wiener-Hopf Equation - Spectrum Factorization - Optimum Filtering and Prediction: Zero-lag filters and pure predictors - Errors in optimum systems and Irremovable Error.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Y. W. Lee, "Statistical Theory of Communication", John Wiley & Sons, Inc., 1960.
2. Lathi, B. P. (1968). Statistical theory of communication. John Wiley & Sons.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

REFERENCE BOOKS

1. N. Wiener, "The Extrapolation, Interpolation, and Smoothing of Stationary Time Series", John Wiley and Sons, 1949.
2. A. Papoulis, "Probability, Random Variables, and Stochastic Processes", McGraw-Hill.

WEB REFERENCES:

1. https://www.itsoc.org/resources/classic-papers
2. https://ocw.mit.edu/courses/6-041sc-probabilistic-systems-analysis-and-applied-probability-fall-2013/
3. https://mathworld.wolfram.com/Autocorrelation.html

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc23_ee102/preview
2. https://www.coursera.org/specializations/digital-communications
3. https://ocw.mit.edu/courses/6-450-principles-of-digital-communication-i-fall-2006

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply generalized harmonic analysis to characterize periodic and random signals. (K3)
2. Examine and differentiate between discrete and continuous random variables, and analyze their probability distributions and density functions. (K3)
3. Evaluate the power density spectrum and correlation properties of random processes. (K4)
4. Examine the response of linear systems to random signals using input-output theorems. (K4)
5. Analyze the impact of noise and statistical dependencies on communication systems. (K4)
6. Examine the optimum linear filters and predictors based on the mean-square-error criterion. (K4)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	1	2
CO2	3	-	-	-	-	-	-	-	-	-	-	1	2
CO3	3	3	-	-	-	-	-	-	-	-	-	1	2
CO4	3	3	-	-	-	-	-	-	-	-	-	1	2
CO5	3	3	-	-	-	-	-	-	-	-	-	1	2
CO6	3	3	-	-	-	-	-	-	-	-	-	1	3

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24ECEL504	INTRODUCTION TO VLSI LIFECYCLE	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 108106191	SYLLABUS VERSION 1.0	SDG NO. 4				
PRE-REQUISITE COURSES	24ECPC303, 24ECPC304					

OBJECTIVES:

- To understand the complete RTL-to-GDSII VLSI design flow and the role of EDA tools in ASIC design.
- To develop and simulate digital circuits using Verilog HDL and perform RTL synthesis.
- To analyze and apply optimization techniques to improve area, timing, and functionality of digital designs.
- To evaluate timing and power characteristics of VLSI circuits using Static Timing Analysis (STA) and power analysis methodologies.
- To understand physical design processes including floorplanning, placement, clock tree synthesis, routing, and signoff verification.

MODULE - I INTRODUCTION TO VLSI DESIGN FLOW 7

Basic concepts of IC's- VLSI Design flow overview-pre RTL methodologies-RTL to GDS flow-Introduction to Tool command language (TCL)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - II VERILOG HDL AND RTL SYNTHESIS 7

Verilog HDL and RTL Synthesis Verilog basics - Verilog Functional verification using simulation: testbench, coverage Verilog Constructs to Hardware Logic Optimization: Definitions, Two-level logic optimization

MODULE - III OPTIMIZATION 8

Logic optimization- Multilevel Logic optimization- sequential Logic optimization- Formal verification- Techniques- Libraries

MODULE - IV STATIC TIMING ANALYSIS 8

Basics and Mechanics of STA- Advanced concepts- constraints- slew propagation - Accounting for variations- Technology mapping

MODULE - V POWER ANALYSIS 8

Components of power dissipation- Estimation of power dissipation- overview of power driven optimization

MODULE - VI CHIP LAYOUT 7

Planning- Placement Basics- Clock tree synthesis- routing- post layout verification and signoff.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Sneh Saurabh, "Introduction to VLSI Design Flow", Cambridge University Press, 2023
2. M.J.S. Smith, "Application-specific integrated circuits", Addison-Wesley, 1997
3. L. Lavagno, I. L. Markov, G. Martin, and L. K. Scheffer (Editors), "Electronic Design Automation for IC Implementation, Circuit Design, and Process Technology", CRC Press, 2016
4. S. Palnitkar, "Verilog HDL: a guide to digital design and synthesis", Pearson Education India, 2003
5. J. Bhasker and R. Chadha, "Static timing analysis for nanometer designs: A practical approach", Springer Science Business Media, 2009

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

REFERENCES:

1. G. D. Micheli, "Synthesis and optimization of digital circuits", McGraw-Hill Higher Education, 1994
2. M. Bushnell and V. Agrawal, "Essentials of electronic testing for digital, memory and mixed-signal VLSI circuits", Springer Science & Business Media, 2004

ONLINE RESOURCES:

1. https://semiconductorclub.com/courses/digital-vlsi-design-rtl-to-gds/
2. https://siliconpath.in/

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply the RTL-to-GDSII design flow, VLSI design methodologies, and TCL commands in ASIC design environments. (K3)
2. Design and simulate digital circuits using Verilog HDL and validate their functionality through testbenches. (K3)
3. Analyze and optimize digital circuits using combinational and sequential optimization techniques and perform formal verification. (K4)
4. Analyze timing characteristics of digital designs using Static Timing Analysis (STA), timing constraints, and technology mapping techniques. (K4)
5. Estimate and evaluate power dissipation in VLSI circuits and understand power-driven optimization techniques. (K4)
6. Perform physical design tasks including floorplanning, placement, clock tree synthesis, routing, and post-layout verification. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	1	3	2
CO2	3	2	-	-	-	-	-	-	-	-	1	3	2
CO3	3	3	-	-	-	-	-	-	-	-	1	3	2
CO4	3	3	-	-	-	-	-	-	-	-	1	3	2
CO5	3	3	-	-	-	-	-	-	-	-	1	3	2
CO6	3	3	-	-	-	-	-	-	-	-	1	3	2

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2025

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24ECEL505	EMBEDDED SYSTEM DESIGN	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 108102169	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24ECPC303					

OBJECTIVES:

- To understand the basics of embedded systems, architecture, and modular design.
- To understand microcontroller-based system design concepts for embedded systems.
- To develop programming skills using Embedded C and work with the MSP430 microcontroller.
- To implement interfacing techniques for input/output devices and peripherals.
- To apply timers, interrupts, and communication protocols in embedded systems.
- To design and develop embedded system projects using FSM/FSMD and lifecycle concepts.

MODULE - I INTRODUCTION TO EMBEDDED SYSTEMS 7

Computer systems terminology-Embedded system design: Modular approach-Embedded system architecture fundamentals-Six-Box Model:Input devices,Output devices,Embedded computer.Communication block,Host and storage elements,Power supply.

MODULE - II MICROCONTROLLER SYSTEM DESIGN 8

Microcontroller architecture overview-Features of modern microcontrollers-Microcontroller ecosystem and significance-Power supply design for embedded systems-Linear regulator topologies-Switching power supply topologies-Design considerations for power systems.

MODULE - III MSP430 ARCHITECTURE AND PROGRAMMING 8

Introduction to MSP430 microcontroller-MSP430 CPU Architecture-Programming methods for MSP430-Development tools and IDE usage-

LaunchPad (Lunchbox) platform overview-Embedded C basics-Version control basics-Introduction to Git version control-Code Composer Studio (CCS) environment.

MODULE - IV PERIPHERAL INTERFACING TECHNIQUES 7

Fundamentals of physical interfacing-Digital I/O programming with MSP430-Interfacing LEDs and switches-keyboard-Output devices: LEDs, seven-segment displays (SSD)

MODULE - V TIMERS, INTERRUPTS, AND COMMUNICATION PROTOCOLS 8

Real-time embedded concepts-MSP430 clock and reset system-Clock sources and distribution-Reset handling-Interrupt handling in MSP430-Timer module and modes of operation-PWM generation-ADC operation and analog interfacing-DAC interfacing and waveform generation-Frequency and time measurement-Serial communication protocols: UART, SPI, I2C.

MODULE - VI SYSTEM DESIGN & PROJECT DEVELOPMENT 7

Interfacing displays(LCD)-Random number generation-Circuit prototyping techniques-System modeling using FSM-Finite State Machine with Datapath (FSMD) design approach-Embedded project development methodology-MSP430-based project design and implementation.

TOTAL : 45 PERIODS

TEXTBOOKS:

1. Designing Embedded Hardware, John Catsoulis. 2nd edition. Shroff Publishers and Distributors. ISBN-10: 9788184042597
2. Embedded System Design: A Unified Hardware / Software Introduction. Tony Givargis and Frank Vahid. Wiley. ISBN-10: 812650837X
3. MSP430 Microcontroller Basics. John H. Davies. Elsevier. ISBN-10: 9789380501857.
4. Rajkamal, 'Embedded system-Architecture, Programming, Design', TMH, 2011.

REFERENCES:

1. Bruce Powell Douglass,"Real-Time UML Workshop for Embedded Systems, Elsevier,2011
2. Peckol, "Embedded system Design", JohnWiley & Sons, 2010

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

3. Tammy Noergaard, "Embedded System Architecture, A comprehensive Guide for Engineers and Programmers", Elsevier, 2006
4. Jonathan W.Valvano,"Embedded Microcomputer Systems ,Real Time Interfacing", Cengage Learning,3rd edition,2012

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/108103378
2. https://nptel.ac.in/courses/106106210
3. https://www.classcentral.com/course/swayam-embedded-systemsdesign-7943
5. https://nptel.ac.in/courses/108102169

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply the fundamentals of embedded systems, system architecture, and modular design approaches including the Six-Box model.(K3)
2. Apply knowledge of microcontroller architecture, ecosystem, and power supply design techniques to develop energy-efficient embedded systems.(K3)
3. Develop embedded programs using Embedded C and modern development tools, and implement basic interfacing using the MSP430 microcontroller.(K3)
4. Analyze and implement interfacing techniques for various input/output devices.(K4)
5. Analyze and apply real-time concepts, timers, interrupts, and communication protocols (UART, SPI, I2C) in embedded system applications.(K4)
6. Analyze embedded systems for real-world applications using FSM/FSMD models and product lifecycle concepts. (K4)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	1	3	3
CO2	3	2	2	-	-	-	1	-	-	-	1	3	3
CO3	3	2	2	1	2	-	-	-	-	-	1	3	3
CO4	3	2	2	2	2	-	-	-	-	-	1	3	3
CO5	3	2	2	2	2	-	-	-	-	-	1	2	3
CO6	3	3	2	2	2	1	1	-	2	1	1	3	3

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24ECEL506	SEMICONDUCTOR DEVICE MODELLING	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: -	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24BSPH201, 24ECPC303					

OBJECTIVES:

- To provide a strong foundation in semiconductor physics, including energy band theory, carrier transport mechanisms, and recombination processes.
- To understand the operation and modelling of PN junction devices, including current–voltage behavior, capacitance effects, and breakdown mechanisms.
- To analyze the structure and characteristics of Bipolar Junction Transistors (BJT) using various large-signal and small-signal models.
- To study MOSFET device physics and modeling, including threshold voltage, I–V characteristics, and short-channel effects in modern devices.
- To explore advanced semiconductor device modeling concepts such as scaling effects, noise, and compact models used in modern VLSI design.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - I FUNDAMENTALS OF SEMICONDUCTOR PHYSICS 7

Energy bands in solids-Intrinsic and extrinsic semiconductors-Carrier concentration and Fermi level-Carrier transport: drift and diffusion-Generation and recombination mechanisms-Continuity equations

MODULE - II PN JUNCTION MODELLING 8

PN junction theory and operation-Built-in potential and depletion region-Current-voltage characteristics-Junction capacitances (transition and diffusion)-Small-signal modelling of diodes-Breakdown mechanisms (Zener and avalanche).

MODULE - III BJT MODELLING 7

Structure and operation of BJT-Ebers-Moll model-Gummel-Poon model-DC and AC characteristics-Charge control model-High-frequency effects in BJT.

MODULE - IV MOSFET MODELLING 8

MOS capacitor fundamentals-Threshold voltage modelling-I–V characteristics of MOSFET-Channel length modulation-Mobility degradation and velocity saturation-Short-channel effects-Small-signal model of MOSFET

MODULE - V ADVANCED DEVICE MODELLING 7

Scaling of MOS devices-Subthreshold conduction-Hot carrier effects-Drain-induced barrier lowering (DIBL)-Noise modelling (thermal and flicker noise)-Compact models (BSIM basics)-Introduction to TCAD tools

MODULE - VI NUMERICAL AND SIMULATION TECHNIQUES 8

Poisson's equation and carrier transport equations-Finite difference method-Device simulation basics-Introduction to SPICE modelling-Parameter extraction techniques

TOTAL : 45 PERIODS

TEXT BOOKS

1. Simon M. Sze and Kwok K. Ng, "Physics of Semiconductor Devices", Third Edition, Wiley, 2007.
2. Yannis Tsividis, "Operation and Modeling of the MOS Transistor", Third Edition, Oxford University Press, 2011.
3. Robert F. Pierret, "Semiconductor Device Fundamentals", First Edition, Pearson, 1996.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

REFERENCES:

1. Yuan Taur and Tak H. Ning, "Fundamentals of Modern VLSI Devices", Second Edition, Cambridge University Press, 2009.
2. Ben G. Streetman and Sanjay Banerjee, "Solid State Electronic Devices", Seventh Edition, Pearson, 2015.
3. Paul R. Gray and Robert G. Meyer, "Analysis and Design of Analog Integrated Circuits", Fifth Edition, Wiley, 2009.

WEB REFERENCES:

1. https://www.sciencedirect.com/science/article/pii/S2667325824000323
2. https://iopscience.iop.org/article/10.1088/0034-4885/48/2/002

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc23_ee35/preview
2. https://www.keysight.com/blogs/en/tech/educ/2024/device-modeling

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply the fundamental concepts of semiconductor physics, including carrier transport mechanisms and recombination processes in device modelling.(K3)
2. Apply PN junction theory to analyze current–voltage characteristics and capacitance effects in semiconductor diodes. (K3)
3. Analyze the operation of BJTs using Ebers-Moll and Gummel-Poon models for DC and AC conditions. (K3)
4. Analyze MOSFET characteristics considering threshold voltage, short-channel effects, and small-signal models. (K4)
5. Analyze the impact of advanced effects such as scaling, noise, and compact modelling techniques in modern semiconductor device (K4)
6. Apply numerical models using simulation tools (SPICE/TCAD) for semiconductor device analysis. (K3)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	–	–	–	–	–	–	–	–	2	2	2
CO2	3	-	1	–	-	–	–	–	–	–	2	2	2
CO3	3	-	2	–	-	–	–	–	–	–	2	2	2
CO4	3	3	2	–	-	–	–	–	–	–	2	2	2
CO5	3	3	2	–	-	-	-	–	–	–	2	2	2
CO6	3	-	2	–	-	-	-	–	-	-	2	2	2

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24ECEL507	INTRODUCTION TO PHOTONICS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 108106135	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24ECPC302, 24ECPC303					

OBJECTIVES:

- To understand the fundamentals of light and optical wave propagation.
- To study optical components and photonic devices.
- To analyze light–matter interaction and optical properties of materials.
- To explore fiber optics and optical communication basics.
- To understand modern applications of photonics in technology.

MODULE - I FUNDAMENTALS OF LIGHT AND OPTICS 8

Nature of light – Wave-particle duality – Electromagnetic spectrum – Maxwell's equations – Plane waves – Reflection and refraction – Snell's law – Total internal reflection – Interference and diffraction – Polarization of light.

MODULE - II LIGHT–MATTER INTERACTION 7

Absorption, emission, and scattering – Spontaneous and stimulated emission – Einstein coefficients – Optical properties of materials – Refractive index – Dispersion – Nonlinear optics basics – Optical gain and loss.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - III LASERS AND OPTICAL SOURCES 7

Principles of lasers – Population inversion – Optical resonators – Laser modes – Types of lasers (solid-state, semiconductor, fiber lasers) – LED and laser diodes – Characteristics of optical sources.

MODULE - IV OPTICAL FIBERS AND WAVEGUIDES 8

Optical fiber structure – Step index and graded index fibers – Light propagation in fibers – Numerical aperture – Modes in optical fibers – Losses and dispersion – Optical waveguides – Fiber fabrication techniques.

MODULE - V PHOTONIC DEVICES AND SYSTEMS 8

Photodetectors (PIN, APD) – Modulators – Optical amplifiers – Couplers and splitters – Integrated photonics – Basics of optical communication systems – Signal transmission and noise.

MODULE - VI APPLICATIONS OF PHOTONICS 7

Optical communication systems – Fiber optic sensors – Biomedical optics – Imaging systems – Photonics in computing – Laser applications in industry and medicine – Emerging trends (quantum photonics, silicon photonics).

TOTAL : 45 PERIODS

TEXTBOOKS

1. B. E. A. Saleh and M. C. Teich, "Fundamentals of Photonics", Wiley.
2. S. O. Kasap, "Optoelectronics and Photonics", Pearson.

REFERENCES

1. Lasers – University Science Books
2. Semiconductor Optoelectronic Devices – Prentice Hall
3. Introduction to Fiber Optics – Cambridge

WEB REFERENCES

1. https://avantierinc.com/resources/knowledge-center/understanding-light-and-optics/
2. https://www.nmlaser.com/different-types-of-laser-in-optical-communication/

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

ONLINE COURSES

1. https://onlinecourses.nptel.ac.in/noc21_ee87/preview

OUTCOMES:

At the end of this course, the students should be able to:

1. Explain the fundamental principles of light and optical propagation. (K2)
2. Describe light–matter interaction mechanisms. (K2)
3. Apply the concepts of laser systems and optical sources. (K3)
4. Apply the principles of optical fibers and waveguiding structures. (K3)
5. Apply photonic devices in communication systems. (K3)
6. Explain modern photonics applications and emerging technologies. (K2)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	1	-	2	3	2
CO2	3	3	1	-	-	-	-	-	1	-	2	3	2
CO3	3	3	1	-	1	-	-	2	1	-	2	3	2
CO4	3	3	1	1	1	-	-	2	1	-	2	3	2
CO5	3	3	1	1	1	-	-	2	1	-	2	3	2
CO6	3	3	1	1	1	-	-	2	1	-	2	3	2

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24ECEL502	REMOTE SENSING ESSENTIALS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 105107201	SYLLABUS VERSION 1.0	SDG NO. 4				
PRE-REQUISITE COURSES	24ECPC301, 24ECPC402					

OBJECTIVES:

- To provide fundamental knowledge of remote sensing principles and electromagnetic radiation.
- To understand radiometric concepts and interaction of EMR with terrain features.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

- To study radiance–reflectance relationships and correction techniques in remote sensing
- To introduce image acquisition processes, sensor systems, and resolution concepts
- To develop understanding of spectral analysis, spectral indices, and thermal remote sensing

MODULE - I FUNDAMENTALS OF REMOTE SENSING AND EMR 8

Remote Sensing: definition, system, advantages, role of medium - Electromagnetic Radiation (EMR): spectrum, sub-classification, sources, generation - EMR properties: polarization, coherent radiation - Radiation laws: Planck's Law, Stefan–Boltzmann Law, Wien's Displacement Law - Blackbody Radiation: spectrum, Sun–Earth curves, units & constants -EMR interaction: propagation, absorption, attenuation - Atmospheric scattering: Rayleigh, Mie, Non-selective

MODULE - II RADIOMETRY AND INTERACTION WITH TERRAIN FEATURES 8

Fundamentals of radiometry and its importance - Radiometric quantities: radiant energy, flux, radiance, irradiance, reflectance - Units and measurement of radiometric quantities - Spectral reflectance and spectral signatures - Interaction of EMR with terrain features: Vegetation, Soil, Water bodies - Factors affecting reflectance characteristics

MODULE - III REMOTE SENSING IN VISIBLE AND INFRARED REGIONS 7

Characteristics of visible and infrared regions in remote sensing - Radiance and reflectance concepts - Conversion of radiance to surface reflectance - Atmospheric effects on EMR (scattering and absorption) - Atmospheric correction techniques (conceptual overview) - Topographic effects on reflectance - Topographic correction methods (basic concepts)

MODULE - IV IMAGE ACQUISITION AND SENSOR SYSTEMS 8

Principles of remote sensing image acquisition - Platforms: ground-based, airborne, satellite - Types of sensors:Optical sensors,Thermal sensors and Microwave sensor - Sensor characteristics: field of view, swath, revisit time - Resolution concepts:Spatial resolution, Spectral resolution, Radiometric resolution, Temporal resolution - Trade-offs among different resolutions

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - V SPECTRAL CHARACTERISTICS AND ANALYSIS 7

Detailed study of resolution concepts - Spectral reflectance curves and their interpretation - Spectral signatures of vegetation, soil, and water - Factors influencing spectral reflectance - Introduction to spectral indices - Concept and significance of vegetation indices

MODULE - VI SPECTRAL INDICES AND THERMAL REMOTE SENSING 7

Advanced spectral reflectance analysis - Principles of thermal infrared remote sensing - Thermal radiation and heat energy -Emissivity and land surface temperature - Thermal properties of Earth surface materials - Applications of thermal remote sensing in environmental studies

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Rees, W. G. (2012), Physical Principles of Remote Sensing, Third Edition, Cambridge University Press
2. Joseph, G. and Jeganathan, C. (2018), Fundamentals of Remote Sensing, Third Edition, Universities Press

REFERENCE BOOKS:

1. Jensen, J. R. (2007), Remote sensing of the environment: An earth resource perspective, Second edition, Pearson
2. Lillesand, T. M., Kiefer, R. W. and Chipman, J. W. (2008), Remote sensing and image interpretation, Sixth or Seventh edition, Wiley

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc25_ce86/preview

OUTCOMES:

At the end of this course, the students should be able to:

1. Summarize the fundamentals of remote sensing and EMR and use basic radiation laws including Planck's Law in analysis (K2)
2. Outline radiometric principles and EMR interaction with terrain and demonstrate reflectance-based interpretation of features. (K2)
3. Implement radiance–reflectance relationships and correction methods including atmospheric and topographic corrections (K3)
4. Interpret image acquisition processes and sensor characteristics and utilize resolution concepts in data evaluation. (K2)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

5. Execute spectral analysis based on classification of spectral reflectance behavior of surfaces. (K3)
6. Employ spectral indices and thermal remote sensing principles for environmental assessment (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	3	3
CO2	3	3	1	-	-	-	-	-	-	-	-	3	3
CO3	3	3	1	-	-	-	-	-	-	-	-	3	3
CO4	3	3	1	-	-	-	-	-	-	-	-	3	3
CO5	3	3	1	-	-	-	-	-	-	-	-	3	3
CO6	3	3	1	-	-	-	-	-	-	-	-	3	3

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24ECEL509	INTRODUCTION TO RELIABILITY ENGINEERING	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 127105234	SYLLABUS VERSION 1.0	SDG NO. 4, 9, 12, 15				
PRE-REQUISITE COURSES	24BSPH201, 24ECPC303					

OBJECTIVES:

- To understand the fundamental concepts of reliability, quality assurance, failure analysis, and reliability prediction methods for electronic systems.
- To analyze qualification testing, maintainability concepts, and failure mechanisms of electronic components and assemblies.
- To apply reliability and maintainability design guidelines for hardware and software systems.
- To evaluate reliability and availability characteristics of repairable and redundant systems using analytical methods.
- To interpret statistical quality control techniques, reliability testing methods, and accelerated testing procedures.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - I FUNDAMENTALS OF RELIABILITY AND RELIABILITY ANALYSIS DURING THE DESIGN PHASE **7**

Definition of reliability, quality, failure, failure rate, availability, maintenance, maintainability, Logistic support, Safety, Risk and risk acceptance, Reliability Vs quality, Failure concept, types of failures, Cost and system effectiveness, Product liability, Quality and Reliability assurance tasks, basic Quality and Reliability Assurance Rules, Elements of a Quality Assurance System, Predicted Reliability of Equipment and Systems with Simple Structure - Required Function, Reliability Block Diagram, Operating Conditions at Component Level. Stress Factors, Failure Rate of Electronic Components, Reliability of One-Item Structure, Reliability of Series-Parallel Structures, Part Count Method.

MODULE - II QUALIFICATION TESTS FOR COMPONENTS AND ASSEMBLIES AND MAINTAINABILITY ANALYSIS **7**

Basic Selection Criteria for Electronic Components- Environment , Performance Parameters , Technology, Manufacturing Quality, Long-Term Behavior of Performance Parameters; Qualification Tests for Complex Electronic Components - Electrical Test of Complex ICs, Characterization of Complex ICs, Environmental and Special Tests of Complex ICs, Reliability Tests: Failure Modes, Failure Mechanisms, and Failure Analysis of Electronic Components - Failure Modes of Electronic Components, Failure Mechanisms of Electronic Components, Failure Analysis of Electronic Components, Examples of VLSI Production-Related Reliability Problems, Qualification Tests for Electronic, Maintainability Analysis - Maintenance and Maintainability, Maintenance Concept - Fault Recognition and Isolation, Equipment and System Partitioning, Logistic Support, Predicted Maintainability- Calculation of MTTRs, Calculations of MTTPMS

MODULE - III DESIGN GUIDELINES FOR RELIABILITY, MAINTAINABILITY, AND SOFTWARE QUALITY **6**

Design Guidelines for Reliability - Derating, Cooling, Moisture, Electromagnetic Compatibility. ESD Protection, Components and Assemblies; Design Guidelines for Maintainability - General Guidelines, Testability, Accessibility, Exchangeability, Operation, Adjustment; Design Guidelines for Software Quality - Guidelines for Software Defect Prevention, Configuration Management, Guidelines for Software Testing, Software Quality Growth Models.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - IV RELIABILITY AND AVAILABILITY OF REPAIRABLE SYSTEM **9**

Introduction and General Assumptions, One-Item Structure - One-Item Structure New at Time t = 0, Reliability Function, Point Availability, Average Availability, Special Kinds of Availability; One-Item Structure, Asymptotic Behavior, Steady-State Behavior; Systems without Redundancy - Series Structure with Constant Failure and Repair Rates, Series Structure with Constant Failure and Arbitrary Repair Rates, Series Structure with Arbitrary Failure and Repair Rates, out-of-2 Redundancy, 1out-of-2 Redundancy with Constant Failure and Repair, 1-out-of-2 Redundancy with Constant Failure and Arbitrary Repair Rates, 1-out-of-2 Redundancy with Constant Failure Rate in Reserve State and Arbitrary Repair Rates: Simple Series - Parallel Structures.

MODULE - V STATISTICAL QUALITY CONTROL AND RELIABILITY TESTS **9**

Statistical Quality Control - Estimation of a Defective Probability p, Simple Two-sided Sampling Plans for Demonstration of a Def . Probability p, One-sided Sampling Plans for the Demonstration of a Def . Probability p; Statistical Reliability Tests - Reliability & Availability Estimation & Demon . for the case of a given Mission, Availability Estimation &Demonstration for Continuous Operation (steady-state); Estimation and Demonstration of a Constant Failure Rate , Statistical Maintainability Tests - Estimation of an MTTR, Demonstration of an MTTR; Accelerated Testing: Goodness-of-fit Tests - Kolmogorov-Smirnov Test, Chi-square Test; Statistical Analysis of General Reliability Data - General considerations, Tests for Nonhomogeneous Poisson Processes, Trend Tests; Reliability Growth.

MODULE - VI QUALITY & RELIABILITY ASSURANCE DURING THE PRODUCTION PHASE (BASIC CONSIDERATIONS) **7**

Basic Activities; Testing and Screening of Electronic Components- Testing of Electronic Components, Screening of Electronic Components; Testing and Screening of Electronic Assemblies; Test and Screening Strategies, Economic Aspects - Basic Considerations, Quality Cost Optimization at Incoming Inspection Level, Procedure to handle first deliveries.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Elsayed A. Elsayed, Reliability Engineering, 2nd Edition, Wiley, 2012.L. S. Srinath, Reliability Engineering, Affiliated East-West Press, 2011.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engg

2. Klaus Blischke and D. N. Prabhakar Murthy, Reliability for Technology, Engineering and Management, CRC Press, 2003.

REFERENCE BOOKS

1. Charles E. Ebeling, An Introduction to Reliability and Maintainability Engineering, 2nd Edition, Waveland Press, 2010.
2. Patrick D. T. O'Connor and Andre Kleyner, Practical Reliability Engineering, 5th Edition, Wiley, 2012.
3. David J. Smith and Kenneth G. L. Simpson, Reliability, Maintainability and Risk, 8th Edition, Butterworth-Heinemann, 2011.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/127105234
2. https://resourcecenter.rs.ieee.org/education/tutorials"

OUTCOMES:

At the end of this course, the students should be able to:

1. Analyze the concepts of reliability, quality assurance, failure mechanisms, and reliability prediction methods for electronic systems. (K4)
2. Evaluate qualification testing procedures, maintainability measures, and failure analysis techniques for electronic components and assemblies. (K4)
3. Apply reliability and maintainability design guidelines to enhance the performance of hardware and software systems. (K3)
4. Analyze the reliability and availability characteristics of repairable and redundant systems using mathematical models. (K4)
5. Apply statistical quality control methods, reliability testing procedures, and accelerated testing techniques for system assessment. (K3)
6. Analyze quality and reliability assurance practices adopted during the production phase of electronic components and assemblies. (K4)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	-	1	-	-	-	-	-	-	1	2	1
CO2	3	3	-	1	-	-	-	-	-	-	1	2	1
CO3	3	2	3	1	-	-	-	-	-	-	1	2	1
CO4	3	3	-	1	-	-	-	-	-	-	1	2	1
CO5	3	3	2	1	-	-	-	-	-	-	1	2	1
CO6	3	2	-	1	-	-	-	-	-	-	1	2	1

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24ECEL510	SENSORS AND MEASUREMENTS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: -	SYLLABUS VERSION 1.0	SDG NO. 3, 4, 9				
PRE-REQUISITE COURSES	24ECPC201, 24BSPH201					

OBJECTIVES:

- To Illustrate the purpose of measurement, the methods of measurements, errors associated with measurements.
- To apply the principle of transduction, classifications and the characteristics of different transducers and study its biomedical applications.
- To Examine the different display and recording devices.
- To apply smart sensors in real world applications

MODULE - I FUNDAMENTALS OF MEASUREMENT SYSTEMS AND TRANSDUCER CHARACTERISTICS 8

Measurement System – Instrumentation – Classification and Characteristics of Transducers – Static and Dynamic – Errors in Measurements – Calibration – Primary and secondary standards.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - II ELECTRICAL TRANSDUCERS AND BIOMEDICAL APPLICATIONS **8**

Resistive Transducers: Strain Gauge: Gauge factor, sensing elements, configuration, biomedical applications; strain gauge as displacement & pressure transducers, RTD materials & range, Characteristics, thermistor characteristics, biomedical applications of Temperature sensors Capacitive transducer, Inductive transducer, LVDT, Active type: Thermocouple –characteristics.

MODULE - III SIGNAL CONDITIONING AND ANALYSIS **7**

AC and DC Bridges – Wheatstone bridge, Kelvin, Maxwell, Hay, Schering – Concepts of filters, Pre-amplifier – impedance matching circuits – isolation amplifier, Spectrum analyzer.

MODULE - IV PHOTOELECTRIC AND PIEZOELECTRIC SENSORS **8**

Phototube, scintillation counter, Photo Multiplier Tube (PMT), photovoltaic, Photoconductive cells, photo diodes, phototransistor, comparison of photoelectric transducers, spectrophotometric applications of photo electric transducers. Piezoelectric active transducer and biomedical applications as pressure & Ultrasound transducer.

MODULE - V DISPLAY AND RECORDING DEVICES **7**

Digital voltmeter – Multimeter – CRO – block diagram, CRT – vertical & horizontal deflection system, DSO, LCD monitor, PMMC writing systems, servo recorders, photographic recorder, magnetic tape recorder, Inkjet recorder, thermal recorder.

MODULE - VI SMART SENSORS AND ITS APPLICATIONS **7**

Sensors in medical devices, smart phones , industrial automation, air pollution monitoring, agriculture, water quality, weather monitoring systems

TOTAL : 45 PERIODS

TEXT BOOKS

1. Doebelin E.O. and Manik D.N., "Measurement Systems", Tata McGraw-Hill Education Pvt. Ltd., Sixth Edition, 2011.
2. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

3. D Patranabis, Sensors and Transducers, Prentice Hall of India, New Delhi, 2005.
4. L.A Geddes and L.E.Baker , "Principles of Applied Biomedical Instrumentation", – John Wiley and sons, Third Edition, Reprint 2008.

REFERENCES:

1. A.K.Sawhney, "Electrical & Electronics Measurement and Instrumentation", Dhanpat Rai&Co, New Delhi, Seventeenth Edition, 2004.
2. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, Third Edition, 2014.
3. Albert D.Helfrick and William D.Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2007
4. John G.Webster, Medical Instrumentation Application and Design,fourth edition,Wiley India Pvt Ltd,New Delhi.

ONLINE RESOURCE:

1. https://nptel.ac.in/courses/108/108/108108147/
2. https://physicsinstrumentation.wordpress.com/wp-content/uploads/2015/03/measurement_systems_application_design.pdf

WEB RESOURCES:

1. https://www.youtube.com/watch?v=q8UuRkOQ9A0
2. https://www.youtube.com/watch?v=Gxaarq9uR7M
3. https://www.youtube.com/watch?v=7TabKYSbdH4
4. https://www.youtube.com/watch?v=T7zgpjR6pMw
5. https://www.youtube.com/watch?v=owc65TnJCog

OUTCOMES:

At the end of this course, the students should be able to:

1. Illustrate the fundamentals of measurement systems, instrumentation, transducer classification, characteristics, errors, calibration, and standards.(K3)
2. Apply the working principles of resistive, capacitive, inductive, and thermal transducers in biomedical measurement systems. (K3)
3. Analyze signal conditioning circuits and signal analysis instruments for accurate measurement and data acquisition. (K4)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

4. Apply photoelectric and piezoelectric sensors for biomedical applications (K3)
5. Analyze the operation of display and recording devices used in measurement systems. (K4)
6. Analyze smart sensors in real-world applications (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-		-	-	3	2
CO2	3	-	-	-	-	-	-	-	-	-	-	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	2
CO4	3	-	-	-	-	-	-	-	-	-	-	3	2
CO5	3	3	-	-	--	-	-	-	-	-	-	3	2
CO6	3	3	-	-	2	-	-	-	-	-	2	3	2

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24ECEL511	DIGITAL IMAGE PROCESSING	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 107105135	SYLLABUS VERSION 1.0	SDG NO. 4				
PRE-REQUISITE COURSES	24BSMA202, 24ECPC301					

OBJECTIVES:

- To apply fundamental concepts of digital image processing and transform techniques to process digital images.
- To analyze spatial and frequency domain methods for image enhancement.
- To apply feature extraction techniques for efficient image representation.
- To analyze segmentation techniques for extracting meaningful image regions.
- To analyze image compression to reduce image size while maintaining acceptable quality.
- To illustrate machine learning approaches for real-time applications.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

ODULE - I IMAGE FUNDAMENTALS 8

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

MODULE - II IMAGE ENHANCEMENT 8

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

MODULE - III IMAGE REPRESENTATION AND FEATURE EXTRACTION 7

Image representation for analysis – Feature extraction – Texture and shape features –Feature detection techniques– Feature descriptors – Feature selection and dimensionality reduction.

MODULE - IV IMAGE SEGMENTATION 8

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

MODULE - V IMAGE COMPRESSION 8

Need for data compression – Types of redundancy–Lossless vs lossy compression– Huffman, Run Length Encoding, Shift codes, Arithmetic coding – JPEG and MPEG standards– Performance metrics– Applications of image and video compression.

MODULE - VI IMAGE PROCESSING AND ITS APPLICATIONS 6

Pattern recognition basics – Machine learning for image classification – Object detection and tracking Performance metrics – Applications in medical imaging, surveillance, and autonomous systems.

TOTAL : 45 PERIODS

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

TEXTBOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson, 5th Edition, 2010
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson, 2002.

REFERENCES:

1. Kenneth R. Castleman, "Digital Image Processing", Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, "Digital Image Processing using MATLAB", Pearson Education, Inc., 2011.
3. William K. Pratt, "Digital Image Processing", John Wiley, New York,4th Edition,2007.
4. Milan Sonka, Vaclav Hlavac & Roger Boyle, "Image processing, Analysis and Machine Vision", Thomson Asia Prt. Ltd, 4th Edition, 2015.
5. Sid Ahmed M.A., "Image Processing - Theory, Algorithm and Architecture", McGraw Hill, 2009.

WEB REFERENCES:

1. Introduction to sensors: http://www.shortcourses.com/sensors/
2. Digital Image Fundamentals: http://www.ph.tn.tudelft.nl/Courses/FIP/Frames/fip.html
3. DIAL-Digital Image Analysis Laboratory http://www.ece.arizona.edu/~dial/
4. JPEG image compression standard: www.jpeg.org

ONLINE RESOURCES:

1. https://www.tutorialspoint.com/dip/image_processing_introduction.htm
2. https://sisu.ut.ee/imageprocessing/book/1

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply image representation techniques and transform methods for processing digital images.(K3)
2. Analyze spatial and frequency domain enhancement techniques for improving image quality. (K4)
3. Apply feature extraction techniques for efficient image representation. (K3)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication

4. Analyze segmentation techniques to extract meaningful regions from images. (K4)
5. Analyze image compression to reduce image size while maintaining acceptable quality. (K4)
6. Illustrate machine learning approaches for real-time applications. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	2
CO3	3	-	-	-	-	-	-	-	-	-	-	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3	2
CO6	3	-	-	-	1	-	-	-	-	-	1	3	2

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24ECEL512	ADVANCED DIGITAL SIGNAL PROCESSING	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 108105117	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24ECPC502, 24ECPT502					

OBJECTIVES:

- To apply the concepts of stationary and non-stationary random signals for characterizing discrete-time random processes.
- To apply suitable methods to estimate the power spectral density of random processes.
- To evaluate the principles of optimum filters such as Wiener and Kalman filters for signal estimation and noise reduction.
- To apply adaptive filtering techniques to solve problems in communication engineering applications.
- To apply multirate DSP techniques for efficient signal processing applications.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies

MODULE - I DISCRETE RANDOM SIGNAL PROCESSING 7

Weiner Khinchine relation - Power spectral density – filtering random process, Spectral Factorization Theorem, special types of random process – Signal modeling-Least Squares method, Finite Data records, Stochastic Models.

MODULE - II SPECTRUM ESTIMATION 8

Non-Parametric methods - Periodogram estimator - Barlett spectrum estimation - Welch estimation - Model based approach - AR, MA, ARMA Signal modeling - Parameter estimation using Yule-Walker method.

MODULE - III LINEAR PREDICTION 8

Linear prediction theory, prediction error, least squares method, normal equations, Levinson recursion algorithm, lattice realization.

MODULE - IV OPTIMUM ESTIMATION AND FILTERING 7

Maximum likelihood criterion, efficiency of estimator, least mean square error criterion, Wiener filter, discrete Wiener–Hopf equations, recursive estimators, Kalman filter.

MODULE - V ADAPTIVE FILTERS 8

FIR Adaptive filters - Newton's steepest descent method - Adaptive filters based on steepest descent method - Widrow Hoff LMS Adaptive algorithm - Adaptive channel equalization - Adaptive echo canceller - Adaptive noise cancellation - RLS Adaptive filters.

MODULE - VI MULTIRATE DIGITAL SIGNAL PROCESSING 7

Mathematical description of change of sampling rate - Interpolation and Decimation - Continuous time model - Direct digital domain approach - Decimation by integer factor - Interpolation by an integer factor - Single and multistage realization - Poly phase realization - Applications to sub band coding.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Monson H. Hayes, "Statistical digital signal processing and modeling", John Wiley and Sons Inc. New York, Indian reprint 2008.
2. P. P. Vaidyanathan, "Multirate systems and filter banks", Prentice Hall Inc. 1993.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication E...

REFERENCES:

1. John G. Proakis & Dimitris G.Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", 4th Edition, Pearson Education / Prentice Hall, 2007.
2. Sophoncles J. Orfanidis, "Optimum signal processing", McGraw Hill, 2000.

WEB REFERENCES:

1. https://www.youtube.com/watch?v=kbjUCyHBJxQ
2. https://www.youtube.com/watch?v=CPP4NRVccJs
3. https://www.youtube.com/watch?v=5lHJYbkrH6o

ONLINE RESOURCES:

1. https://freevideolectures.com/course/2309/adaptive-signal-processing/29

OUTCOMES:

At the end of this course, the students should be able to:

1. Analyze statistical measures such as mean, variance, autocorrelation and power spectral density for WSS stochastic processes in signal modeling. (K4)
2. Evaluate non-parametric and model-based spectrum estimation techniques to estimate the power spectrum of a random process. (K5)
3. Evaluate linear prediction theory and determine solutions to normal equations used in signal estimation. (K5)
4. Evaluate optimum estimation and filtering techniques including Wiener filter, Wiener–Hopf equations, recursive estimators and Kalman filter. (K5)
5. Analyze adaptive filtering algorithms such as LMS and RLS for processing non-stationary signals. (K4)
6. Analyze multirate signal processing techniques including decimation, interpolation and polyphase realization for coding applications. (K4)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	1	1
CO2	3	2	2	-	-	-	-	-	-	-	-	2	2
CO3	3	3	2	-	-	-	-	-	-	-	-	2	1
CO4	3	3	2	-	-	-	-	-	-	-	-	2	1
CO5	3	2	1	-	1	-	-	-	-	-	-	1	1
CO6	3	2	1	-	-	-	-	-	-	-	-	1	1

Recommended in Board of Studies (BoS) Meeting No. 09 held on 05-06-2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24ECEL513	INFORMATION THEORY	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 117104129	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24BSMA401, 24ECPC402					

OBJECTIVES:

- To understand fundamental concepts of information measures such as entropy and mutual information.
- To learn source and channel coding techniques for efficient and reliable data transmission.
- To analyse error control coding methods for the detection and correction of errors in Communication systems.
- To explore advanced information theory concepts and modern coding techniques.

MODULE -I INFORMATION MEASURES & ENTROPY **8**

Concept of information, Self-information and entropy, Joint, conditional entropy, Relative entropy (KL divergence), Mutual information, Chain rules and properties

MODULE - II SOURCE CODING **8**

Coding concepts and objectives, Prefix codes, Kraft inequality, Shannon source coding theorem, Shannon–Fano coding, Huffman coding, Arithmetic coding, Lempel–Ziv coding

MODULE - III CHANNEL CAPACITY & COMMUNICATION CHANNELS **7**

Discrete Memory less Channel (DMC), Binary Symmetric Channel (BSC), Binary Erasure Channel (BEC), Mutual information of channels, Channel capacity, Shannon's channel coding theorem.

MODULE - IV ERROR CONTROL CODING **7**

Linear block codes, Generator and parity check matrices, Syndrome decoding, minimum distance and error correction capability, Hamming codes, Properties of cyclic codes, Syndrome computation, Cyclic Hamming codes

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05-06-2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - V ADVANCED CODING TECHNIQUES 8

Convolutional codes- State Tree and trellis representation, Viterbi decoding algorithm, Turbo codes, LDPC codes

MODULE - VI ADVANCED INFORMATION THEORY 7

Asymptotic Equipartition Property (AEP), Rate distortion theory, Gaussian channels, Network information theory

TOTAL : 45 PERIODS

TEXT BOOKS

1. Bose, R. (2017). Information theory, coding and cryptography (3rd ed.). McGraw Hill Education India.
2. Saha, A., Manna, N., & Mandal, S. (2013). Information theory, coding and cryptography. Pearson Education India.
3. Kulkarni, M., & Shivaprakasha, K. S. (2017). Information theory and coding (as per AICTE syllabus). Wiley India.
4. Cover, T. M., & Thomas, J. A. (2006). Elements of information theory (2nd ed.). Wiley-Interscience.
5. Lin, S., & Costello, D. J. (2004): Error control coding: Fundamentals and applications (2nd ed.). Pearson.
6. MacKay, D. J. C. (2003). Information theory, inference and learning algorithms. Cambridge University Press.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc25_ee03/unit?unit=40&lesson=41

OUTCOMES:

At the end of this course, the students should be able to:

1. Examine the information measures and entropy concepts to interpret uncertainty and information flow in communication systems. (K4)
2. Differentiate source coding techniques and prefix code properties to assess data compression efficiency. (K4)
3. Investigate channel models and capacity concepts to determine limits of reliable communication over noisy channels. (K4)
4. Deconstruct error control coding techniques to analyse their error

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

detection and correction capabilities. (K4)

5. Compare advanced coding techniques such as convolutional, Turbo, and LDPC codes for performance and reliability. (K4)
6. Examine advanced information theoretic concepts including AEP, rate distortion, and network information theory to interpret communication limits. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	1	2	1
CO2	3	3	-	-	-	-	-	-	-	-	1	2	2
CO3	3	2	-	-	-	-	-	-	-	-	1	3	1
CO4	3	3	-	-	-	-	-	-	-	-	1	2	2
CO5	3	2	-	-	-	-	-	-	-	-	1	2	2
CO6	3	3	-	-	-	-	-	-	-	-	1	3	3

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24ECEL514	MACHINE LEARNING FOR COMMUNICATION AND SIGNAL PROCESSING	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106106179	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24BSMA401					

OBJECTIVES:

- To introduce basics of Machine Learning to select models based on the requirement.
- To develop the technical proficiency required to implement dimensionality reduction and ensemble strategies.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineer

- To bridge the gap between classical statistical methods and modern Deep Learning by mastering the architecture and application of Neural Networks, CNNs, and Generative Adversarial Networks.
- Understand MIMO system design and challenges and apply ML techniques to wireless communication problems

MODULE - I INTRODUCTION TO MACHINE LEARNING 7

Introduction to Machine Learning - Classification - Regression - Supervised Learning - Model Selection and Generalization - Dimensions of Supervised Learning algorithm - Performance Measures, Bias-Variance Trade off, Linear Regression - Bayesian Decision Theory - Classification - Losses and Risks - Discriminant functions - Utility Theory - Association Rules.

MODULE - II PARAMETRIC ESTIMATION 7

Parametric Methods - Bias and Variance - Model selection procedure - Bayesian estimation - Dimensionality reduction - Principal Component Analysis- Linear Discriminant Analysis.

MODULE - III MIXTURE MODELLING 7

Clustering - Mixture densities - k-means clustering - Expectation-Maximization Algorithm - Non Parametric methods - Generalization to Multivariate Data - Nonparametric Classification - Nonparametric Regression.

MODULE - IV PERCEPTRON CRITERIA 8

Perceptron Criteria - Discriminative models - Support Vector Machines (SVM) - Logistic Regression, Decision trees, Hidden Markov Model (HMM) - Ensemble methods: Ensemble strategies, boosting and bagging, Random Forest

MODULE - V AN INTRODUCTION TO NEURAL NETWORKS AND DEEP LEARNING 8

Neural network: Perceptron, multilayer network, backpropagation, RBF Neural Network, Applications- Introduction to Deep Learning, Convolutional Neural Networks (CNN), Vanishing and Exploding Gradients in Deep Neural Networks, LeNet - 5, AlexNet, VGGNet, GoogleNet, and ResNet

MODULE - VI ML APPLICATIONS IN MIMO 8

Limitations of traditional detectors - ML-based signal detection - Deep learning for MIMO detection - Model-driven deep learning approaches -

Comparison with classical techniques - ML-based channel estimation techniques - Deep neural networks for channel prediction - Spectrum allocation using ML - Reinforcement learning in wireless systems - ML in beam management.

TOTAL : 45 PERIODS

BOOKS AND REFERENCES:

1. E. Alpaydin, Introduction to Machine Learning, 3rd Edition, Prentice Hall (India) 2015.
2. C. M. Bishop, Pattern Recognition and Machine Learning (Information Science and Statistics),Springer, 2006.
3. Charu C. Aggarwal, Neural Networks and Deep Learning – A Textbook , Springer, 2018.
4. David Tse and Pramod Viswanath, Fundamentals of Wireless Communication – A Textbook, Cambridge University Press, 2005.

OUTCOMES:

At the end of this course, the students should be able to:

1. Examine supervised learning algorithms, including linear regression and Bayesian decision theory, to analyze model selection and performance measures. (K4)
2. Analyze parametric and non-parametric estimation methods to differentiate between bias-variance trade-offs and model selection procedures. (K4)
3. Investigate dimensionality reduction techniques, such as PCA and LDA, and mixture modelling approaches like K-means to interpret complex data structures. (K4)
4. Differentiate between discriminative models, support vector machines, and ensemble strategies (bagging and boosting) to organize efficient classification solutions. (K4)
5. Analyze neural network architectures and deep learning advancements, including CNNs, RNNs, and GANs, to analyze their application in modern case studies and system advancements. (K4)
6. Investigate the applications of ML in MIMO. (K4)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05-06-2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	1	2	1
CO2	3	3	-	-	-	-	-	-	-	-	1	2	2
CO3	3	2	-	-	-	-	-	-	-	-	1	3	1
CO4	3	3	-	-	-	-	-	-	-	-	1	2	2
CO5	3	2	-	-	-	-	-	-	-	-	2	2	2
CO6	3	3	-	-	-	-	-	-	-	-	2	3	3

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24ECEL515	COMMUNICATION TECHNOLOGIES FOR INDUSTRY 4.0	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106105195	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24ECPC304, 24ECPT401					

OBJECTIVES:

- Understand the fundamentals of Internet of Things (IoT)
- Explain the concepts and evolution of Industry 4.0
- Analyze the architecture and working of Industrial IoT (IIoT)
- Understand industrial communication and data acquisition systems

MODULE - I OVERVIEW OF INTERNET OF THINGS 7

IoT Architecture - Enabling IoT and the Complex Interdependence of Technologies - IoT Networking Components - Addressing Strategies in IoT - Sensors - Actuators - Processing Topologies

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication

MODULE - II INDUSTRY 4.0 BASICS **7**

Introduction Industry 4.0 - Evolution of Industry 4.0 , Impacts of Industry 4.0 , Industrial Internet, Applications of Industry 4.0- Design requirements of Industry 4.0 -Drivers of Industry 4.0

MODULE - III ARCHITECTURE OF INDUSTRIAL INTERNET OF THINGS 8

IIoT -Prerequisites of IIoT , Basics of CPS , CPS and IIoT, Applications of IIoT- Industrial Internet Systems -Industrial sensing - Reference Architecture of IIoT

MODULE - IV TECHNOLOGIES OF INDUSTRIAL INTERNET OF THINGS 8

Off-site Technologies - Cloud Computing, Fog Computing - On-site Technologies - Augmented Reality, Virtual Reality, Big Data and Advanced Analytics- Lean manufacturing system - Smart factories.

MODULE - V INDUSTRIAL DATA TRANSMISSION, ACQUISITION AND ANALYTICS **8**

Data Transmission - Foundation Fieldbus - Profibus - Interbus - ISA 100.11a - Wireless HART - LoRa and LoRaWAN - Data Acquisition - Distributed Control System - PLC - SCADA -Necessity of analytics -IIoT Analytics - Categorization of analytics , Usefulness, Challenges - Applications of analytics .

MODULE - VI APPLICATIONS AND CASE STUDIES **7**

Healthcare Applications -Major challenges associated with healthcare - Applications of Healthcare in Industries- Case Studies - Manufacturing Industry - Automotive Industry - Mining Industry.

TOTAL : 45 PERIODS

BOOKS AND REFERENCES:

1. S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press.
2. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.

OUTCOMES:

At the end of this course, the students should be able to:

1. Utilize IoT architectural frameworks to build real-time application models in domains such as smart homes, healthcare, and agriculture. (K3)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2024

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

2. Apply the design requirements of Industry 4.0 to develop scalable, secure, and interoperable industrial solutions. (K3)
3. Demonstrate the application of Cyber-Physical Systems (CPS) concepts in integrating physical processes with computational systems. (K3)
4. Apply advanced technologies such as cloud computing, fog computing, augmented reality, virtual reality, and big data analytics in Industry 4.0 scenarios. (K3)
5. Demonstrate the application of industrial communication protocols and data acquisition systems including PLC, DCS, SCADA, and wireless technologies for effective data transmission. (K3)
6. Apply data analytics techniques to IIoT-generated data. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	1	2	1
CO2	3	-	-	-	-	-	-	-	-	-	1	2	2
CO3	3	-	-	-	-	-	-	-	-	-	1	3	1
CO4	3	-	-	-	-	-	-	-	-	-	1	2	2
CO5	3	-	-	-	-	-	-	-	-	-	2	2	2
CO6	3	-	-	-	-	-	-	-	-	-	2	3	3

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24ECEL516	ANALOG AND DIGITAL IC DESIGN	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 108104193	SYLLABUS VERSION 1.0	SDG NO. 4, 9, 11				
PRE-REQUISITE COURSES	24ECPC201, 24ECPC303					

OBJECTIVES:

- To understand MOSFET large-signal and small-signal models and analyze single-stage amplifier configurations.
- To design current mirrors and CMOS operational amplifiers and evaluate their performance parameters.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

- To analyze advanced analog functional circuits including op-amp architectures, comparators, and reference circuits.
- To understand digital IC design challenges, performance metrics, and signal integrity issues.
- To explore various digital IC implementation strategies from full custom to semi-custom and array-based approaches.
- To analyze mixed-signal design issues, interconnect effects, and basic data converter architectures.

MODULE - I MOSFET MODELING AND SINGLE-STAGE AMPLIFIERS 8

Large signal and small signal modeling of MOSFET-Advanced MOS modeling-Common Source amplifier-Common Drain amplifier-Common Gate amplifier

MODULE - II CURRENT MIRRORS AND CMOS OP-AMP 7

Simple CMOS current mirror-Source degenerated current mirrors-High output impedance current mirrors-Cascade gain stage-Two-stage CMOS operational amplifier-Gain, frequency response, slew rate, offset voltage

MODULE - III ANALOG FUNCTIONAL CIRCUITS 7

Operational amplifier architectures – Two-stage and folded cascode op-amps – Compensation techniques – Slew rate and settling behavior – Comparator design – Bandgap reference basics – Analog layout considerations.

MODULE - IV BASICS OF DIGITAL IC DESIGN 8

Issues in digital integrated circuit design including scaling challenges and variability. Quality metrics such as cost, functionality and power and energy consumption. Power–Performance–Area (PPA) trade-offs and signal integrity issues like crosstalk and IR drop.

MODULE - V IMPLEMENTATION STRATEGIES FOR DIGITAL ICs 8

From custom to semicustom and structured array design approaches-custom circuit design- cell-based design methodology- Array based implementation approaches

MODULE - VI MIXED-SIGNAL AND INTERCONNECT ISSUES 7

Interconnect effects – Data converters (basic ADC/DAC concepts) – Introduction to on-chip communication and system-level considerations

TOTAL : 45 PERIODS

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

TEXTBOOKS

1. Analog Integrated Circuit Design by David A. Johns, Ken Martin, John Wiley & Sons.
2. Analysis and Design of Analog Integrated Circuits by Gray, Hurst, Lewis, Meyer; John Wiley & Sons.
3. Design of Analog CMOS Integrated Circuits by Behzad Razavi, TMH.
4. CMOS Analog and Mixed-Signal Circuit Design: Practices and Innovations, CRC Press, 2020.
5. Jan M. Rabaey, Digital Integrated Circuits: A Design Perspective, Pearson.

REFERENCE BOOKS

1. Ken Martin, Digital Integrated Circuit Design, Oxford University, 2000.
2. John F. Wakerly, Digital Design Principles & Practices, Pearson Education, 2002.

OUTCOMES:

At the end of this course, the students should be able to:

1. Analyze MOSFET models and evaluate the performance of single-stage amplifiers. (K4)
2. Design current mirrors and CMOS operational amplifiers with specified performance metrics. (K3)
3. Develop and analyze analog functional circuits considering stability, frequency response, and layout aspects. (K4)
4. Evaluate digital IC design metrics including power, performance, area, and signal integrity. (K3)
5. Apply appropriate implementation strategies for digital IC realization based on design requirements. (K3)
6. Analyze mixed-signal and interconnect issues and understand basic ADC/DAC operation in integrated systems. (K4)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	1	2	2
CO2	3	-	-	-	-	-	-	-	-	-	1	2	2
CO3	3	3	-	-	-	-	-	-	-	-	1	2	2
CO4	3	-	-	-	-	-	-	-	-	-	1	2	2
CO5	3	2	-	-	-	-	-	-	-	-	1	2	2
CO6	3	3	-	-	-	-	-	-	-	-	1	2	2

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24ECEL517	COMPUTER ORGANIZATION AND DESIGN	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106105163	SYLLABUS VERSION 1.0	SDG NO. 4, 9, 11				
PRE-REQUISITE COURSES	24ECPC303					

OBJECTIVES:

- Learn the basic structure, instruction execution, and performance aspects of computer systems.
- Understand the arithmetic operations and analyze number representation in computer systems.
- Study the instruction-level parallelism and techniques to improve processor performance.
- Have an in-depth knowledge on data-level parallelism and modern parallel processing architectures.
- Explore emerging computing trends, computing platforms, and design trade-offs

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - I COMPUTER ORGANIZATION AND INSTRUCTIONS 7

Introduction to computer systems - Performance metrics and performance enhancement techniques - Amdahl's law - Power dissipation in processors - Addressing and addressing modes - Operations and Operands of the computer Hardware - Representing instructions.

MODULE - II ARITHMETIC FOR COMPUTERS 7

Fixed point Addition, Subtraction, Multiplication and Division, Floating Point arithmetic, Subword parallelism.

MODULE - III THE PROCESSOR 7

Introduction, Logic Design Conventions, Building a Datapath - Simple Implementation of MIPS32 - MIPS Instruction Cycle.

MODULE - IV INSTRUCTION-LEVEL PARALLELISM 7

Pipeline datapath - Data and Control dependences - Challenges in ILP realization - Pipeline hazards and their solutions - out of order execution - Branch prediction and dynamic scheduling.

MODULE - V MEMORY AND I/O ORGANIZATION 8

Overview of memory hierarchy, Cache design considerations - Virtual memory - Parallel Bus Architectures - Internal Communication Methodologies - Serial Bus Architectures - Mass storage - Input and Output Devices.

MODULE - VI PARALLEL PROCESSORS FROM CLIENT TO CLOUD 9

Parallel processing architectures and challenges - Introduction to Graphics processing units - Clusters - Warehouse scale computers - Introduction to Multiprocessor network topologies.

TOTAL : 45 PERIODS

TEXT BOOKS

1. David A. Patterson and John L. Hennessey, —Computer Organization and Design, Fifth edition, Morgan Kauffman , Elsevier, 2014.
2. V. Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, —Computer Organization—, Fifth edition, Mc Graw-Hill Education India Pvt Ltd, 2014.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

REFERENCES

1. William Stallings —Computer Organization and Architecture||, Seventh Edition, Pearson Education, 2006.
2. Miles J. Murdocca and Vincent P. Heuring, —Computer Architecture and Organization: An Integrated approach, Second edition, Wiley India Pvt Ltd, 2015

WEB RESOURCES:

1. https://ocw.mit.edu/courses/6-823-computer-system-architecture-fall-2005/pages/lecture-notes/
2. https://www.geeksforgeeks.org/computer-organization-architecture/computer-organization-and-architecture-tutorials/

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs88/preview
2. https://nptel.ac.in/courses/106103206

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply the concepts of computer organization, instruction formats and performance metrics to analyze basic computing systems. (K3)
2. Apply arithmetic operations, floating-point representation in solving computational problems. (K3)
3. Analyze the MIPS32 processor architecture by examining datapath components, control signals, and instruction cycle execution for different instruction formats. (K4)
4. Apply the concepts of instruction-level parallelism techniques such as pipelining, hazard handling, branch prediction, and dynamic scheduling. (K3)
5. Examine the cache design, virtual memory, and I/O organization for system performance evaluation. (K4)
6. Analyze parallel processing architectures including multicore systems, GPUs, and clusters. (K4)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	2	2	2
CO2	3	-	-	-	-	-	-	-	-	-	2	2	2
CO3	3	3	-	-	-	-	-	-	-	-	2	2	2
CO4	3	-	-	-	-	-	-	-	-	-	2	2	2
CO5	3	3	-	-	-	-	-	-	-	-	2	2	2
CO6	3	3	-	-	-	-	-	-	-	-	2	2	2

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24ECEL518	INTRODUCTION TO MICROFABRICATION	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 103106075	SYLLABUS VERSION 1.0	SDG NO. 4, 9, 12				
PRE-REQUISITE COURSES	24BSPH101, 24BSPH201					

OBJECTIVES:

- To provide a deep understanding of the history of integrated circuits, crystal growth, and the critical necessity of ultra-clean environments and specific wafer cleaning protocols.
- To master the principles of optical and advanced lithography—such as E-beam and X-ray—enabling the precise transfer of circuit designs onto silicon wafers.
- To analyze and model the physical processes of oxidation, thermal diffusion, and ion implantation required to modify electrical properties and create device junctions.
- To evaluate thin-film deposition techniques and etching methods while addressing the technical challenges of metallization and multi-level interconnects.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE -I INTRODUCTION 7

History of IC"s; Operation & Models for Devices of Interest: CMOS and MEMS.

Electronic Materials: Crystal Structures, Defects in Crystals, Si, Poly-Si, Si Crystal Growth. Clean Room and Wafer Cleaning: Definition, Need of Clean Room, RCA cleaning of Si.

MODULE - II OXIDATION 6

Dry and Wet Oxidation, Kinetics of Oxidation, Oxidation Rate Constants, Dopant Redistribution, Oxide Charges, Device Isolation, LOCOS, Oxidation System

MODULE - III LITHOGRAPHY 7

Overview of Lithography, Radiation Sources, Masks, Photoresist, Components of Photoresist Optical Aligners, Resolution, Depth of Focus, Advanced Lithography: E-beam Lithography, X-ray Lithography, Ion Beam Lithography.

MODULE - IV DIFFUSION 9

Pre-Deposition and Drive-in Diffusion Modeling, Dose, 2-Step Diffusions, Successive Diffusion, Lateral Diffusion, Series Resistance, Junction Depth, Irvin's Curves, Diffusion System. Ion Implantation:Problems in Thermal Diffusion, Advantages of Ion Implantation, Applications in ICs, Ion Implantation System, Mask, Energy Loss Mechanisms, Depth Profile, Range & Straggle, Lateral Straggle, Dose, Junction Depth, Ion Implantation Damage, Post Implantation Annealing, Ion Channeling, Multi Energy Implantation.

MODULE - V THIN FILM DEPOSITION 8

Physical Vapor Deposition: Thermal evaporation, Resistive Evaporation, Electron beam evaporation, Laser ablation. Sputtering Chemical Vapor Deposition: Advantages and disadvantages of Chemical Vapor deposition (CVD) techniques over PVD techniques, reaction types, Boundaries and Flow, Different kinds of CVD techniques: APCVD, LPCVD, Metalorganic CVD (MOCVD), Plasma Enhanced CVD etc.

MODULE - VI ETCHING 8

Anisotropy, Selectivity, Wet Etching, Plasma Etching, Reactive Ion Etching. Overview of Interconnects, Contacts, Metal gate/Poly Gate, Metallization, Problems in Aluminum Metal contacts, Al spike, Electromigration, Metal Silicides, Multi-Level Metallization, Planarization, Inter Metal Dielectric.

TOTAL : 45 PERIODS

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

TEXT BOOKS:

1. J.D. Plummer, M.D. Deal, and P.B. Griffin, "Silicon VLSI Technology Fundamentals, Practice, and Modeling", 1st Edition, Pearson Education, 2009.
2. Sze and May, "Fundamental of Semiconductor Fabrication", 2nd Edition, Wiley India, 2009.

REFERENCE BOOKS:

1. S K Gandhi, "Silicon Process Technology", 2nd Edition, Wiley India, 2009.
2. Richard C. Jaeger, "Introduction to Microelectronic Fabrication", Vol. 5 of Modular Series on Solid State Devices (2nd Edition), Prentice Hall, 2001.

WEB RESOURCES:

1. https://www.coursera.org/learn/microfabrication-fundamental-processes
2. https://ocw.mit.edu/courses/6-152j-micro-nano-processing-technology-fall-2005/pages/lecture-notes/

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/103106075
2. https://onlinecourses.nptel.ac.in/noc19_bt29/preview
3. https://nptel.ac.in/courses/117106093

OUTCOMES:

At the end of this course, the students should be able to:

1. Explain the history of ICs, crystal structures, and the critical role of cleanroom protocols and wafer cleaning in semiconductor manufacturing. (K2).
2. Analyze the kinetics of dry and wet oxidation, including oxidation rate constants and the impact of dopant redistribution on device isolation. (K4)
3. Examine the principles of optical lithography, resolution, and depth of focus, while comparing advanced methods like E-beam and X-ray lithography. (K4)
4. Apply mathematical models to determine diffusion profiles and ion implantation parameters such as dose, range, and junction depth. (K3)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

5. Evaluate the differences between Physical Vapor Deposition (PVD) and Chemical Vapor Deposition (CVD) techniques regarding reaction types and flow boundaries. (K4)
6. Analyze etching selectivity and anisotropy while identifying solutions for metallization issues such as electromigration and Al spiking. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	2	2	2
CO2	3	3	-	-	-	-	-	-	-	-	2	2	2
CO3	3	3	-	-	-	-	-	-	-	-	2	2	2
CO4	3	2	-	-	-	-	-	-	-	-	2	2	2
CO5	3	3	-	-	-	-	-	-	-	-	2	2	2
CO6	3	3	-	-	-	-	-	-	-	-	2	2	2

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24ECEL519	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 108105375	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24ECPC302, 24ECPC304					

OBJECTIVES:

- To learn the basics of EMI/EMC, its sources, and problems
- To understand EMI coupling mechanisms
- To gain knowledge of shielding, grounding, and filtering techniques
- To study EMI standards and regulations
- To understand EMI/EMC test methods and instrumentation

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - I BASIC THEORY OF EMI/EMC 7

Introduction to EMI and EMC, Intra-system and Inter-system EMI, Elements of Interference, Sources and Victims of EMI, Conducted and Radiated Emissions, Susceptibility, Case Histories, Radiation Hazards to Humans, Overview of EMC issues.

MODULE - II EMI COUPLING MECHANISMS 8

Electromagnetic field sources and coupling paths, Coupling via supply network, Common mode and Differential mode coupling, Impedance coupling, Inductive and Capacitive coupling, Radiative coupling, Ground loop coupling, Cable-related emissions and coupling.

MODULE - III TRANSIENTS AND EMI SOURCES 7

Transient sources, Switching transients, ESD (Electrostatic Discharge), Automotive transients, Lightning effects, Characteristics of transient disturbances and their impact on systems.

MODULE - IV EMI MITIGATION TECHNIQUES 8

Shielding principles and Murphy's Law, Low-frequency magnetic shielding, Shielding effectiveness, Apertures and leakage, Material selection for E, H, and free-space fields, Gasketing and sealing, PCB-level shielding techniques.

MODULE - V GROUNDING, FILTERING AND PROTECTION 7

Principles of grounding, Isolated and single-point grounding, Grounding for large systems and mixed-signal systems, Filter types and operation, EMI filters, Surge protection devices, Transient protection techniques.

MODULE - VI STANDARDS, TESTING AND INSTRUMENTATION 8

Need for standards, Generic and product standards, Organizations like IEC, FCC, CISPR, ANSI, MIL-STD-461E standards. EMI testing methods: Open field test, TEM cell, Shielded Anechoic chamber, Shielding effectiveness tests. Instrumentation: Spectrum analyzer, EMI receivers, LISN, antennas, current probes, coupling networks, wave simulators.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Henry W. Ott, "Electromagnetic Compatibility Engineering", John Wiley & Sons Inc, Newyork, 2009.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

2. V Prasad Kodali, "Engineering Electromagnetic Compatibility", IEEE Press, Newyork, 2001.
3. Bernhard Keiser, "Principles of Electromagnetic Compatibility", 3rd Ed, Artech house, Norwood, 1986.
4. Dr Kenneth L Kaiser, "The Electromagnetic Compatibility Handbook", CRC Press, 2005.
5. Clayton Paul, "Introduction to Electromagnetic Compatibility", Wiley Interscience, 2006.

REFERENCES:

1. Daryl Gerke and William Kimmel, "EDN's Designer's Guide to Electromagnetic Compatibility", Elsevier Science & Technology Books, 2002.
2. S Guide to Electromagnetic Compatibility", Elsevier Science & Technology Books, 2002.
3. Paul, C.R., "Introduction to Electromagnetic Compatibility", 2nd ed., Wiley (2010).
4. W Scott Bennett, "Control and Measurement of Unintentional Electromagnetic Radiation", John Wiley & Sons Inc., (Wiley Interscience Series) 1997.

WEB REFERENCES:

1. https://www.ee.iitb.ac.in/web/academics/courses/EE785
2. https://nptel.ac.in/courses/108106138/
3. https://www.classcentral.com/course/swayam-electromagnetic compatibility-emc-12959

ONLINE RESOURCES:

1. http://www.montana.edu/tjkaiser/ee335/notes/EE335-29-EMI.pdf
2. https://www.getmynotes.com/electromagnetic-interference-andcompatibility-ec6011-notes/

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply fundamental concepts of EMI/EMC to identify sources, victims, and types of electromagnetic interference in practical systems. (K3)
2. Apply knowledge of EMI coupling mechanisms (conducted and radiated) to evaluate interference paths in electrical and electronic systems. (K3)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

3. Apply appropriate grounding, shielding, and filtering techniques to minimize EMI in circuit and system design.(K3)
4. Analyze different EMI sources including transients, ESD, and switching disturbances and assess their impact on system performance.
5. Analyze the effectiveness of EMI mitigation techniques such as shielding, grounding strategies, and filters under various operating conditions.
6. Analyze EMI/EMC standards and testing methods to evaluate compliance of electronic systems.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	1	-	-	1	-	-	2	2
CO2	3	3	2	1	-	-	-	-	1	-	-	2	2
CO3	3	2	3	-	1	-	-	-	-	-	-	2	2
CO4	3	3	-	2	-	1	-	-	-	-	-	2	2
CO5	3	3	2	2	1	-	-	-	-	-	-	2	2
CO6	2	2	1	1	2	3	2	1	-	-	1	2	2

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24ECEL520	PRINCIPLES AND TECHNIQUES OF MODERN RADAR SYSTEMS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 108105154	SYLLABUS VERSION 1.0	SDG NO. 4				
PRE-REQUISITE COURSES	24ECPC302, 24ECPC402					

OBJECTIVES:

- To apply fundamental radar principles for system analysis and design.
- To analyze different radar types and their operational characteristics.
- To evaluate radar signal processing techniques for detection and imaging.
- To analyze modern radar applications including imaging and subsurface sensing.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - I RADAR FUNDAMENTALS: 7

Basic Radar Concept and Classification-Radar Equation (Derivation and Applications)-Minimum Detectable Signal-Radar Cross Section (RCS) – Definition, Types, Fluctuating Targets-Frequency Dependence of RCS-Continuous Wave (CW) Radar – Principle and Doppler Measurement-FMCW Radar – Range Measurement and Applications-Comparison: CW vs FMCW Radar-Radar system components and block diagram.

MODULE - II RADAR SIGNAL PROCESSING: 8

Introduction to Radar Signal Processing-Noise, Interference, and SNR-Matched Filtering and Receiver Concepts-Pulse Compression Techniques (LFM, Phase Coding)-Doppler Effect and Velocity Measurement-Radar Ambiguity Function (Range–Doppler Trade-off)-Digital Signal Processing Techniques in Radar-Data Processing Algorithms

MODULE - III TRACKING AND DETECTION TECHNIQUES: 8

Fundamentals of Target Detection-Probability of Detection (Pd) and False Alarm (Pfa)-Radar Range Equation with Swerling Models-Clutter Types and Statistical Models-Moving Target Indicator (MTI) and Improvement Factor-Pulsed Doppler Radar-Tracking Radar Principles-Monopulse Tracking and Angular Resolution

MODULE - IV RADAR IMAGING AND RESOLUTION 7

Radar Resolution Concepts (Range and Angular-Synthetic Aperture Radar (SAR) – Principles and Processing-Range and Azimuth Resolution in SAR-Inverse SAR (ISAR) Imaging-Pulse Compression for Imaging-Imaging Artifacts and Limitations-Radar Imaging Algorithms (Overview)-Applications of Imaging Radar.

MODULE - V ADVANCED RADAR SYSTEMS AND DESIGN 8

Phased Array Radar Systems-Active Electronically Scanned Array (AESA) Frequency Modulated Continuous Wave (FMCW) Radar (Advanced)-Bistatic and Multistatic Radar-MIMO Radar Systems-Radar System Design Principles-Hardware–Software Integration-Radar Performance Optimization and Calibration.

MODULE - VI ADVANCED RADAR APPLICATIONS: 7

Ground Penetrating Radar (GPR)-Radar Wave Propagation in Lossy Media-Radar Tomography and Microwave Imaging-Automotive Radar Systems-

Recommended in Board of Studies (BoS) Meeting No. 09 held on 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

Radar in Defense, Aviation, and Weather Monitoring-Quantum Radar Concepts-Emerging Technologies in Radar-Case Studies and Future Trends

TOTAL : 45 PERIODS

TEXTBOOKS

1. Introduction to Radar Systems, M.I. Skolnik, 3rdEdition, Tata Mcgraw hill edition, 2001
2. Radar Systems Analysis and Design using MATLAB, B.R.Mahafza, 3rd Edition, CRC Press, 2013
3. Monopulse Principles and Techniques, S.M.sherman and D.K.Barton, 2ndEdition,Artech house, 2011 .

REFERENCES:

1. Fundamentals of Radar Signal Processing, M.A.Richards, TMH, 2005
2. Ground Penetrating Radar: Theory and Applications, Ed: H.M. Jolt, Elsevier, 2009
3. Microwave Imaging, M.Pastorino, John Wiley, 2010

ONLINE REFERENCES:

1. https://www.ll.mit.edu/outreach/web-based-course-radar-introduction-radar-systems
2. https://onlinecourses.nptel.ac.in/noc24_ee104/preview
3. https://ocw.mit.edu/courses/res-ll-003-build-a-small-radar-system-capable-of-sensing-range-doppler-and-synthetic-aperture-radar-imaging-january-iap-2011/download

OUTCOMES:

At the end of this course, the students should be able to:

1. Explain fundamental radar principles, radar equation, and different radar system components and classifications. (K3)
2. Apply radar signal processing techniques such as matched filtering, pulse compression, and Doppler processing for target detection and measurement. (K3)
3. Analyze target detection and tracking techniques by evaluating probability of detection, false alarm rates, clutter effects, and radar performance using Swerling models. (K4)
4. Apply radar imaging concepts to determine range and angular resolution in systems such as SAR and ISAR. (K4)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engg

5. Apply principles of advanced radar systems including phased arrays, MIMO radar, and system design considerations for performance optimization. (K4)
6. Analyze advanced radar applications such as ground penetrating radar, automotive radar, and microwave imaging in different operational environments. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	1	-	-	-	-	1	-	2	1
CO2	3	3	2	2	3	-	-	-	-	1	-	3	1
CO3	3	3	2	3	2	-	-	-	-	1	-	3	2
CO4	3	2	2	2	3	-	-	-	-	1	-	3	1
CO5	3	2	3	2	3	-	-	-	1	1	2	3	2
CO6	3	3	2	2	2	2	1	1	1	1	2	2	3

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24ECEL521	COMPUTATIONAL ELECTROMAGNETICS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 108106152	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24ECPC302, 24ECPC401					

OBJECTIVES:

- To Apply vector calculus and Maxwell's equations to analyze electromagnetic problems
- To Formulate and implement integral equation methods for electromagnetic analysis
- To Solve 1D/2D electromagnetic boundary value problems using finite element methods

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engin.

- To understand the time-domain electromagnetic wave interactions using FDTD techniques.
- To Analyze practical electromagnetic applications using appropriate computational methods

MODULE - I FOUNDATIONS OF COMPUTATIONAL ELECTROMAGNETICS **8**

Common theorems in vector calculus, Different regimes of Maxwell's equations, Different ways of solving them, Maxwell's Equations, Boundary Conditions, Uniqueness Theorem, Equivalence Theorem

MODULE - II NUMERICAL METHODS FOR ELECTROMAGNETIC ANALYSIS **7**

Simple Numerical Integration, Gauss Quadrature, Line Charge Problem, Solving the Integral Equation, Basis Functions, Helmholtz Equation, Motivations for Green's functions

MODULE - III METHOD OF MOMENTS **8**

Motivation for MoM, Formulating Method of Moments, Electrostatic Formulation: Capacitance matrix extraction, Magnetostatic Formulation: Inductance matrix extraction, Electric Field Integral Equation (EFIE): S-parameter extraction, Magnetic Field Integral Equation (MFIE) and Combined Field Integral Equation (CFIE)

MODULE - IV FINITE ELEMENT METHOD IN 1D AND 2D **7**

Introduction to finite element methods, Generating System of Equations for 1D FEM, 1D wave equation: Formulation, 1D Wave Equation: Boundary Conditions, 2D FEM Shape Functions, Total field formulation, Scattered field formulation, Matrix assembly

MODULE - V FINITE DIFFERENCE TIME DOMAIN (FDTD) METHOD **8**

2D FDTD Formulation : Stencil, 2D FDTD Formulation : Time Stepping, 2D FDTD Formulation : Divergence Conditions, Stability Criteria , Dealing with dispersive and non-dispersive dielectric media, Perfectly Matched Layers(PML), PML - Tangential Boundary Conditions, Implementing PML into FDTD

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication E

MODULE - VI APPLICATIONS OF CEM 7

Inverse Problems - Mathematical Formulation, Antennas - Potential formulation, Antennas - Radiation Patterns, Antennas - Source Modeling, Antennas – Circuit Modeling, Antennas - MoM details, Hybrid Methods - Motivation

TOTAL : 45 PERIODS

TEXT BOOKS and REFERENCES

1. Computational Methods for Electromagnetics - Peterson, Ray, Mitra, IEEE Press
2. Advanced Engineering Electromagnetics - C A Balanis, Wiley India.
3. Waves and fields in inhomogeneous media - W C Chew, IEEE Press
4. Finite Element Method for Electromagnetics: Antennas, Microwave Circuits, and Scattering Applications - Volakis, Chatterjee, and Kempel, Wiley

ONLINE REFERENCES:

1. https://nptel.ac.in/courses/108106152(Computational Electro magnetics)

OUTCOMES:

At the end of this course, the students should be able to:

1. Explain fundamental vector calculus theorems, Maxwell's equations in different regimes, boundary conditions, and uniqueness/equivalence theorems to model electromagnetic field problems. (K2)
2. Apply numerical integration techniques and Green's function solutions to Helmholtz equation for formulating integral equations of electro/magnetostatic and wave problems. (K3)
3. Solve electromagnetic problems using Method of Moments, including capacitance/inductance matrix extraction and S-parameter computation via EFIE, MFIE, and CFIE. (K4)
4. Implement 1D and 2D Finite Element Method for wave equations, including shape functions, boundary condition enforcement, and matrix assembly for total/scattered field formulations. (K3)
5. Develop 2D FDTD algorithms incorporating time stepping, stability criteria, dispersive media, and PML absorbing boundaries to simulate transient electromagnetic wave propagation. (K3)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

6. Explain real-world applications such as antenna radiation, source/circuit modeling, and inverse problems using appropriate CEM techniques, and compare hybrid methods for complex EM systems. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	-	-	-	1	-	3	1	2	2
CO2	3	3	2	2	2	-	-	-	1	1	-	3	2
CO3	3	3	3	3	3	1	-	-	2	2	1	3	3
CO4	3	2	3	2	3	-	-	-	2	2	1	3	3
CO5	2	3	3	3	3	1	1	-	2	2	1	3	3
CO6	2	3	3	3	2	1	2	3	2	3	3	2	2

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24ECEL522	MEDICAL ELECTRONICS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 102106669	SYLLABUS VERSION 1.0	SDG NO. 3 & 4				
PRE-REQUISITE COURSES	24ECPC304, 24ECPT402					

OBJECTIVES:

- To introduce the principles of electrical physiological parameters (biopotentials) for acquiring and analyzing biomedical signals.
- To elaborate techniques for measuring non-electrical physiological and biochemical parameters using appropriate biomedical instruments.
- To apply suitable methods for recording, processing, and transmitting physiological signals in healthcare systems.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

- To understand the operation and application of human assist biomedical devices in clinical practice.
- To understand the working principles of therapeutic, diagnostic, and advanced biomedical equipment in modern healthcare applications.

MODULE - I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL 7

Sources of biomedical signals, bio-potentials, bio-potential electrodes, biological amplifiers, signal acquisition methods.

MODULE - II BIO SIGNAL ACQUISITION & INTERPRETATION 8

ECG, EEG, EMG, PCG, lead systems and recording methods, typical waveforms, signal characteristics.

MODULE - III BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT 8

pH, pO_2, pCO_2 measurement, colorimeter, auto analyzer, blood flow meter, cardiac output measurement, respiratory measurement, blood pressure, temperature and pulse measurement, blood cell counters.

MODULE - IV ASSIST DEVICES 7

Cardiac pacemakers, DC defibrillator, dialyzer, ventilators, heart-lung machine.

MODULE - V THERAPEUTIC, SURGICAL AND DIAGNOSTIC TOOLS 8

Diathermies (shortwave, ultrasonic, microwave) and applications, surgical diathermy, radio pill, endomicroscopy, magnetic resonance imaging systems, ultrasonic imaging systems.

MODULE - VI RECENT TRENDS IN MEDICAL INSTRUMENTATION 7

Telemedicine, insulin pumps, brain-machine interface, lab-on-a-chip, laser in medicine, cryogenic applications, biotelemetry.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007.
2. Khandpur, R.S., "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 2003.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

REFERENCES:

1. Myer Kutz, "Standard Handbook of Biomedical Engineering and Design", McGraw Hill Publisher, 2003.
2. John G.Webster, "Medical Instrumentation Application and Design", 3rd Edition, Wiley India Edition, 2007.
3. Joseph J.Carr and John M.Brown, "Introduction to Biomedical Equipment Technology", John Wiley and Sons, New York, 2004.
4. R.D.Lele, "Computers in Medicine," Tata McGraw Hill, NewDelhi-1989.
5. Onkar N. Pandey, Rakesh Kumar, "Medical Electronics", S.K. Kataria & Sons, 2009

WEB REFERENCES:

1. https://books.google.co.in/books/about/Principles_of_Medical_Electronics_and_Bi.html?id=Uu1_6V7H5n8C
2. https://www.youtube.com/watch?v=JOMsijqtHps

ONLINE RESOURCES:

1. https://academicearth.org/biomedical-engineering/ww.youtube
2. https://www.ecs.soton.ac.uk/undergraduate/biomedical-electronicengineering
3. https://www.sciencedirect.com/topics/engineering/medicalelectronics

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply the principles of biomedical signal sources, bio-potentials, bio-potential electrodes, and biological amplifiers to acquire physiological signals. (K3)
2. Interpret physiological signals and evaluate their significance in medical diagnosis. (K3)
3. Utilize appropriate biomedical instruments to measure biochemical and physiological parameters. (K3)
4. Examine the principles of human assist biomedical devices in clinical applications. (K3)
5. Illustrate the principles of biomedical therapeutic, surgical and diagnostic devices in medical applications. (K3)
6. Summarize modern biomedical technologies and advanced medical systems in healthcare and diagnostic applications. (K3)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	2
CO2	3	-	-	-	2	-	-	-	-	-	-	2	2
CO3	3	-	-	-	-	-	-	-	-	-	-	2	2
CO4	3	-	-	-	-	-	-	-	-	-	-	2	2
CO5	3	-	-	-	-	-	-	-	-	-	-	2	2
CO6	3	-	-	-	-	-	-	-	-	-	-	2	2

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24ECEL523	BIOMEDICAL SIGNAL & IMAGE PROCESSING	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 108105101	SYLLABUS VERSION 1.0	SDG NO. 3, 4, 9				
PRE-REQUISITE COURSES	24ECPC301, 24ECPC502					

OBJECTIVES:

- To introduce biomedical signal acquisition and processing techniques
- To develop understanding of medical imaging systems
- To enable analysis of physiological signals and medical images
- To introduce machine learning methods for clinical decision support
- To provide exposure to modern AI-based healthcare applications

MODULE - I BIOMEDICAL SIGNALS & ACQUISITION SYSTEMS 7

Nature and characteristics of biomedical signals – Physiological origin of bioelectric signals – Types of biomedical signals : ECG, EEG, EMG – Biomedical signal acquisition systems – Electrodes and biosensors – Signal conditioning and amplification – Sampling and Quantization of Biomedical Signals – Noise and artifacts in biomedical signals – Introduction to biomedical signal analysis – Introduction to clinical signal databases

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - II BIOMEDICAL SIGNAL PROCESSING TECHNIQUES 8

Filtering for artifact removal – ECG baseline wander removal – Power-line interference suppression – Motion and electrode artifacts – Digital filtering review for biomedical applications Wavelet-based denoising – Feature extraction : Peak detection and Envelope extraction

MODULE - III ANALYSIS OF BIOMEDICAL SIGNALS 8

ECG signal analysis : ECG waveform characteristics , QRS detection, Heart rate variability analysis, Arrhythmia detection – EEG signal analysis : Brain rhythms , Spectral analysis , Epileptic seizure detection – EMG signal analysis : Muscle activity analysis. ,

MODULE - IV MEDICAL IMAGE FORMATION & ENHANCEMENT 7

Medical imaging modalities – Digital Image Fundamentals : Image representation, Spatial sampling, Gray-level transformations, Histogram processing – Image enhancement techniques : Spatial and frequency filtering, Noise models and restoration techniques – Image quality evaluation

MODULE - V MEDICAL IMAGE ANALYSIS & SEGMENTATION 8

Edge detection techniques – Thresholding and region-based segmentation – Clustering methods: k-means segmentation – Morphological image processing – Feature extraction: shape and texture features – Medical image registration and fusion techniques.

MODULE - VI MACHINE LEARNING & CLINICAL APPLICATIONS 7

Pattern recognition basics - Classification methods (k-NN- SVM- basics of ANN) - Introduction to deep learning (CNN for medical images) - Computer Aided Diagnosis - Clinical applications: tumor detection, ECG classification , biomedical case studies

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Rangaraj M. Rangayyan - Biomedical Signal Analysis- Wiley-IEEE Press (John Wiley & Sons)- 2nd Edition- 2015
2. Prince- J. & Links- J. Medical Imaging Signals and Systems- Prentice Hall
3. Gonzalez & Woods - Digital Image Processing- Pearson - 5th edition (2022).

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

REFERENCE BOOKS:

1. Willis J. Tompkins - Biomedical Digital Signal Processing - Prentice Hall / Pearson - second edition - 600 pages - ISBN: 978-0130833186
2. Christopher Bishop - Pattern Recognition and Machine Learning- Springer - first edition 2006 - 700 pages - ISBN: 978-0387310732
3. Ian Goodfellow- Yoshua Bengio- and Aaron Courville - Deep Learning - MIT Press - 2016 - Adaptive Computation and Machine Learning series - ISBN 978-0262035613
4. Kayvan Najarian & Robert Splinter – Biomedical Signal and Image Processing -CRC Press- 2012.
5. John G. Proakis & Manolakis – Digital Signal Processing - Pearson- 2014.

ONLINE RESOURSES:

1. https://nptel.ac.in/courses/108105101
2. https://nptel.ac.in/courses/108105091
3. https://nptel.ac.in/courses/117105079

WEB RESOURSES:

1. https://openneuro.org/
2. https://physionet.org/about/tutorial/
3. https://github.com/topics/biomedical-signal-processing
4. https://www.mathworks.com/discovery/biomedical-signal-pro

OUTCOMES:

At the end of this course, the students should be able to:

1. Demonstrate the physiological origin, fundamental characteristics, acquisition techniques, and artifacts of biomedical signals and medical images. (K3)
2. Apply signal processing techniques for noise removal, feature extraction, and enhancement of biomedical signals.(K3)
3. Analyze ECG, EEG, and EMG signals using time-domain, frequency-domain, and machine learning approaches. (K4)
4. Apply image enhancement and restoration techniques for improving medical image quality. (K3)
5. Analyze biomedical images and segmentation methods for pattern recognition and classification. (K4)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

6. Analyze machine learning and deep learning methods for the classification of biomedical signals and medical images in computer-aided diagnosis systems. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	3	2
CO2	3	-	-	-	-	-	-	-	-	-	-	3	2
CO3	2	3	-	-	-	-	-	-	-	-	-	3	2
CO4	3	-	-	-	-	-	-	-	-	-	-	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3	2
CO6	3	3	-	-	3	-	-	-	-	-	3	3	2

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24ECEL524	NEURAL SIGNAL PROCESSING AND ITS APPLICATION	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 108108167	SYLLABUS VERSION 1.0	SDG NO. 4				
PRE-REQUISITE COURSES	24ECPC301, 24ESMC301					

OBJECTIVES:

- To explain the fundamentals of brain structure, neural signals, and different types of Brain-Computer Interface Systems (BCI).
- To describe the principles of neural signal acquisition using modalities such as EEG, ECoG, MEG, and fMRI.
- Explain brain activation patterns and various evoked potentials related to motor, sensory, and cognitive activities.
- To apply signal processing and feature extraction techniques to analyze brain signals in BCI systems.
- To describe machine learning methods and explain real-world applications of BCI along with ethical considerations.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

MODULE - I FUNDAMENTALS OF BRAIN AND BRAIN COMPUTER INTERFACE **7**

Introduction - Brain structure and function, Brain Computer Interface Types - Synchronous and Asynchronous -Invasive BCI -Partially Invasive BCI - Non Invasive BCI.

MODULE - II BRAIN COMPUTER INTERFACE SIGNALS AND ITS ACQUISITION **7**

Structure of BCI System, BCI Monitoring Hardware, Electroencephalography, Electrocorticography, Magnetoencephalography, Functional Magnetic Resonance Imaging.

MODULE - III BRAIN ACTIVATION SIGNALS **8**

Brain activation patterns - Spikes, Oscillatory potential and ERD, Slow cortical potentials, Movement related potentials-Mu rhythms, motor imagery, Stimulus related potentials - Visual Evoked Potentials – P300 and Auditory Evoked Potentials, Potentials related to cognitive tasks.

MODULE - IV FEATURE EXTRACTION AND SIGNAL PROCESSING **8**

Data Processing – Spike sorting, Frequency domain analysis, Wavelet analysis, Time domain analysis, Spatial filtering - Principal Component Analysis (PCA), Independent Component Analysis (ICA), Artifacts reduction, Feature Extraction - Phase synchronization and coherence.

MODULE - V MACHINE LEARNING FOR BRAIN COMPUTER INTERFACE **7**

Classification techniques –Binary classification, Ensemble classification, Multiclass Classification, Evaluation of classification performance, Regression - Linear, Polynomial, RBF's, Perceptron's, Multilayer neural networks, Support vector machine, Graph theoretical functional connectivity analysis.

MODULE - VI APPLICATIONS OF BRAIN COMPUTER INTERFACE **8**

Case Studies - Invasive BCIs: decoding and tracking arm (hand) position, controlling prosthetic devices such as orthotic hands, Cursor and robotic control using multi electrode array implant, Cortical control of muscles via functional electrical stimulation. Noninvasive BCIs:P300 Mind Speller, Visual cognitive BCI, Emotion detection. Ethics of Brain Computer Interfacing.

TOTAL : 45 PERIODS

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

TEXT BOOKS

1. Tom M. M1. Rajesh.P.N.Rao, "Brain-Computer Interfacing: An Introduction", Cambridge University Press, First edition, 2013.
2. Jonathan Wolpaw, Elizabeth Winter Wolpaw, "Brain Computer Interfaces: Principles and practice", Oxford University Press, USA, First Edition , January 2012.

REFERENCES:

1. Ella Hassianien, A & Azar.A.T (Editors), "Brain-Computer Interfaces Current Trends and Applications", Springer, 2015.
2. Bernhard Graimann, Brendan Allison, GertPfurtscheller, "Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction", Springer, 2010
3. Ali Bashashati, MehrdadFatourechi, Rabab K Ward, Gary E Birch," A survey of signal Processing algorithms in brain–computer interfaces based on electrical brain signals" Journal of Neural Engineering, Vol.4, 2007, PP.32-57
4. Arnon Kohen, "Biomedical Signal Processing", Volume I and II, CRC Press Inc, Boca Rato, Florida.
5. Bishop C.M., "Neural networks for Pattern Recognition", Oxford, Clarendon Press, 1995.
6. Andrew Webb, "Statistical Pattern Recognition", Wiley International, Second Edition, 2002.

WEB RESOURCES:

1. https://alison.com/course/an-introduction-to-brain-computer-interfaces?utm_source=chatgpt.com
2. https://eeglab.ucsd.edu/wiki/Introduction_To_Modern_Brain-Computer_Interface_Design?utm_source=chatgpt.com

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/108105101
2. https://www.coursera.org/learn/neurohacking

OUTCOMES:

At the end of this course, the students should be able to:

1. Explain the fundamentals of brain structure, neural signals, and different types of Brain-Computer Interface (BCI) systems. (K3)

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

2. Apply the principles of signal acquisition and instrumentation to interpret EEG, ECoG, MEG, and fMRI signals in BCI systems. (K3)
3. Examine brain activation patterns and various neural signals such as spikes, ERD, and evoked potentials for feature identification. (K4)
4. Analyze and apply signal processing and feature extraction techniques including time-frequency analysis, PCA, and ICA for BCI data. (K4)
5. Assess machine learning techniques including classification and regression models for decision-making in BCI systems. (K4)
6. Investigate BCI applications and case studies, including invasive and non-invasive systems, with consideration of ethical issues. (K4)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	1
CO2	3	-	-	-	-	-	-	-	-	-	-	3	1
CO3	2	3	-	-	-	-	-	-	-	-	-	2	1
CO4	3	3	-	-	-	-	-	-	-	-	-	3	1
CO5	3	2	-	-	-	-	-	-	-	-	-	3	2
CO6	2	2	-	-	-	-	-	-	-	-	-	2	3

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 05.06.2026

CHAIRMAN
Board of Studies
Electronics and Communication Engineering

Imagine the Future and
Make it happen!





Together let's build a better world where there is **NO POVERTY** and **ZERO HUNGER.**

We have **GOOD HEALTH AND WELL BEING** **QUALITY EDUCATION** and full **GENDER EQUALITY** everywhere.

There is **CLEAN WATER AND SANITATION** for everyone. **AFFORDABLE AND CLEAN ENERGY**

which will help to create **DECENT WORK AND ECONOMIC GROWTH.** Our prosperity shall be fuelled

by investments in **INDUSTRY, INNOVATION AND INFRASTRUCTURE** that will help us to

REDUCE INEQUALITIES by all means. We will live in **SUSTAINABLE CITIES AND COMMUNITIES.**

RESPONSIBLE CONSUMPTION AND PRODUCTION will help in healing our planet.

CLIMATE ACTION will reduce global warming and we will have abundant,

flourishing **LIFE BELOW WATER**, rich and diverse **LIFE ON LAND.**

We will enjoy **PEACE AND JUSTICE** through **STRONG INSTITUTIONS**

and will build long term **PARTNERSHIPS FOR THE GOALS.**

For the goals to be reached, everyone needs to do their part: governments, the private sector, civil society and **People like you.**

Together we can...

Sai Prakash Leo Muthu

Chairman & CEO – Sairam Institutions

We build a Better nation through Quality education.

Sairam
INSTITUTIONS



Sri
SAI RAM
ENGINEERING COLLEGE

An Autonomous Institution
Affiliated to Anna University & Approved by AICTE, New Delhi

*Accredited by **NBA** and **NAAC "A+"***
***IS/ISO** 21001 : 2018 (EOMS) Certified by BIS*
*and **NIRF** ranked institution*

College Campus
Sai Leo Nagar, West Tambaram,
Chennai - 600 044. Ph : 044-2251 2222

Administrative Office
"Sai Bhavan", 31B, Madley Road, T.Nagar,
Chennai - 600 017. Ph : 044-4226 7777
e-mail : sairam@sairamgroup.in

www.sairamgroup.in

