Sri

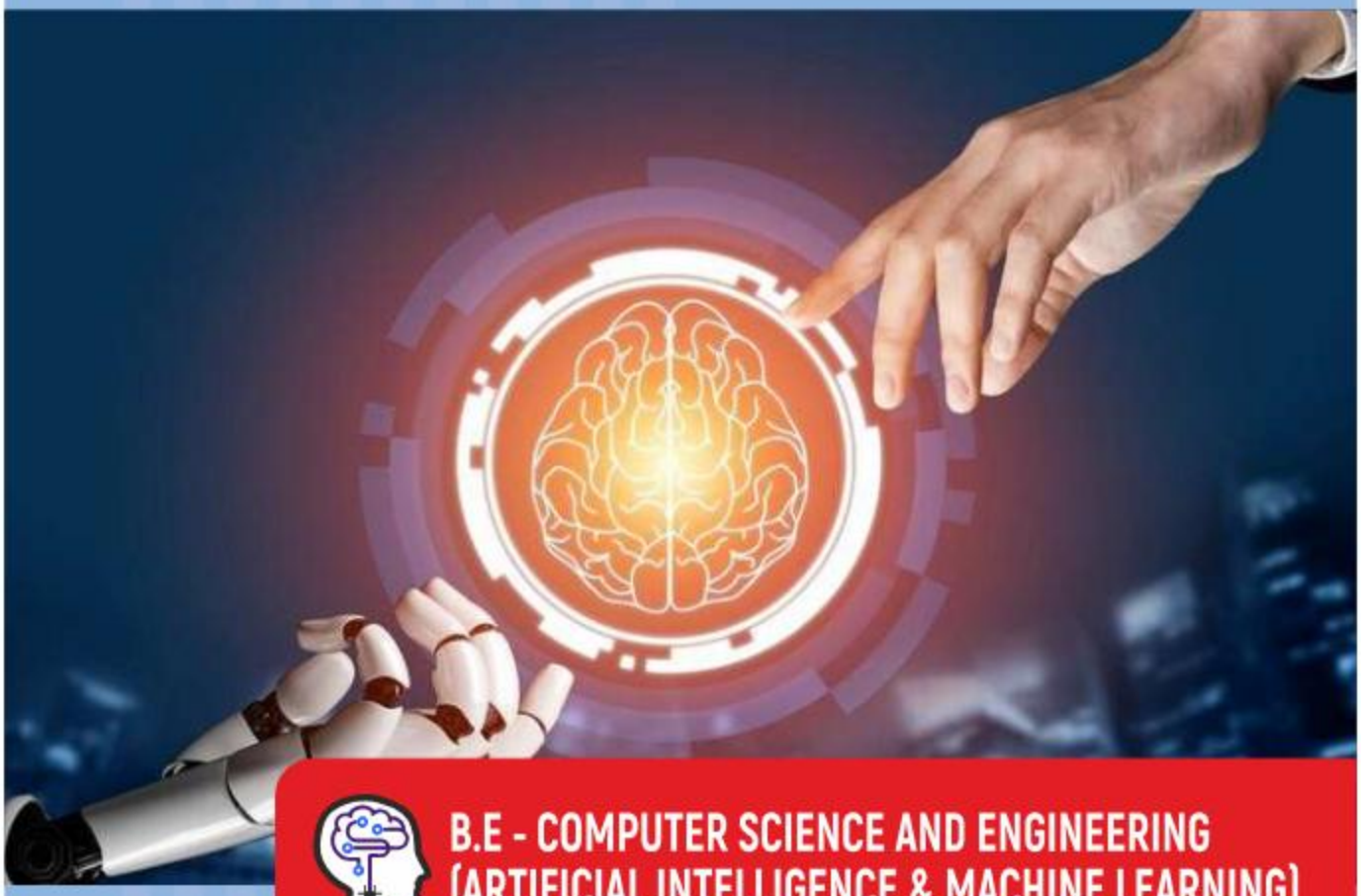
SAI RAM ENGINEERING COLLEGE

An Autonomous Institution

West Tambaram, Chennai - 44

www.sairam.edu.in

Approved by AICTE, New Delhi
Affiliated to Anna University



B.E - COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

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

B.E - COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

VISION

To emerge as a "Centre of Excellence" in the field of Artificial Intelligence and Machine Learning by providing required skill sets, domain expertise and interactive industry interface for students and shape them to be a socially conscious and responsible citizen.

MISSION

Computer Science and Engineering (Artificial Intelligence and Machine Learning), Sri Sairam Engineering College is committed to

- **M1** Nurture students with a sound understanding of fundamentals, theory and practice of AI & ML.
- **M2** Develop students with the required skill sets and enable them to take up assignments in the field of AI & ML
- **M3** Facilitate Industry Academia interface to update the recent trends in AI & ML
- **M4** Create an appropriate environment to bring out the latent talents, creativity and innovation among students to contribute to the society.

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	24ESID101	Idea Engineering Lab -I	0	0	2	2	1
2	24ENTP101	Functional Life Skills	1	0	1	2	1
ONLINE SUPPLEMENTARY							
		As recommended by BOS					
				Total		30	25

SEMESTER II

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			CONTACT PERIODS	CREDITS
			L	T	P		
THEORY							
1	24BSMA201	Discrete Structures	3	1	0	4	4
2	24HSEN201	Professional English	2	0	0	2	2
3	24BSPH203	Physics for Information Science	3	0	0	3	3
4	24BSCY201	Chemistry for Environment and Sustainability	3	0	0	3	3
5	24HSTA201	Tamils and Technology	1	0	0	1	1
6	24HSNC201	NCC Course Level 1*	2	0	0	2	0
PRACTICALS							
1	24ESGE102	Engineering Practices Laboratory	0	0	4	4	2
2	24AMPT201	Python Programming Laboratory with Theory	1	0	4	5	3
VALUE ADDITIONS - II							
1	24ENTP201	Digital Dynamics	1	0	1	2	0
2	24ESID201	Idea Engineering Lab - II	0	0	2	2	1
ONLINE SUPPLEMENTARY							
1	24ESMC201	MS Office (Mandatory - NC)	0	0	0	0	0
				Total		26	19

*only for NCC cadets

Approved by
Academic Council Meeting
No. 08 Dated: 3.9.2024

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

AUTONOMOUS CURRICULA AND SYLLABI
Regulations 2024

SEMESTER III

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			CONTACT PERIODS	CREDITS
			L	T	P		
THEORY							
1	24BSMA303	Probability and Statistical Modeling	3	1	0	4	4
2	24AMPC301	Fundamentals of Artificial Intelligence	3	0	0	3	3
3	24AMPC302	Foundations of Data Structures and Algorithm Design	3	0	0	3	3
4	24AMPC303	Operating System	3	0	0	3	3
5	24HSMC301	Universal Human Values - II Understanding Harmony	3	0	0	3	3
6	24HSNC301	NCC Course Level 2*	3	0	0	3	0
PRACTICALS							
1	24AMPL302	Data Structures and Algorithm Design Laboratory	0	0	4	4	2
2	24AMPT301	Database Management Systems Laboratory with Theory	1	0	4	5	3
VALUE ADDITIONS - III							
1	24AMTP301	Aptitude Skills - I	0	0	2	2	1
2	24AMID301	Innovative Design Lab - I	0	0	2	2	1
ONLINE SUPPLEMENTARY							
1	24ESMC302	Programming in JAVA (Mandatory - NC)	0	2	0	2	0
				Total		31	23

*only for NCC cadets

SEMESTER IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			CONTACT PERIODS	CREDITS
			L	T	P		
THEORY							
1	24BSMA407	Linear Algebra and its Applications	3	1	0	4	4
2	24AMPC401	Nature Inspired Computing Techniques	3	0	0	3	3
3	24AMPC402	Computer Networks and Security	3	0	0	3	3
4	24AMPW401	Machine Learning Techniques with Laboratory	3	0	2	5	4
5	24xxOExxx	Open Elective - I #	3	0	0	3	3
6	24HSNC401	NCC Course Level 3*	3	0	0	3	0
PRACTICALS							
1	24AMPT401	Web Development Framework Laboratory with Theory	1	0	4	5	3
VALUE ADDITIONS - IV							
1	24AMTP401	Aptitude Skills - II	0	0	2	2	0
2	24AMID401	Innovative Design Lab - II	0	0	2	2	1
ONLINE SUPPLEMENTARY							
1		As recommended by BOS					
				Total		27	21

*only for NCC cadets # Logistics Information System

Approved by
Academic Council Meeting
No. 08 Dated: 3.9.2024

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

AUTONOMOUS CURRICULA AND SYLLABI
Regulations 2024

SEMESTER V

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS L	T	P	CP	C	PREREQUISITE COURSES
THEORY								
1	24AMPC501	AI for Human Language Understanding	3	0	0	3	3	24BSMA407, 24AMPT201, 24AMPC301
2	24AMPW501	Big Data Analytics with Laboratory	3	0	2	5	4	24AMPT201, 24AMPT301, 24AMPC302
3	24AIPC403	Deep Learning	3	0	0	3	3	24BSMA40, 24AMPW401
4	24xxEL5xx	Professional Elective - I	3	0	0	3	3	-
5	24xxEL5vv	Professional Elective - II	3	0	0	3	3	-
6	24xxOExxx	Open Elective - II#	3	0	0	3	3	-
7	24MGMC501	Constitution of India	2	0	0	2	0	-
PRACTICALS								
1	24AMPL501	AI for Human Language Understanding Laboratory	0	0	4	4	2	24BSMA407, 24AMPT201 24AMPC301
2	24AIPL401	Deep Learning Laboratory	0	0	4	4	2	24BSMA407, 24AMPW401
VALUE ADDITIONS - V								
1	24AMTP501	Skill Enhancement	0	0	2	2	1	-
2	24AMID501	Prototype Development Lab - I	0	0	2	2	1	-
ONLINE SUPPLEMENTARY								
		As recommended by BoS						
		Total				30	25	

Digital Devices Security, Tools and Technologies For Cyber Security

SEMESTER VI

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS L	T	P	CONTACT PERIODS	CREDITS
THEORY							
1	24AMPC601	Advanced Machine Learning	3	0	0	3	3
2	24xxEL6xx	Professional Elective - III	3	0	0	3	3
3	24xxEL6yy	Professional Elective - IV	3	0	0	3	3
4	24xxEL6zz	Professional Elective - V	3	0	0	3	3
5	24HSMG501	Principles of Engineering Management	3	0	0	3	3
6	24xxOExxx	Open Elective - III	3	0	0	3	3
PRACTICALS							
1	24AMPL601	Advanced Machine Learning Laboratory	0	0	4	4	2
VALUE ADDITIONS - VI							
1	24AMTP601	Technical Skill	0	0	2	2	0
2	24AMID601	Prototype development Lab - II	0	0	2	2	1
ONLINE SUPPLEMENTARY							
		As recommended by BOS					
		Total				31	24

Approved by
Academic Council Meeting
No. 08 Dated: 3.9.2024

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

AUTONOMOUS CURRICULA AND SYLLABI
Regulations 2024

SEMESTER VII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			CONTACT PERIODS	CREDITS
			L	T	P		
THEORY							
1	24AMPC701	Generative Deep Learning with Laboratory	3	0	2	5	4
2	24AIPC601	Robotic Process Automation	3	0	0	3	3
3	24xxEL7xx	Professional Elective - VI	3	0	0	3	3
5	24XXOExxx	Open Elective - IV	3	0	0	3	3
6	24MGEL703	Creative Innovation and Entrepreneurship	2	0	0	2	2
PRACTICALS							
7	24AIPL601	Robotics Laboratory	0	0	4	4	2
8	24AMPJ701	Project work - Phase I	0	0	8	8	4
VALUE ADDITIONS - VII							
9	24AMTP701	Company Specific Skills	0	0	2	2	1
ONLINE SUPPLEMENTARY							
		As recommended by BOS					
		Total				29	22

SEMESTER VIII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			CONTACT PERIODS	CREDITS
			L	T	P		
THEORY							
4	24xxEL8yy	Professional Elective - VII	3	0	0	3	3
PRACTICALS							
1	24AMPJ801	Project Work - Phase II	0	0	12	12	6
VALUE ADDITIONS - VIII							
1	24AMIN801	Internship	0	0	9	9	3
		Total				24	12

Approved by

Academic Council Meeting

No. 08 **Dated:** 3.9.2024

E.N—

CHAIRMAN
Board of Studies
Computer Science and Engineer
(Artificial Intelligence and Machine Learn

AUTONOMOUS CURRICULA AND SYLLABI
Regulations 2024

PROFESSIONAL ELECTIVES - I

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN	PREREQUISITE COURSES
1	24AMEL501	Foundations of Cognitive Science for Engineers	3	Cognitive and Intelligent Technologies	24AMPC302, 24BSMA303, 24AMPW401
2	24AMEL502	Intelligent Data Recognition	3	Cognitive and Intelligent Technologies	24AMPW401, 24AMPC301, 24AMPC302
3	24AMEL505	Object Detection and Recognition Systems	3	Cognitive and Intelligent Technologies	24AMPC302, 24BSMA407
1	24ITEL501	Computer Graphics and Multimedia	3	Computing Technologies	24BSMA201, 24BSMA407
2	24ITEL502	Graph Theory	3	Computing Technologies	24AMPC303, 24AMPC402, 24AMPT301
3	24ITEL511	Distributed Systems	3	Computing Technologies	24AMPT201, 24BSMA407
1	24AIEP502	Visual Perception and Intelligent Systems Laboratory with Theory	3	Automation Tools for AI	24AMPT201, 24BSMA407, 24AMPW401
2	24AIEP503	AI Infrastructure and Optimization Techniques Laboratory with Theory	3	Automation Tools for AI	24AMPT301, 24AMPC303, 24AMPC402
3	24AIEP506	Business Visualization Laboratory with Laboratory	3	Automation Tools for AI	24BSMA303, 24ANPT301
1	24AIEL513	Information Security and Privacy	3	Smart and Secure Systems	24AMPT301, 24AMPC303, 24AMPC402
2	24AIEL514	Embedded Sensor Networks and Middleware Architectures	3	Smart and Secure Systems	24AMPC303, 24AMPC402
3	24AIEL518	IoT Based Smart Systems	3	Smart and Secure Systems	24AMPC402
1	24MGEL5xx	Intellectual Property Rights	3	Management	

Approved by
Academic Council Meeting
No. 08 Dated: 3.9.2024

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

AUTONOMOUS CURRICULA AND SYLLABI
Regulations 2024

PROFESSIONAL ELECTIVES - II

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN	PREREQUISITE COURSES
1	24AMEL503	Intelligent User Interfaces	3	Cognitive and Intelligent Technologies	24AMPC301, 24BSMA302, 24BSMA303
2	24AMEL504	Decision Making Under Uncertainty	3	Cognitive and Intelligent Technologies	24BSMA303, 24AMPC301
3	24AMEP501	Edge AI and Cognitive IoT Laboratory with Theory	3	Cognitive and Intelligent Technologies	24AMPC301, 24AMPW401, 24AMPC402
1	24ITEL503	Cloud Computing	3	Computing Technologies	24AMPC303, AMPC402
2	24ITEL510	Advanced Analysis of Algorithms	3	Computing Technologies	24AMPC302
3	24ITEL512	Parallel Algorithms	3	Computing Technologies	24BSMA201, 24AMPC302, 24AMPC303
1	24AIEP501	Software Design Patterns for Intelligent Automation Laboratory with Theory	3	Automation Tools for AI	24AMPT201, 24AMPC302, 24AMPC301
2	24AIEP504	AI for Enterprise Data Analytics Laboratory with Theory	3	Automation Tools for AI	24AMPT201, 24AMPT301
3	24AIEP505	Artificial Intelligence Applications in Robotics Laboratory with Theory	3	Automation Tools for AI	24AMPT201, 24AMPC301
1	24AIEL515	Data Privacy and Protection Techniques	3	Smart and Secure Systems	24AMPT301, 24AMPC402
2	24AIEL516	Smart Building and Automation Security	3	Smart and Secure Systems	24AMPC303, 24AMPC402
3	24AIEL517	Introduction to Smart and Secure Systems	3	Smart and Secure Systems	24AMPC402
1	24MGEL5vv	Total Quality Management	3	Management	

Approved by
Academic Council Meeting
No. 08 Dated: 3.9.2024

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1 Graduates imbibe fundamental knowledge in Artificial Intelligence, Programming, Mathematical modelling and Machine Learning

PEO2 Graduates will be trained to gain domain expertise by applying the theory basics into practical situation through simulation and modelling techniques.

PEO3 Graduates will enhance the capability through skill development and make them industry ready by inculcating leadership and multitasking abilities

PEO4 Graduates will apply the gained knowledge of AI & ML in Research & Development, Innovation and contribute to the society in making things simpler.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1 The graduates will be in a position to design, develop, test and deploy appropriate mathematical and programming algorithms required for practical applications.

PSO2 The graduates will have the required skills and domain expertise to provide solutions in the field of Artificial Intelligence and Machine Learning for the Industry and society at large.

COMPONENTS OF THE CURRICULUM (COC)

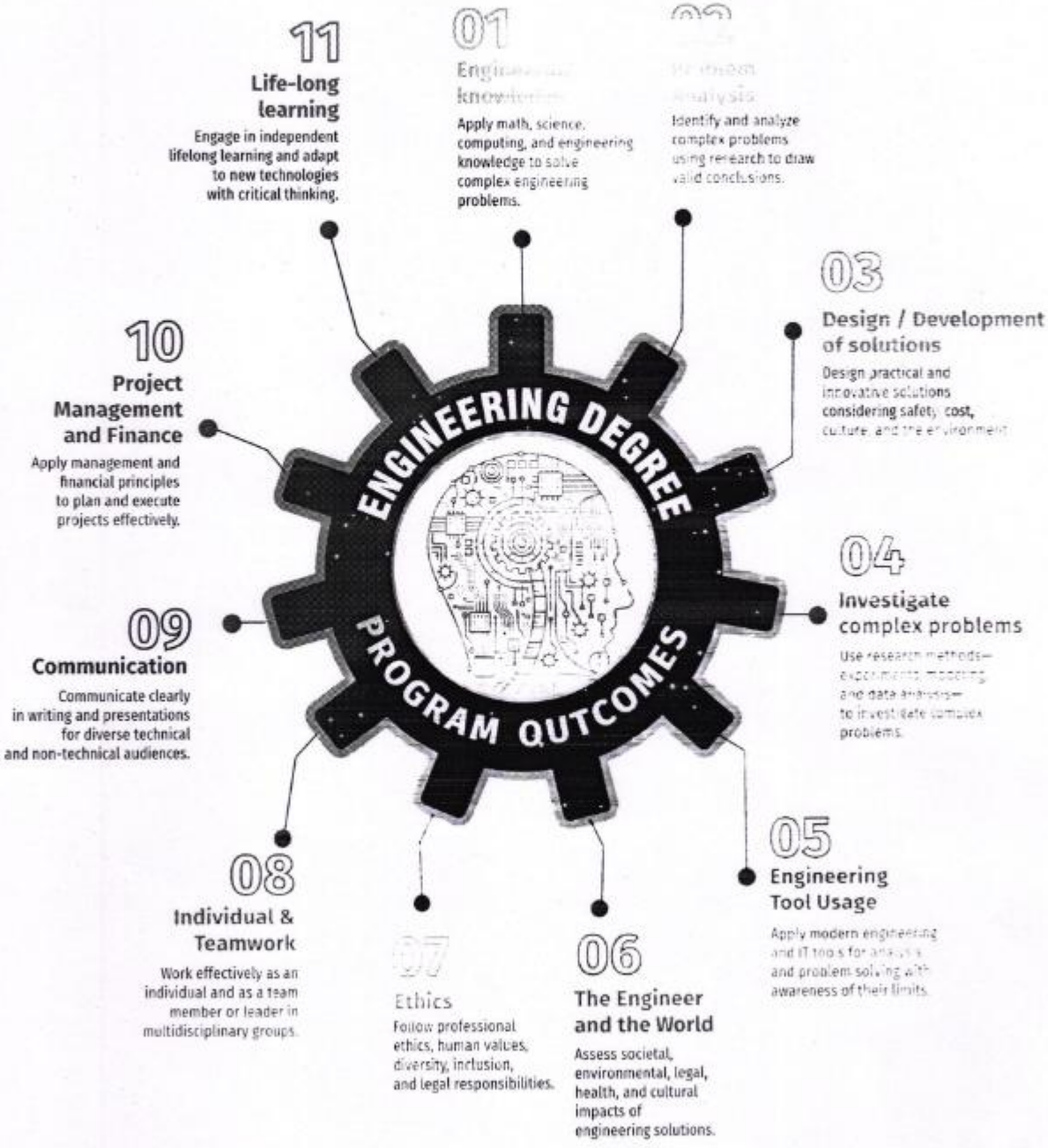
Course Component	Curriculum Content (% of total number of credits of the program)	Total number of contact hours	Total Number of credits
Basic Sciences (BS)	18	32	30
Engineering Sciences (ES)	6	12	09
Humanities and Social Sciences (HS)	8	13	13
Professional Electives (EL)	14	23	23
Program Core + Program Lab (PC+PL)	23	42	36
Program theory with Lab (PW) / Program Lab With Theory (PT)	12	35	22
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		**228**	**168**

Approved by
Academic Council Meeting
No. 8 Dated: 03.09.2024

E.N
CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

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



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: 31/5/24

S. Ramakrishnan
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. 6 Dated: 31/5/2024

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

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/5/2024

S Ramakrishnan
Chairman
Board of Studies
Department of Humanities & Sciences

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. 6 Dated: 31/8/2024

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. 6 Dated: 21/5/2024

S. Narasaka Rao
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 6. 21/5/2024

S. Narasimhan
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. 6 Dated: 21/5/2024

S. Narasakrishnan
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. 6 Dated: 31/5/2024

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	3	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. 6 Dated: 31/5/2024

S. Ramakrishnan
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. 6 Dated: 21/5/2024

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 &CompanyLTD, 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.

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)
2. Recognize the basic principles of electrochemistry and describe their application in battery technologies. (K3)

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/5/2024

S Ramakrishnan
Chairman
Board of Studies
Department of Humanities & Sciences

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: 30.05.24

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: 30.05.24

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 & Flliot 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: 30.05.24

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.

REFERENCES:

1. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University Press, New Delhi, 2015.

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

CHAIRMAN
Board of Studies
Mechanical Engineering

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.

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

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 விடுதலைப் போரில் 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. 6 Dated: 31/5/2024

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. 6 Dated: 31/5/2024

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.

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

Chairman
Board of Studies
Department of Humanities & Sciences

3	Determination of Young's modulus by non-uniform bending method.
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.

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

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

8	Estimation of iron content of the water sample using spectrophotometer (1,10- Phenanthroline / thiocyanate method).
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: 30 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, Parikshit Gogoi, 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 semi conductors by evaluating the band gap, I-V characteristics of solar cell 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 nano particles, analyze the corrosion behaviour of materials in different environments. (K3)

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

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

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

CSE

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.

Recommended by
Board of Studies of CSE dept.
Meeting No. 7 Dated: 30.05.2024

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

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 it.
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

Recommended by
Board of Studies of CSE dept.
Meeting No. 7 Dated: 30.5.2019

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

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

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

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 21/5/2024

Chairman
Board of Studies
Department of Humanities & Sciences

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
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

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

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 - 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)

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/8/2024

Chairman
Board of Studies
Department of Humanities & Sciences

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)

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.

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 21/5/2024

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

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)
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. 6 Dated: 21/5/2024

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

SEMESTER - II

24BSMA201 - SDG NO. 4	DISCRETE STRUCTURES	L	T	P	CP	C
		3	1	0	4	4

OBJECTIVES:

- To understand the fundamental concepts of logic, rules of inference, and quantifiers.
- To learn the principles of mathematical induction, permutations, and combinations.
- To gain knowledge of groups and normal subgroups in abstract algebra.
- To develop graph algorithms using the foundational concepts of graph theory.
- To understand the concepts of lattices and Boolean algebra and their applications.

MODULE - I LOGICS **9**

Basic Connectives – Truth Tables – Logical Equivalence - The Laws of Logic- Logical Implications - Normal Forms – Rules of Inference – The use of Quantifiers.

MODULE - II COMBINATORICS **9**

The Principles of Mathematical Induction – Basic counting techniques – Inclusion and exclusion - Pigeonhole principle – Permutation – Combination.

MODULE - III ALGEBRAIC STRUCTURES WITH ONE BINARY OPERATION **12**

Semi Groups– Monoids– Groups - Subgroups – Cosets- Normal subgroups –Lagrange's theorem.

MODUL - IV GRAPHS **12**

Graphs - Definition -Special types of Graphs- Matrix representation of Graphs - Graph isomorphism- Path, Cycle, Connectivity - Eulerian and Hamiltonian Graphs.

MODULE - V LATTICES **9**

Partial ordering - Posets - Lattices as Posets - Properties of lattices - Lattices as algebraic systems - Sub lattices - Direct product and homomorphism - Some special lattices.

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

Chairman
Board of Studies
Department of Humanities & Sciences

MODULE - VI BOOLEAN ALGEBRA **9**

Boolean Algebra – Definition – Identities of Boolean Algebra -Demorgan's laws.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Discrete Mathematics and its Applications: with Combinatorics and Graph Theory, Kenneth H. Rosen, 7th Edition, Tata McGraw –Hill Education Pvt. Ltd., 2015.
2. Discrete Mathematical Structure with Applications to Computer Science", J.P. Tremblay and R. Manohar, Reprint, McGraw-Hill Education (India), 1997.

REFERENCES:

1. Discrete Mathematics with Applications, Susanna S. Epp, 4th edition, Brooks/Cole, Cengage Learning, 2010.
2. Discrete Mathematics, Norman L. Biggs, 2nd Edition, Oxford University Press, 2002.
3. Discrete Mathematics, Seymour Lipschutz, Marc Lipson, Schaum's Outlines Series, 3rd edition, McGraw-Hill Education, 2009.
4. Elements of Discrete Mathematics: A Computer Oriented Approach, C. L. Liu and D. P. Mohapatra, 4th Edition, Tata McGraw –Hill Education Pvt. Ltd., 2012.

WEB REFERENCES:

1. https://web.stanford.edu/class/cs103x/cs103x-notes.pdf
2. https://www.cs.cornell.edu/~rafael/discmath.pdf
3. http://home.iitk.ac.in/~arlal/book/mth202.pdf
4. https://drive.google.com/file/d/1-PqMUlqDim1-AHQK5_zL34l97zHV3W15/view

ONLINE RESOURSES:

1. https://nptel.ac.in/courses/106106183
2. https://www.youtube.com/watch?v=xlUFkMKSB3Y&list=PL0862D1A947252D20
3. https://www.youtube.com/watch?v=4LlTmsfDS4Y&list=PLEAYkSg4uSQ2Wfc_l4QEZUSRdx2ZcFziO&index=13
4. https://www.youtube.com/watch?v=jBsEKyx6Rj0&list=PLwdnzlV3ogoVxVxCTlI45pDVM1aoYoMHf
5. https://www.youtube.com/watch?v=rdXw7Ps9vxc&list=PLHXZ9OQGMqxer3kBFbxfL0M3Ux0DBqsKZS

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 21/5/2024

Chairman
Board of Studies
Department of Humanities & Sciences

COURSE OUTCOMES:

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

1. Construct mathematical arguments using logical connectives, quantifiers and verify the correctness of an argument using symbolic logic, truth tables. (CO1) (K3)
2. Apply counting principle and mathematical induction to solve combinatorial problems. (CO2) (K3)
3. Explain the fundamental concepts of algebraic structures such as groups and Boolean algebra. (CO3) (K3)
4. Illustrate the concepts of graphs. (CO4) (K3)
5. Apply the concepts of Lattices in the field of computer science. (CO5) (K3)
6. Apply the concepts of Boolean algebra in logical circuits. (CO6) (K3)

CO-PO, 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	2
CO4	3	-	-	-	-	-	-	-	-	-	-	3	3
CO5	3	-	-	-	-	-	-	-	-	-	-	3	2
CO6	3	-	-	-	-	-	-	-	-	-	-	3	2

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
- Develop skills for preparing effective job application

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/5/2024

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

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 1745 dept.
Meeting No. 6 Dated: 31/5/24

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: 31/5/2024

S. Ramakrishnan
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

24BSPH203 - SDG NO. 4,7,9	PHYSICS FOR INFORMATION SCIENCE	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To understand the essential principles of physics of conducting materials.
- To educate the basic principles of semiconductor device and electron transport properties.
- To become proficient in magnetic materials.
- To acquaint the basics of superconducting and optical materials.
- To acquire the basic working of nanoelectronic devices.
- To understand the basics of quantum computing.

MODULE - I CONDUCTING MATERIALS 8

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

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

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

MODULE - II SEMICONDUCTOR MATERIALS 7

Direct and indirect band gap semiconductors - Intrinsic Semiconductors - Carrier concentration in intrinsic semiconductors - Extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors - Variation of carrier concentration with temperature - Variation of Fermi level with temperature and impurity concentration - Carrier transport in Semiconductor: random motion, drift, mobility and diffusion - Hall effect and devices.

MODULE - III MAGNETIC PROPERTIES OF MATERIALS 8

Magnetic dipole moment - atomic magnetic moments - magnetic permeability and susceptibility - Magnetic material classification: diamagnetism - paramagnetism - ferromagnetism - antiferromagnetism - ferrimagnetism - Ferromagnetism: Domain Theory - M versus H behaviour - Hard and soft magnetic materials - applications – Magnetic principle in computer data storage - Magnetic hard disc - GMR sensor.

MODULE - IV SUPERCONDUCTING & OPTICAL PROPERTIES OF MATERIALS 7

Superconductivity - Type-I and Type-II superconductors - Properties and applications - Classification of optical materials - Absorption and emission of light in metals, semiconductors and insulators - Carrier generation and recombination processes - Solar cell - LED - Organic LED - Optical data storage techniques and devices.

MODULE - V NANO DEVICES 8

Introduction - Size dependence of Fermi energy - Quantum confinement - Quantum structures - Density of states in quantum well, quantum wire and quantum dot structure - Band gap of nanomaterials - Tunneling: single electron phenomena and single electron transistor - Quantum dot laser - Carbon nanotubes: Properties and applications.

MODULE - VI QUANTUM COMPUTING 7

Quantum system for information processing - quantum states - classical bits – quantum bits or qubits – multiple qubits – Bloch sphere - Superposition - Entanglement - quantum gates - CNOT gate - Types of Quantum Computer: Quantum Annealer- Analog Quantum- Universal Quantum.

TOTAL: 45 PERIODS

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

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

TEXT BOOKS:

1. Jasprit Singh, "Semiconductor Devices: Basic Principles", Wiley 2012.
2. Kasap, S.O., "Principles of Electronic Materials and Devices", McGraw- Hill Education, 2017.
3. Kittel, C., "Introduction to Solid State Physics", Wiley, 2018.
4. S.O.Pillai, "Solid State Physics, New Academic Science", 2017.
5. D.K.Bhattacharya & Poonam Tandon., "Physics for Information Science and Electronics Engineering", Oxford Higher Education", 2017.

REFERENCES:

1. Garcia, N. & Damask, A., "Physics for Computer Science Students", Springer -Verlag, 2012.
2. Hanson, G.W., "Fundamentals of Nanoelectronics", Pearson Education, 2009.
3. Rogers, B., Adams, J. & Pennathur, S., "Nanotechnology: Understanding Small Systems", CRC Press, 2014.

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. Have an insight into the different types of magnetic materials and magnetic data storage device (K3)
4. Analyze the properties of superconductors and optical interactions in materials and explain the working of optoelectronic and optical storage devices (K4)
5. Examine quantum confinement and quantum structures, analyze the working principles of quantum devices, and explore the applications of carbon nanotubes (K4)
6. Apply the basic concepts of quantum computing to demonstrate the operation of quantum gates and the formation of entangled states (K3)

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

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

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 - 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.

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/5/2024

Chairman
Board of Studies
Department of Humanities & Sciences

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).

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

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/24

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

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.

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.

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

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

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)
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	-	-	-	-	-	-

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

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

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 கட்டுமானங்கள்ூசங்க காலத்தில் வீட்டுப்பொருட்களில் 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

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.

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/8/2024

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

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.

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.)

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2023

S Ramakrishnan
Chairman
Board of Studies
Department of Humanities & Sciences

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.
   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)

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 21/5/2024

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	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: 31/5/2024

S. Narasakarthikeyan
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: 31/5/2024

S. Narasakkumar
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: 31/5/2024

S Ramakrishnan
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.
6. Simulation of Half Wave Rectifier and Full Wave Rectifier using TinkerCAD.

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

CHAIRMAN
Board of Studies
Mechanical Engineering

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, planing 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.

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

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

CHAIRMAN
Board of Studies
Mechanical Engineering

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	

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

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

CHAIRMAN
Board of Studies
Mechanical Engineering

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 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

24AMPT201 106106182 SDG NO. 4 & 9	PYTHON PROGRAMMING LABORATORY WITH THEORY	L	T	P	CP	C
		1	0	4	5	3

OBJECTIVES:

- To teach essential problem-solving skills and the use of flowcharts and pseudocode.
- To develop simple Python programs with conditionals and loops.
- To define Python functions and to implement lists, tuples, dictionaries and sets.
- To comprehend the file and exception handling concepts .
- To understand NumPy and Pandas.

MODULE - I COMPUTATIONAL THINKING AND PROBLEM SOLVING **10**

Fundamentals of Computing – Identification of Computational Problems - Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).

LIST OF EXPERIMENTS:

a. Write a program to find minimum in a list.
b. Write a program to insert a card in a list of sorted cards.
c. Get the height and weight value of five persons. Write a function BMI_Calc ( ) to calculate the BMI. (BMI = weight / height 2) using all four prototypes.

MODULE - II PYTHON PROGRAMMING FUNDAMENTALS **10**

Introduction to Python: Interactive and Script Mode - Indentation and Comments - Variables and Reserved Words - Data Types - Operators and their Precedence - Expressions - Built-in Functions- Importing from Packages.

LIST OF EXPERIMENTS:

Write a python program using simple data types. Get the input from the keyboard. (Do not use built-in functions).

a. To find the square and cube of a number
b. To find the roots of a quadratic equation
c. To find the square root and cube root of a number
d. To calculate Simple Interest

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 04 Dated: 31.05.2024

E.N
CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

MODULE - III CONTROL STRUCTURES AND FUNCTIONS **10**

Decision Making and Branching: if, if-else, nested if, multi-way if-elif statements - Looping: while loop, for loop, else clauses in loops, nested loops - Break, continue and pass statements - Functions: Parameters and Arguments (Positional, Keyword, Default values) - Local and Global Scope of Variables - Functions with Arbitrary Arguments - Recursive Functions - Lambda Functions.

LIST OF EXPERIMENTS:

a. Write a code to get the age of a person and print an age group. (Infant, Children, Adolescents, Adults, Older adults)

b. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.

c. Write a python program to print Pascal triangle using for loop.

d. Write a program to print the multiplication table of the number entered by the user.

MODULE - IV COLLECTIONS AND STRINGS **10**

Lists: Create, Access, Slicing, Negative Indices, List Methods, List Comprehensions - Tuples: Create, Indexing and Slicing, Operations on Tuples - Dictionary: Create, Add, Replace Values, Operations on Dictionaries - Sets: Creation and Operations - Strings: Comparison, Formatting, Slicing, Splitting, Stripping.

LIST OF EXPERIMENTS:

a. Make a program that displays your favourite actor/actress and print the word 'lucky' inside the string.

b. Print the day, month, year in the form "Today is 2/2/2016".

c. Given an article, split it based on phrases.

MODULE - V FILES AND EXCEPTION **10**

Files: Create, Open, Read, Write, Append, Close - Tell and Seek Methods. Errors and Exceptions: Syntax Errors, Exception types, Handling Exceptions, Raising Exceptions.

LIST OF EXPERIMENTS:

a. Write a program to read a file and display its contents along with line numbers before each line. Also, handle EOF error.

b. Suppose a file contains student's records with each record containing name and age of a student. Write a program to read these records and display them in sorted order by name. How will you handle if file is not found.

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 04 Dated: 31.05.2024

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

MODULE - VI MODULES AND PACKAGES **10**

Built-in Modules - User-Defined Modules - Packages: NumPy, Pandas, Scikit learn-Visualization Matplotlib package – Plotting Graphs.

LIST OF EXPERIMENTS:

a. Perform Matrix operations using NumPy.
b. Perform Dataframe operations using Pandas.
c. Use Matplotlib on the dataset and visualize.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Reema Thareja, "Python Programming Using Problem Solving Approach", Oxford University Press 2018.
2. Anurag Gupta, G.P. Biswas, "Python Programming: Problem Solving, Packages and Libraries", McGrawHill, 2020.

REFERENCES:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Second edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2", Network Theory Ltd., 2011.
3. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press , 2013
4. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
5. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
6. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.

WEB REFERENCES:

1. http://greenteapress.com/wp/think-python/
2. www.docs.python.org
3. https://nptel.ac.in/courses/106/106/106106182/

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 04 Dated: 31.05.2024

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

OUTCOMES:

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

1. Apply computational thinking strategies to formulate algorithms using iteration, recursion for solving real-world problems. (K3)
2. Develop programs that apply decision-making constructs to control logical flow effectively. (K3)
3. Build solutions using arbitrary argument functions, recursive functions, and lambda functions for practical applications. (K3)
4. Make use of problem-solving techniques to manage and manipulate data collections and perform string operations. (K3)
5. Implement file operations with error and exception handling to ensure robust and error-free program execution. (K3)
6. Utilize Python modules like NumPy, Pandas, and Matplotlib for efficient data processing and visualization. (K3)

CO-PO, PSO MAPPING:

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

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

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

S Narasimhan
Chairman
Board of Studies
Department of Humanities & Sciences

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

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

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

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

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. Demonstrate basic understanding of effective online communication techniques (K1)
2. Show and utilize fundamental computer skills (K1)
3. Comprehend and apply the use of virtual platforms to enhance communication reachability (K2)
4. Understand and implement principles of digital ethics (K2)
5. Use basic technologies for securing data and maintaining information integrity (K1)
6. Understand the importance of standardization and adhere to BIS (K2)

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

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	-	2	-	-
CO2	-	-	-	-	-	-	-	-	2	-	2	-	-
CO3	-	-	-	-	-	-	-	-	2	-	2	-	-
CO4	-	-	-	-	-	-	-	-	2	-	2	-	-
CO5	-	-	-	-	-	-	1	-	2	-	2	-	-
CO6	-	-	-	-	-	-	1	-	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 understand the effectiveness of SDGs and implementation strategy

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/5/2024

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

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
- 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

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

Chairman
Board of Studies
Department of Humanities & Sciences

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.
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: 31/5/2024

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

SEMESTER - III

24BSMA303 SDG NO. 4	PROBABILITY AND STATISTICAL MODELLING	L	T	P	CP	C
		3	1	0	4	4

OBJECTIVES:

- The aim of this course is to provide a solid foundation in Probability and Statistics thereby students' master statistical tools and models that are of relevance to various fields of Engineering.

MODULE - I PROBABILITY AND RANDOM VARIABLES **12**

Introduction to Probability and Conditional probability - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

MODULE - II TWO DIMENSIONAL RANDOM VARIABLES **9**

Joint distributions – Marginal and conditional distributions – Covariance – Central limit theorem (for independent and identically distributed random variables).

MODULE - III LINEAR REGRESSION MODELS AND ANALYSIS OF VARIANCE **9**

Simple linear regression and correlation, multiple regression and multiple correlation. Test of hypothesis – concept and formulation, Type I and Type II errors. Neyman Pearson lemma (Statement only), Procedures of testing. Analysis of Variance (one-way, two-way with as well as without interaction).

MODULE - IV NON-PARAMETRIC INFERENCE **12**

Comparison with parametric inference, use of order statistics, Sign test, Wilcoxon signed rank test, Mann-Whitney test, Run test, Kolmogorov-Smirnov test, Spearman's and Kendall's test. Tolerance region.

MODULE - V ESTIMATION **9**

Point estimation, criteria for good estimates (unbiasedness, consistency), Methods of estimation including maximum likelihood estimation.

MODULE - VI TIME SERIES ANALYSIS AND FORECASTING **9**

Basics of Time Series: Stationary, ARIMA Models: Identification, Estimation and Forecasting.

TOTAL: 60 PERIODS

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

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

TEXT BOOKS:

1. Probability and Statistics for Engineers, I. R. Miller, J. E. Freund and R. Johnson, 8th Edition, Prentice Hall India Learning Pvt. Ltd., 2011.
2. Introduction to Probability Models, S. M. Ross, 11th Edition, Academic Press Inc., 2014.
3. 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.
4. The Analysis of Time Series: An Introduction, Chris Chatfield, 6th Edition, Chapman & Hall, 2003

REFERENCES:

1. A first course in Probability, S. M. Ross, 9th Edition, Pearson Education, India, 2013.
2. Introduction to the Theory of Statistics, A. M. Mood, F. A. Graybill and D.C. Boes, 3rd Edition, McGraw-Hill Education, 2017.
3. Introduction to Linear Regression Analysis, D. C. Montgomery and E. Peck., 5th Edition, Wiley, 2012.
4. Applied Regression Analysis, N. Draper and H. Smith., 3rd Edition, Wiley-Interscience, 1998.
5. Time Series Analysis, James D. Hamilton, 1st Edition, Princeton University Press, 1994.

WEB REFERENCES:

1. https://www.stat.berkeley.edu/~aldous/134/gravner.pdf
2. https://home.iitk.ac.in/~shalab/regression/Chapter2-Regression-SimpleLinearRegressionAnalysis.pdf
3. https://dl.icdst.org/pdfs/files3/22a131fac452ed75639ed5b0680761ac.pdf
4. https://otexts.com/fpp2/arima.html

ONLINE RESOURCES:

1. https://www.nptel.ac.in/courses/110107113/
2. https://nptel.ac.in/courses/103106123/
3. https://archive.nptel.ac.in/courses/111/102/111102111/

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

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

COURSE OUTCOMES

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

1. Apply fundamental concepts of probability, random variables, and probability distributions to solve practical problems. (K3)
2. Apply concepts of joint, marginal, and conditional distributions, covariance, and the Central Limit Theorem to solve problems involving two-dimensional random variables. (K3)
3. Analyze linear regression models and hypothesis testing procedures, including ANOVA, to evaluate data relationships. (K4)
4. Analyze non-parametric inference methods for hypothesis testing when parametric assumptions are violated. (K4)
5. Apply suitable point estimation methods, including maximum likelihood estimation, and evaluate estimators based on properties such as unbiasedness and consistency. (K3)
6. Apply time series data through ARIMA modelling for accurate forecasting and trend analysis. (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	-	-	-	-	-	-	-	-	-	3	2
CO4	-	3	-	-	-	-	-	-	-	-	-	2	2
CO5	3	-	-	-	-	-	-	-	-	-	-	2	2
CO6	3	-	-	-	-	-	-	-	-	-	-	2	2

SEMESTER - III

24AMPC301 106102220 SDG NO. 4	FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To understand various characteristics of Intelligent agents.
- To learn the different search strategies in AI.
- To learn to represent knowledge in solving AI problems.
- To understand the different ways of designing software agents.
- To know about the various applications of AI.
- To familiarize with advanced topics in AI.

Recommended by Board of Studies of CSE(AI&ML) dept. Meeting No. 05 Dated: 19.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

MODULE - I INTRODUCTION **8**

Introduction–Definition - History and milestones in AI development - Future of Artificial Intelligence – Trends in AI development - Characteristics of Intelligent Agents – Structure of agents - Typical Intelligent Agents – Problem Solving Approach to Typical AI Problems – Search Strategies- Uninformed- Heuristics- Informed.

MODULE - II PROBLEM SOLVING METHODS **8**

Local Search Algorithms and Optimization Problems - Hill Climbing - Simulated Annealing - Genetic Algorithms - Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing – Optimal Decisions in Games – Alpha - Beta Pruning.

MODULE - III REPRESENTATION OF KNOWLEDGE **7**

First Order Predicate Logic – Quantifiers and connectives - Prolog Programming – Unification – Forward Chaining - Backward Chaining – Resolution in FOPL - Resolution – Knowledge Representation - Semantic networks - Ontological Engineering - Ontologies in AI.

MODULE - IV PLANNING **8**

Planning - Components of a planning system - Planning problems - STRIPS notation - Simple planning agent - Planning languages - PDDL (Planning Domain Definition Language) - Blocks world - Goal stack planning - Mean Ends Analysis - Non-linear Planning - Conditional planning Reactive planning - Implementation of block world problem.

MODULE - V APPLICATIONS **7**

AI applications – Language Models – Information Retrieval - Information Extraction – Natural Language Processing - Robot – Hardware – Perception - Planning – Moving - AI in Autonomous Systems – Self Driving Cars - Sensors and perception - Decision-making systems - Drones - Navigation and control.

MODULE - VI AI CHALLENGES AND OPPORTUNITIES **7**

Challenges in AI - Limitations and Open Problems in AI Research - Ethics and Future of AI – Responsible AI - Explainable AI - Challenges Posed by Transparency - Data Integrity Principles.

TOTAL : 45 PERIODS

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

E.N—
CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

TEXT BOOKS:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prentice Hall, Fourth Edition, 2022.
2. Bratko, "Prolog: Programming for Artificial Intelligence", Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

REFERENCES:

1. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc.; First Edition, 2009.
2. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
3. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.

WEB REFERENCES:

1. https://www.youtube.com/watch?v=5SVXUAFvui4&t=5s
2. https://www.geeksforgeeks.org/artificial-intelligence/
3. https://www.coursera.org/learn/ai-for-everyone

ONLINE RESOURCES:

1. https://www.khanacademy.org/computing/computer-science/algorithms
2. https://hai.stanford.edu/

OUTCOMES

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

1. Apply AI concepts on evolution, intelligent agents, and search strategies to solve typical problem-solving tasks. (K3)
2. Apply appropriate searching techniques to solve problems with constraint and gaming. (K3)
3. Solve the problem and infer suitable knowledge representation schemes. (K3)
4. Develop planning and apply learning algorithms on block world problems. (K3)
5. Utilize the effectiveness of AI applications including robotics, natural language processing. (K3)
6. Identify the ethical, societal, and technical challenges of AI technologies. (K3)

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 19.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

CO – PO, PSO MAPPING:

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

SEMESTER - III

24AMPC302 106106145 SDG NO. 4 & 9	FOUNDATIONS OF DATA STRUCTURES AND ALGORITHM DESIGN	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To analyze algorithm efficiency using time, space and recurrence-solving methods.
- To understand and apply linear data structures like List, stacks, queues and their applications.
- To perform operations on tree-based data structures including binary trees, AVL trees, splay trees and red-black trees.
- To represent graphs and apply traversal, shortest path, and minimum spanning tree algorithms effectively.
- To be able to incorporate various searching and sorting techniques in real time scenarios.
- To learn hashing, collision resolution, and rehashing techniques.

MODULE - I ALGORITHM ANALYSIS 7

Importance of algorithms and data structures-Fundamentals of Algorithm Analysis: Space and Time complexity of an algorithm- Types of Asymptotic Notations and its properties – Analysis of non-recursive and recursive algorithms- Solving Recurrence Relations: Substitution method, Master method and recursive Tree method.

MODULE - II LINEAR DATA STRUCTURES 8

Abstract Data Types (ADTs) – List ADT- Linked List Implementation: singly linked lists- circularly linked lists- doubly-linked lists –Applications of lists: Polynomial Manipulation – All operations (Insertion, Deletion, Merge,

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 19.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

Traversal)-Stack ADT – Operations-Evaluating arithmetic expressions-Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – Applications of Queues.

MODULE - III NON-LINEAR DATA STRUCTURES - TREES **7**

Tree ADT: Terminologies in Tree Data Structure - Operations in Tree ADT- Tree Traversals: Inorder, Preorder, Postorder –Binary Tree ADT– Operations in Binary Tree ADT - Binary Search Trees- Operations in Binary Search Tree - AVL Trees: Key Properties of AVL Trees- Operations in AVL Trees (Insertion, Deletion) –Splay Trees (Insertion, Deletion, Searching)-Red-Black Trees and its operations.

MODULE - IV NON-LINEAR DATA STRUCTURES - GRAPHS **8**

Graph Terminologies – Representation of Graph: Set, Linked and Matrix Representation – Graph Traversals: Breadth-first traversal (BFS), Depth first traversal (DFS) – Shortest Path Problem: Floyd-Warshall Algorithm, Dijkstra's Algorithm - Minimum Spanning Tree: Prim's Algorithm, Kruskal's Algorithm.

MODULE - V SEARCHING AND SORTING **7**

Searching: Linear Search, Binary Search. Sorting: Insertion sort, Selection sort, Bubble sort, Quick sort - Merge Sort - Analysis of Sorting Algorithms.

MODULE - VI HASHING **8**

Hashing: Hash Functions –Collision resolution strategies- Separate Chaining – Open Addressing: Linear Probing, Quadratic Probing, Double Hashing-Closed Hashing – Rehashing- Extendible Hashing.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, Data Structures & Algorithms in Python, John Wiley & Sons Inc., 2021.
2. Anany Levitin, "Introduction to design and analysis of algorithms",3rd Edition, Pearson Education,2017.

REFERENCES:

1. Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, Data Structures and Algorithms, Pearson Education, New Delhi, 2006.
2. Mark Allen Weiss, —Data Structures and Algorithm Analysis in C++||, Fourth Edition,Pearson Education, 2014.
3. Sara Baase and Allen Van Gelder, Computer Algorithms – Introduction to Design & Analysis, Third Edition, Pearson Education, New Delhi, 2000.

Recommended by Board of Studies of CSE(AI&ML) dept. Meeting No. 05 Dated: 19.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Lea

WEB REFERENCES:

1. https://www.geeksforgeeks.org/c-language-set-1-introduction/
2. https://www.codechef.com/certification/data-structures-and-algorithms/prepare
3. https://www.w3schools.in/data-structures-tutorial/intro/

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/
2. https://www.w3schools.in/data-structures-tutorial/
3. https://www.tutorialspoint.com/data_structures_algorithms/

OUTCOMES

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

1. Use asymptotic analysis and recurrence relations to find the algorithm complexity.(K3)
2. Implement linear data structures for efficient data organization and processing.(K3)
3. Analyse the behaviour and performance of tree-based data structures.(K4)
4. Assess the effectiveness of graph algorithms in addressing graph-based computational problems.(K4)
5. Analyse the computational efficiency and performance characteristics of searching and sorting algorithms under varying data conditions. (K4)
6. Employ hashing techniques and collision resolution methods to facilitate efficient data storage and retrieval. (K4)

CO – PO, PSO MAPPING:

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

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

SEMESTER - III

24AMPC303 106106144 SDG NO. 4 , 9	OPERATING SYSTEM	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To apply core concepts and functions of operating systems in practical contexts.
- To analyze process management and evaluate CPU scheduling algorithms.
- To demonstrate deadlock scenarios and analyze prevention and avoidance strategies.
- To analyze various memory management techniques and their performance.
- To apply knowledge of file systems and their organizational methods.
- To analyze the architecture and features of Mobile OS and Linux systems.

MODULE - I OVERVIEW 7

Introduction to Operating Systems – Operating System Operations – Resource Management – Virtualization - Operating System Structures: Operating System Services – User and Operating System Interface – System Calls – System Services - Operating System Structure – Building and Booting an Operating System.

MODULE - II PROCESS MANAGEMENT 8

Processes: Process Concept – Process Scheduling – Operations on Processes – Inter process Communication - IPC in Shared-memory Systems - IPC in Message–Passing Systems – Threads: Overview – Multithreading models – CPU Scheduling: Basic Concepts - Scheduling Criteria – Scheduling Algorithms.

MODULE - III PROCESS SYNCHRONIZATION 8

Synchronization Tools: The Critical Section Problem – Peterson's Solution – Hardware support for Synchronization – Mutex Locks – Semaphores – Monitors - Synchronization Examples: Classic Problems of Synchronization – Deadlocks: Deadlock characterization – Methods for handling deadlocks – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection –Recovery from Deadlock.

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

MODULE - IV MEMORY MANAGEMENT 7

Main Memory: Background - Contiguous Memory Allocation – Paging – Structure of the Page Table – Swapping – Example: Intel 32-bit and 64-bit Architectures – Virtual Memory: Background - Demand Paging – Copy-on-Write - Page Replacement – Allocation of Frames – Thrashing.

MODULE - V STORAGE MANAGEMENT AND FILE SYSTEM 8

Mass Storage Structure: Overview of Mass-Storage Structure – HDD Scheduling – NVM scheduling – Swap-Space Management - File-System Interface: File Concept – Access Methods – Directory Structure – Protection – File-System Implementation: File-System Structures - File-System Operations - Directory Implementation – Allocation Methods – Free-Space Management.

MODULE - VI MOBILE OS AND CASE STUDIES 7

Mobile OS - iOS and Android. The Linux System: Design Principles - Kernel Modules - Process Management - Scheduling - Memory Management - File Systems - Input and Output - Inter process Communication – Network structure – Security.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", 10th Edition, Wiley, United States, 2021.

REFERENCES:

1. Andrew S. Tanenbaum, Herbert Bos. "Modern Operating Systems", Pearson, Fifth edition,2023.
2. William Stallings, Operating Systems: Internals and Design Principles, 9th Edition, Prentice Hall, 2018
3. D. M. Dhamdhere. "Operating Systems: A Concept-Based Approach", 3rd. Edition, Tata McGrawHill, 2017.
4. Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems – A Spiral Approach", Tata McGraw Hill Edition, 2010.
5. Achyut S.Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106/106/106106144/
2. https://www.coursera.org/courses?query=operating%20system
3. https://www.computerhope.com/jargon/o/os.html

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 19.4.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine L

4. https://www.os-book.com/OS9/slide-dir/
5. http://web.iitd.ac.in/~minati/MTL458.html

ONLINE RESOURCES:

1. https://www.udacity.com/course/introduction-to-operating-systems--ud923
2. https://freevideolectures.com/course/3670/introduction-to-operatingsystems

OUTCOMES

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

1. Apply the basic concepts and functions of the operating system to real-world scenarios.(K3)
2. Make use of process and CPU scheduling concepts to solve problems in process execution and synchronization. (K3)
3. Identify the deadlock conditions along with prevention and avoidance techniques. (K3)
4. Solve memory management problems using paging, segmentation, and virtual memory techniques. (K3)
5. Implement file-system structures and storage management techniques for efficient data access. (K3)
6. Analyze the design and key components of mobile and Linux OS, including process, memory, and file management. (K4)

CO – PO, PSO MAPPING:

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

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

E-M—
CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine L

SEMESTER - III

24HSMC301 - SDG NO. 4 & 9	UNIVERSAL HUMAN VALUES – II UNDERSTANDING HARMONY	L	T	P	CP	C
		2	1	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

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

Recommended by Board of Studies of CSE(AI&ML) dept. Meeting No. 05 Dated: 17.04.2025

CHAIRMAN Board of Studies Computer Science and Engineering (Artificial Intelligence and Machine Learning)

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.

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.

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

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

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.

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

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)

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

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

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

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

Recommended by
Board of Studies of HLS dept.
Meeting No. 6 Dated: 31/5/2024

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

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

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

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

Chairman
Board of Studies
Department of Humanities & Sciences

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

BORDER & COASTAL AREAS 2

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

TOTAL :45 PERIODS

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

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

SEMESTER - III

24AMPL302 - SDG NO. 4 & 9	DATA STRUCTURES AND ALGORITHM DESIGN LABORATORY	L	T	P	CP	C
		0	0	4	4	2

OBJECTIVES:

- To implement fundamental data structures like linked lists, stacks, queues, trees, and graphs in Python.
- To construct and manage binary search trees and AVL trees with self-balancing capabilities.
- To develop graph traversal methods using BFS and DFS with adjacency structures.
- To apply Prim's and Dijkstra's algorithms for minimum spanning tree and shortest path problems.
- To perform sorting, and searching using efficient algorithms.
- To demonstrate hashing with collision handling using linear and quadratic probing methods.

LIST OF PROGRAMS

Implement the following programs

1. Implement a Python program to perform addition, subtraction, and multiplication of two polynomials represented as linked lists.
2. Write a Python program to implement a stack using lists with push(), pop(), peek(), isEmpty() and handle underflow errors.
3. Write a Python program to evaluate a postfix expression using a stack, supporting integers and the operators +, -, *, and /.
4. Implement a queue data structure in Python using a custom singly linked list. Include operations such as enqueue(), dequeue(), isEmpty(), and display().
5. Write a Python program to implement a binary search tree with operations for inserting, deleting, and searching for elements.
6. Implement an AVL tree (a self-balancing binary search tree) in Python, with node insertion and automatic balancing using rotations to maintain the AVL property.
7. Write a Python program to represent a graph using an adjacency list or matrix, and implement both Breadth-First Search (BFS) and Depth-First Search (DFS) traversal methods.
8. Implement Prim's algorithm in Python to find the Minimum Spanning Tree of a weighted, undirected graph.

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

9. Implement Dijkstra's algorithm to find the shortest path from a starting node to all other nodes in a graph with non-negative edge weights.
10. Write a Python program to implement Bubble sort, Selection sort, Insertion sort Algorithms.
11. Write a Python program to implement Linear Search and Binary Search, with input validation (e.g., ensuring sorted input for binary search) and returning the index of the searched element if found.
12. Write a program to implement Linear Probing and Quadratic Probing for inserting and searching elements.

TOTAL: 45 PERIODS

OUTCOMES

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

1. Implement and apply linear and non-linear data structures such as stacks, queues, linked lists, trees, and graphs in solving computing problems. (K3)
2. Apply searching and sorting techniques to solve problems efficiently, and evaluate their performance in different scenarios. (K4)
3. Analyze real-world problems and design suitable data structure-based solutions with optimized algorithmic approaches. (K4)

LAB REQUIREMENTS:

Operating System: Windows 10 or above

IDE: VS Code, PyCharm, Jupyter Notebook (For Python)

Interpreter: Python 3.8

CO – PO, PSO MAPPING:

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

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

E.M—
CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

SEMESTER - III

24AMPT301 106104135 SDG NO. 4 & 9	DATABASE MANAGEMENT SYSTEMS LABORATORY WITH THEORY	L	T	P	CP	C
		1	0	4	5	3

OBJECTIVES:

- To design a database using ER diagrams, convert them to Relational Databases and to write SQL Queries.
- To learn SQL and normalization techniques for efficient database design.
- To understand the fundamental concepts of Transaction Processing, Concurrency Control techniques, and Recovery procedures.
- To understand file organization, indexing, and hashing techniques for efficient data storage and retrieval
- To explore distributed and object-oriented databases, focusing on architecture, data storage, and advanced query languages
- To study query processing, optimization techniques, and explore XML databases, including XML schema and Xquery.

MODULE - I DATABASE DESIGN **10**

Purpose of Database System – Views of Data – Database System Architecture – Data Models – Entity Relationship Model – ER Diagrams – Enhanced ER Model – Introduction to Relational Databases – Relational Model – ER-to-Relational Mapping – Keys – Relational Algebra.

List of Experiments:

a) Data Definition Language - Create, Describe, Alter, Truncate, Drop

i) Create the employee table with the following columns (EMP ID, EMP NAME, EMP AGE)

ii) Use a command to describe the structure of the employee's table.

iii) Write an SQL statement to alter the employees table to add a new column salary.

iv) Use a command to truncate the employees table, removing all rows but keeping the structure intact.

v) Write a command to drop the employees table completely from the database.

b) Data Manipulation Language - Insert, Select, Update, Delete

i) Write an SQL command to insert a new student with (ID, NAME and GRADE)

ii) Write a select query to retrieve all records from the student's table.

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

E.M.
CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

iii) Write an SQL command to update the grade of the student with ID.
iv) Write an SQL command to delete the student record with their NAME.

c) Transaction Control Language - Commit, Rollback, and Savepoint
i) Insert a new ID and name and Set a SAVEPOINT after the insertion.
ii) Insert another ID and name. Note that the second insertion was a mistake, so ROLLBACK to the savepoint.
iii) COMMIT the transaction to make the first insertion permanent in the database.

MODULE - II RELATIONAL DATABASES **10**

SQL Fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL- Functional Dependencies – Non-loss Decomposition – First – Second - Third Normal Forms - Dependency Preservation – Boyce/Codd Normal Form – Multi Valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

List of Experiments:

Database Querying:

a) Write simple SQL queries to perform the following
i) Retrieve all the records from the student's table.
ii) Display only the name and grade of each student.
iii) Select all students who have scored more than 80.
iv) Display all student records sorted by grade in descending order.
v) Retrieve only the first two records from the table.

b) Nested Queries
i) Retrieve the employee(s) who earn the highest salary in the company using a subquery.
ii) Display the names and salaries of employees whose salary is above the average salary of all employees.
iii) Find the department(s) where the lowest salary is paid, using a nested query
iv) List all employees whose department_id is found in a list of departments where at least one employee earns more than 100000, using a multi-row subquery

c) Joins (Inner Join, Left Join, Right Join, Full Join, Cross Join)
i) Write a SQL query to list the names of all employees along with their department names, only for those employees who have a corresponding department in the departments table. Use an INNER JOIN.
ii) Write a SQL query to retrieve a list of all employees and their department

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

E-H—
CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

names. If an employee does not belong to any department, show the department name as NULL. Use a LEFT JOIN.

iii) Write a SQL query to list all departments along with the names of employees working in those departments. If a department has no employees, display NULL for employee names. Use a RIGHT JOIN.

iv) Write a SQL query to list all employees and all departments, even if some employees are not assigned to a department and some departments have no employees. Use a FULL OUTER JOIN.

v) Write a SQL query to list all possible combinations of employee names and department names from the employees and departments tables. Use a CROSS JOIN

MODULE - III TRANSACTIONS **10**

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two-Phase Locking – Deadlock – Transaction Recovery – Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery.

List of Experiments:

a) Write a SQL program for adding two numbers and displaying the sum.

b) Write a SQLprogram to print a series of "n" numbers using for loop.

c) Write a SQL program to print a series of "n" numbers using while loop.

MODULE - IV IMPLEMENTATION TECHNIQUES **10**

RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ Tree Index Files – B Tree Index Files – Static Hashing – Dynamic Hashing

List of Experiments:

a) Write a SQL program for debiting an amount from an entry in a table

b) Write a SQL program to determine the sum of a series of n numbers.

c) Write a SQL program to determine the factorial of the given number.

MODULE - V DATABASE MODELS **10**

Distributed Databases – Architecture – Data Storage – Transaction Processing – Object-Based Databases – Object Database Concepts – Object Relational Features – ODMG Object Model – ODL – OQL

List of Experiments:

a) Write a SQL program for reversing a string using the for loop.

b) Write a SQL program to implement Fibonacci series.

c) Write a SQL program for displaying a particular attribute from a table.

Recommended by Board of Studies of CSE(AI&ML) dept. Meeting No. 05 Dated: 17.04.2025

CHAIRMAN Board of Studies Computer Science and Engineering (Artificial Intelligence and Machine Learning)

MODULE - VI ADVANCED TOPICS **10**

Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics - Cost Estimation - XML Databases - XML Hierarchical Model–DTD-XML Schema–XQuery.

List of Experiments:

a) Mini Project (Banking System) Connect Oracle Database from Visual Basic for Banking System.

TOTAL: 60 PERIODS

LAB REQUIREMENTS

Front end: VB/VC ++/JAVA or Equivalent

Back end: Oracle / SQL / MySQL/ Postgres / DB2 or Equivalent

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, Tata McGraw Hill, 2020.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2022.

REFERENCES:

1. Avi Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", Seventh Edition, McGraw-Hill Education,2019.
2. Raghu Ramakrishnan, "Database Management Systems", Fourth Edition, McGraw-Hill Education,2015.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_cs46/
2. http://www.nptelvideos.in/2012/11/database-management-system.html
3. https://www.classcentral.com/course/swayam-database-management-system-9914
4. https://www.w3schools.com/sql/default.asp
5. https://www.khanacademy.org/computing/computer-programming/sql

OUTCOMES

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

1. Apply database concepts to design ER models, map entities to relational schemas, and implement the design using SQL. (K3)

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 19.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

2. Select and apply normalization techniques and functional dependencies to enhance and optimize relational database design. (K3)
3. Utilize SQL queries for transaction processing and apply concurrency control mechanisms based on ACID properties. (K3)
4. Apply query processing and optimization strategies, including relational algebra and heuristic rules to improve SQL execution efficiency. (K3)
5. Identify appropriate indexing and hashing methods, such as B-Tree and B+ Tree, for efficient organization and retrieval of database records. (K3)
6. Analyze query optimization and XML database concepts to enhance the design and performance of applications like a banking system. (K4)

CO – PO, PSO MAPPING:

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

SEMESTER - III

24AMTP301 - 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

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

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:

- Familiarize the team and leadership skills.
- Gain Scouting spirit.
- Understand the standards relevant to AI&ML.

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.

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 19.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

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.

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: 45 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://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]

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

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	-	-

SEMESTER - III

24AMID301 - 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.

Recommended by Board of Studies of CSE(AI&ML) dept. Meeting No. 05 Dated: 17.04.2025

CHAIRMAN Board of Studies Computer Science and Engineering (Artificial Intelligence and Machine Learning)

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 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)

Recommended by Board of Studies of CSE(AI&ML) dept. Meeting No. 05 Dated: 17.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

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	3	-	-	-	-	2	-	-	-	2	2

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

E.M—
CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

SEMESTER - IV

24BSMA407 - SDG NO. 4	LINEAR ALGEBRA AND ITS APPLICATIONS	L	T	P	CP	C
		3	1	0	4	4

OBJECTIVES:

- To learn about solving system of linear equations using matrices
- To learn about vector spaces, subspaces, basis and dimension of Vector Spaces
- To learn about the Linear transformation and the matrix representation and diagonalizability
- To learn about the inner product Spaces, orthogonalization and Least Square Approximations
- To learn about the applications of singular value decomposition and principal component analysis in data science.

MODULE - I SOLUTION OF SYSTEM OF LINEAR EQUATIONS 9

Rank of a matrix.- Solution of systems of Linear Equations using Gaussian elimination and LU Decomposition.

MODULE - II VECTOR SPACES 9

Field (definitions and examples) - Vector Spaces(definitions and examples) - Subspaces(definitions and examples) - Linear Combinations and system of linear equations - Linear Dependence and Linear Independence of Vectors - Bases and Dimensions.

MODULE - III LINEAR TRANSFORMATIONS 12

Linear Transformations - Null spaces and ranges - Dimension Theorem(Statement Only) - Matrix of a Linear Transformation - Eigen Values and Eigen Vectors - Diagonalizability-Test for Diagonalization.

MODULEN - IV INNER PRODUCT SPACES 12

Introduction - Inner Product Spaces - orthogonality – Gram Schmidt Orthogonalization Process (without proof) - QR decomposition.

MODULE - V ADJOINT OPERATORS 9

Adjoint of a linear operator - Least Square Approximation - Normal and Self-Adjoint operators

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

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

MODULE - VI APPLICATIONS OF LINEAR ALGEBRA 9

Singular value decomposition - Principal component analysis – Introduction to their applications in Data Science.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Higher Engineering Mathematics, B. S. Grewal, 40th Edition, Khanna Publishers, New Delhi, 2007.
2. Linear Algebra, Stephen H. Friedberg, Arnold J. Insel and Lawrence E. Spence, 5th edition, Pearson, 2018.

REFERENCES:

1. Advanced Engineering Mathematics, Peter V. O'Neil, 7th edition, Cengage Learning, 2011.
2. Advanced Engineering Mathematics, Michael D. Greenberg, 2nd edition, Pearson, 1998.
3. Introduction to linear algebra, Gilbert Strang, 5th edition, Wellesley-Cambridge Press, 2016.
4. Applied Mathematics (Vol. I & II), P. N. Wartikar & J. N. Wartikar, 1st edition, Pune Vidyarthi Griha Prakashan, 1985.

WEB REFERENCES:

1. https://nptel.ac.in/courses/111106135/
2. https://swayam.gov.in/nd1_noc20_ma08/preview

ONLINE RESOURCES:

1. https://freevideolectures.com/course/3382/linear-algebra-iLinear Algebra | Khan Academy
2. Singular Value Decomposition (SVD), Demystified | Towards Data Science
3. Principal Component Analysis Made Easy: A Step-by-Step Tutorial | Towards Data Science

COURSE OUTCOMES

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

1. Apply Gaussian elimination, LU decomposition, and rank computation to solve systems of linear equations. (K3)
2. Analyze vector spaces, subspaces, linear independence, basis, and dimension with examples. (K4)
3. Analyze linear transformations, compute null/range, and evaluate eigenvalues/eigenvectors for diagonalization. (K4)

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

Chairman
Board of Studies
Department of Humanities & Sciences

4. Apply inner product space concepts, orthogonality, and Gram–Schmidt process for orthonormal basis & QR decomposition. (K3)
5. Analyze least-squares approximations and properties of normal & self-adjoint operators using adjoint concepts. (K4)
6. Apply SVD and PCA for solving problems in data science contexts. (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	-	-	-	-	-	-	-	-	-	-	2	2
CO5	-	3	-	-	-	-	-	-	-	-	-	3	3
CO6	3	-	-	-	3	-	-	-	-	-	-	3	3

SEMESTER - IV

24AMPC401 - SDG NO. 4	NATURE INSPIRED COMPUTING TECHNIQUES	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To introduce students to the foundational concepts of nature-inspired computing.
- To enable them to explore and apply evolutionary algorithms.
- To learn swarm-based algorithms and their applications in problem-solving
- To familiarize with immune-inspired computing techniques.
- To examine the principles and computational potential of DNA computing.
- To know about challenges of nature-inspired algorithms.

MODULE - I INTRODUCTION 8

From Nature-to-Nature Computing, Philosophy, Three Branches: A Brief Overview, Individuals, Entities and agents - Parallelism and Distributivity Interactivity, Adaptation Feedback - Self-Organization - Complexity, Emergence and, Bottom-up Vs Top - Down - Determination, Chaos and Fractals.

Recommended by Board of Studies of CSE(AI&ML) dept. Meeting No. 05 Dated: 19.04.2025

EM
CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

MODULE - II COMPUTING INSPIRED BY NATURE 8

Evolutionary Computing, Hill Climbing and Simulated Annealing, Darwin's Dangerous Idea, Genetics Principles, Standard Evolutionary Algorithm - Genetic Algorithms, Reproduction - Crossover, Mutation Techniques, Evolutionary Programming, Genetic Programming.

MODULE - III SWARM INTELLIGENCE 8

Introduction - Ant Colonies, Ant Foraging Behavior - Positive feedback mechanisms Ant Colony Optimization, SACO and scope of ACO algorithms, Ant Colony Algorithm (ACA), Swarm Robotics - Principles of distributed robotics, Foraging for food, Social Adaptation of Knowledge, Particle Swarm Optimization (PSO) - Velocity and position updates.

MODULE - IV IMMUNO COMPUTING 7

Introduction- Immune System - Anatomy and physiology of immunity, Physiology and main components, Pattern Recognition and Binding, Immune Network Theory- Danger Theory, Evaluation Interaction Immune Algorithms, Introduction -- Genetic algorithms, Bone Marrow Models, Forest's Algorithm, Artificial Immune Networks.

MODULE - V COMPUTING WITH NEW NATURAL MATERIALS 7

DNA Computing: Motivation, DNA Molecule, Adleman's experiment, Test tube programming language, Universal DNA Computers - Models and theoretical foundations, PAM Model, Splicing Systems, Lipton's Solution to SAT Problem, Scope of DNA Computing, From Classical to DNA Computing.

MODULE - VI APPLICATIONS IN NATURE INSPIRED COMPUTING 7

Applications in Optimization – Robotics and AI - Adaptive behavior and decision-making, Ensemble and Hybrid approaches – Real World Applications: Case Studies - Challenges and Future Directions - Scalability, Ethical and Environmental considerations - Impact on society and ecosystems.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. .Leandro Nunes de Castro, " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, First Edition, 2006.

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

E.H—
CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

REFERENCES:

1. Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, Second Edition, 2023.
2. Albert Y. Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.
3. Marco Dorrigo, Thomas Stutzle," Ant Colony Optimization", PHI, 2004.

WEB REFERENCES:

1. https://link.springer.com/book/10.1007/978-3-319-50920-4
2. https://www.computersciencedegreehub.com/faq/what-is-nature-inspired-computing/
3. https://pmc.ncbi.nlm.nih.gov/articles/PMC4675795/

ONLINE RESOURCES:

1. https://www.nature.com/natmachintell/
2. https://ai.stanford.edu/

OUTCOMES

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

1. Identify the core concepts of nature-inspired computing techniques and explain their significance in solving complex problems. (K3)
2. Utilize knowledge of genetic algorithm operators and interpret genetic programming processes. (K3)
3. Apply the concepts of Ant Colony Optimization (ACO) and Particle Swarm Optimization (PSO) to solve practical optimization problems. (K3)
4. Model the functioning of the immune system and its relevance to immune computing, including pattern recognition and immune algorithms. (K3)
5. Build solutions using DNA computing principles to address computational problems. (K3)
6. Examine real-world applications using nature-inspired techniques in fields such as optimization, robotics, and AI. (K4)

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

E-M—
CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

CO – PO, PSO MAPPING:

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

SEMESTER - IV

24AMPC402 106105183 SDG NO. 4 & 9	COMPUTER NETWORKS AND SECURITY	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To understand the basics of building communication networks and protocol layering.
- To familiarize in physical communication and data link protocols.
- To learn the functions of the network layer and its various routing protocols.
- To discuss transport and application layer services.
- To illustrate concepts of Security and its Protocols.
- To explore the roles of OSI layers and gain the knowledge of network security.

MODULE - I INTRODUCTION TO PHYSICAL LAYER 8

Evolution of Data Communication and Networks – Transmission Modes: Topology – The OSI model – TCP/IP Protocol suite – Transmission Fundamentals: Data and Signals – Analog and Digital transmission – Physical Layer: Transmission Medium: Guided and Unguided – Switching: Circuit and Packet Switching.

MODULE - II DATA LINK LAYER 8

Introduction: Data link Layer Services – Data Link Control: Flow control and Error Control – Framing – Error Detection and Correction – Media Access control – Local Area Network: Ethernet – Wi-Fi – IEEE 802.11 – Bluetooth –

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

Zig-bee – Wide Area Networks: Cable Networks – Cellular Communication – Satellite Communication.

MODULE - III NETWORK LAYER 8

Introduction: Network Layer Services – Internetwork Protocol (IP) – Packet Switching – Performance – IPV4 & IPV6: Addressing and Protocols – Internet Control Message Protocol – Routing Algorithms: Distance Vector Routing: Routing Table – Link state Routing: Dijkstra Algorithm– Internet Group Message Protocol.

MODULE - IV TRANSPORT LAYER 7

Introduction: Transport Layer Services: End-to-End Delivery– Addressing – Flow Control – Connection: Connection-Oriented and Connectionless – Transport Protocol Data Unit (TPDU) – Transport Layer Protocols: User Datagram protocol (UDP) – Transmission Control Protocol (TCP) – Stream Control Transmission Protocol.

MODULE - V UPPER OSI LAYER 7

Introduction: Services – Session Layer: Synchronization – Session Protocol Data Unit – Presentation Layer: Translation – Encryption/ Decryption – Data Compression – Application Layer: Client/Server Paradigm, World Wide Web and HTTP – File Transfer Protocol – TELNET – DNS – Socket Interfacing.

MODULE - VI CRYPTOGRAPHY AND NETWORK SECURITY 7

Introduction – Confidentiality: Symmetric and Asymmetric Key Ciphers – Key Aspects of Security – Network Layer Security: Protocols – Modes – Security Association – IKE – VPN – Transport Layer Security – protocols – SSL Architecture – Application Layer Security – Firewall – Email – PGP.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Behrouz A. Forouzan, "Data communications and networking with TCP/IP protocol suite", Sixth Edition, McGraw Hill, cop. 2022.
2. Andrew S. Tanenbaum, Nick Feamster, David J. Wetherall, "Computer Networks", 6th edition, Pearson Education, 2022.

REFERENCES:

1. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
2. Nader F. Mir, "Computer and Communication Networks", Second Edition Prentice Hall, 2014.

Recommended by Board of Studies of CSE (AI&ML) dept. Meeting No. 05 Dated: 17.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

3. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill Publisher, 2011.
4. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013.
5. William Stallings, "Data and Computer Communications", Tenth Edition, Pearson Education, 2014.

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc20_cs23/preview
2. https://onlinecourses.swayam2.ac.in/cec21_cs19/preview

OUTCOMES

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

1. Use the basic concepts of computer networks and layered communication architecture to support effective data communication.(K3)
2. Utilize data link and media access control functionalities to ensure reliable node-to-node transmission. (K3).
3. Apply routers, IP addressing, and routing algorithms to enable efficient packet forwarding.(K3)
4. Identify transport layer services and infer UDP and TCP protocols to facilitate end-to-end delivery.(K3).
5. Analyze the functionalities of the application layer to evaluate network-based services. (K4).
6. Select application layer security components such as firewalls, secure email, and PGP to support secure application communication. (K3)

CO – PO, PSO MAPPING:

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

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 11.04.2025

E.M—
CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

SEMESTER - IV

24AMPW401 106106139 SDG NO. 4 & 9	MACHINE LEARNING TECHNIQUES WITH LABORATORY	L	T	P	CP	C
		3	0	2	5	4

OBJECTIVES:

- To teach the theoretical foundations of various machine learning techniques.
- To learn the dimensionality reduction techniques for feature engineering.
- To know about the data pre-processing and feature engineering approaches.
- To understand the supervised classification and regression algorithms for solving real-world problems.
- To apply the clustering algorithm techniques for solving real-world problems.
- To explore Unsupervised learning and clustering methods.

MODULE - I INTRODUCTION TO PATTERN RECOGNITION AND MACHINE LEARNING 7

Machine Perceptron – Pattern Recognition Systems – Design Cycle – Introduction to Machine Learning – Essential concepts of ML – Types of learning: Supervised – Unsupervised – Reinforcement Learning – Applications of Machine Learning Techniques in Healthcare – Finance – Education – Computer Vision – Challenges in Machine Learning – State of Art Languages /Tools in Machine Learning.

MODULE - II DECISION THEORY & DIMENSIONALITY REDUCTION TECHNIQUES 8

Bayesian Decision Theory – Bayesian Networks – Association rule – Problems of Dimensionality – Dimensionality Reduction Techniques– Component Analysis and Discriminants: Principal Component Analysis (PCA) – Linear Discriminant Analysis (LDA) – Independent Component Analysis (ICA) – t-distributed Stochastic Neighbor Embedding (t-SNE).

MODULE - III DATA AND FEATURE ENGINEERING 8

Basic types of data – Numerical data – Categorical data – Data Quality and Remediation – Data Pre-processing – Training the models – Performance Evaluation – Fine-tuning model performance. Introduction to Feature Engineering – Feature construction – Feature extraction – Feature subset selection.

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

MODULE - IV SUPERVISED MACHINE LEARNING CLASSIFICATION **8**

Introduction to classification – Naïve Bayes – K-Nearest Neighbors – Decision Tree: CART & ID3 – Support Vector Machine: Kernel functions – Ensemble Learning: Random Forest – AdaBoost – eXtreme Gradient Boosting – Light Gradient Boosting Machine – Categorical Boosting – Introduction to scikit-Learn– Hyperparameter Tuning.

MODULE - V SUPERVISED MACHINE LEARNING REGRESSION **7**

Introduction to Regression – Assumptions in Regression Analysis – Simple Linear Regression – Multiple Linear Regression – Improving Accuracy of Linear Regression Models – Polynomial Regression – Ridge regression – Lasso regression – Elastic Net Regression – Hyperparameter Tuning.

MODULE - VI UNSUPERVISED LEARNING **7**

Introduction to Clustering – Unsupervised Vs Supervised – Applications of Unsupervised – Different types of Clustering – Partitioning based methods: K means – Fuzzy C-means clustering – K-Medoids – Hierarchical Clustering: Divisive and Agglomerative – Density-Based Clustering (DBSCAN).

TOTAL : 45 PERIODS

List of Experiments: 10

1) Explore Numpy and Pandas libraries for data pre-processing techniques such as handling missing data and outliers, encoding to prepare data for machine learning models.
2) Implement Linear Regression to predict a continuous target variable and explore how Multiple Linear Regression can capture the relationship between multiple predictors and the target. Use GHI dataset to perform model training, validation, and performance evaluation.
3) Apply Polynomial Regression to model non-linear relationships between the input variables and the target variable. Investigate how the degree of the polynomial impacts the model's ability to fit GHI data, avoiding overfitting or underfitting.
4) Learn how to apply Naïve Bayes and K-Nearest Neighbors (KNN) supervised learning techniques to identify Level of experience.
5) Implement a Decision Tree classifier technique to identify whether the cars require service or not and Plot the confusion Matrix using seaborn library.
6) Implementation of Support Vector Machine technique to identify user behavior classes and Plot the confusion Matrix using seaborn library.
7) Apply the Random Forest algorithm to identify Classification of users based on driving habits (e.g., Commuter, Long-Distance Traveler) and Plot the confusion Matrix using seaborn library.

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

8) Implementation of AdaBoost technique to Classify loan approval and loan not approval and Plot the confusion Matrix using seaborn library.
9) Implementation of XGBoost and LightGBM technique to Classify Waitlist and admit in Wharton Class of 2025's statistics and Plot the confusion Matrix using seaborn library.
10) Implementation of K-means and Hierarchical Clustering on customer segmentation dataset and plot the elbow and dendrogram for k-means and Hierarchical clustering respectively.

TOTAL: 15 PERIODS

TEXT BOOKS:

1. Ethem Alpaydin, "Introduction to Machine Learning", Fourth Edition, MIT Press, 2020.
2. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das "Machine Learning", First Edition, Wiley, 2018.

REFERENCES:

1. Christopher Bishop, "Pattern recognition and machine learning", Springer, 2007.
2. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", MIT Press,2012.
3. Kevin Murphy, "Machine learning: a probabilistic perspective", MIT Press, 2012.
4. Charu C. Aggarwal, Data Classification Algorithms and Applications, CRC Press, 2014
5. Tom Mitchell, Machine Learning, McGraw Hill, 3rd Edition, 1997.
6. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

WEB REFERENCES:

1. https://www.geeksforgeeks.org/machine-learning/
2. https://onlinecourses.nptel.ac.in/noc22_cs97/preview
3. https://archive.nptel.ac.in/courses/106/106/106106139/

OUTCOMES

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

1. Utilize appropriate machine learning techniques to solve real-world problems across various domains. (K3)
2. Apply the dimensionality reduction techniques to reduce data complexity and improve model performance. (K3)

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 19.04.2025

E.H—
CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

3. Make use of data preprocessing and feature engineering techniques to refine datasets for better model performance. (K3)
4. Select suitable supervised classification algorithms to effectively address real-world problem scenarios.(K3)
5. Examine supervised regression methods and assess their performance for predictive modelling tasks. (K4)
6. Analyze clustering algorithms to uncover patterns and groupings in unlabeled data. (K4)

CO – PO, PSO MAPPING:

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

SEMESTER - IV

24HSNC401 NPTEL CODE : - 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

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

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

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

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
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

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

S Ramakrishnan
Chairman
Board of Studies
Department of Humanities & Sciences

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
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

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/5/2024

Chairman
Board of Studies
Department of Humanities & Sciences

SEMESTER - IV

24AMPT401 106106156 SDG NO. 4 & 9	WEB DEVELOPMENT FRAMEWORK LABORATORY WITH THEORY	L	T	P	CP	C
		1	0	4	5	3

OBJECTIVES:

- To apply HTML and CSS to design and develop interactive web pages.
- To use scripting languages like JavaScript to design interactive and dynamic web pages.
- To analyze the features and applications of Node.js for efficient web application development.
- To develop applications using MongoDB for efficient data storage and retrieval.
- To understand the role of Express and React in the development of modern web applications.
- To design and implement full-stack web applications using the MERN stack.

MODULE - I WEB PAGE DESIGNING **10**

HTML – Form Elements - Input types and Media elements - CSS3 - Selectors, Box Model, Backgrounds and Borders, Text Effects, Animations, Multiple Column Layout, User Interface.

List of Experiments:

a) How to create a simple user registration form using HTML form elements. What are the common form elements used, and provide an example with code?

b) Explain how to style a web page using the CSS Box Model and background properties. Describe the components of the box model and list various CSS background properties with examples. Provide sample CSS code to demonstrate their usage.

c) How to implement CSS animations and create a multiple column layout using CSS. Describe the key properties used for animations and the methods to divide content into columns. Provide suitable examples with HTML and CSS code.

MODULE - II CLIENT-SIDE PROCESSING AND SCRIPTING **10**

JavaScript Introduction – Variables and Data Types-Statements – Operators - Literals-Functions Objects- Arrays-Built-in-Objects- Regular Expression, Exceptions, Event handling, Validation.

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

List of Experiments:

a) Write a JavaScript program that declares and initializes variables using different data types, including string, number, Boolean, array, and object. Explain each data type briefly and provide example values.

b) Write a JavaScript function that accepts an array of numbers as its parameter. The function should iterate through the array, identify all even numbers, and return the sum of those even numbers. Provide the complete code and explain how the function works.

c) Design and create an HTML form that includes input fields for Name, Email, and Age. Ensure each field uses the appropriate input type and includes basic validation. Provide the complete HTML code.

MODULE - III PHP PROGRAMMING **10**

PHP - Working principle of PHP - PHP Variables - Constants - Operators – Flow Control and Looping - Arrays - Strings - Functions - File Handling - File Uploading.

List of Experiments:

a) Write a PHP script that declares and initializes variables using different data types, including integer, string, float, and Boolean. Also, define a constant using the appropriate PHP function. Explain each data type with example values used in your script.

b) Write a PHP function that accepts an array of numbers as input and returns the maximum value from the array. Explain how the function works and test it with a sample array.

c) Write a PHP script to handle the file upload process, ensuring that only image files (JPEG, PNG) are allowed. Display a message confirming successful upload and save the file in a specific directory.

MODULE - IV NODE JS **10**

Basics of Node JS – Installation – Working with Node packages – Using Node package manager – Creating a simple Node JS application – Using Events – Listeners –Timers - Callbacks – Handling Data I/O.

List of Experiments:

a) Write a simple "Hello, World!" program using Node.js. Save the program in a .js file and run it using the command line. Describe the steps involved in writing, saving, and executing the Node.js script.

b) Write a Node.js program that creates an EventEmitter, defines a custom event called "welcome", and triggers it to display "Welcome to Node.js!" after 3 seconds using setTimeout().

c) Write a Node.js function that accepts two numbers and a callback function as arguments. The callback function should return the sum of the two

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

numbers. Explain how the function works, how the callback is used, and provide a sample program to demonstrate its functionality.

d) Write a Node.js script that reads the contents of a text file (e.g., sample.txt) and displays the content in the console. Use the fs module to handle file operations. Explain how the fs module works in Node.js and describe the steps involved in reading a file asynchronously.

MODULE - V MONGO DB **10**

Understanding NoSQL and Mongo DB – Building Mongo DB Environment – User accounts – Access control – Administering databases – Managing collections – Connecting to Mongo DB from Node JS.

List of Experiments:

a) Install MongoDB on your system and start the MongoDB server. Then, use the MongoDB shell to create a new database named studentDB. Describe the steps for installation, starting the server, and creating the database.

b) In the database studentDB, create a collection called students and insert a document with the following details: {"name": "John Doe", "age": 20, "course": "Computer Science"}. Describe the steps for creating a collection and inserting the document using MongoDB shell.

c) Write a simple Node.js script to connect to a MongoDB database and retrieve all documents from the student's collection using the MongoDB Node.js driver. Explain the steps involved in establishing the connection and retrieving data from the collection.

MODULE - VI EXPRESS AND REACT **10**

Implementing Express in Node.js - Configuring routes - Using Request and Response objects - MERN STACK – Basic React applications – React Components – React State-Routing with React Router.

List of Experiments:

a) Install Express.js and write a Node.js script to create a basic Express server that listens on port 3000. The server should respond with "Hello, Express!" when accessed at the root URL (/). Explain the steps for setting up Express and creating the server.

b) Create a simple React application with a component named Counter. The component should have a button that, when clicked, increases a count state and displays the updated count. Explain the steps to set up the React application and implement the Counter component.

c) Set up React Router in a React application and create two pages: "Home" and "About". Use navigation links to switch between these pages without refreshing the page. Explain the process of installing React Router, setting up routes, and handling navigation between pages.

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 19.04.2025

E.H—
CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

d) Create a React component named ToggleText that initially displays the text "Hello!". When a button is clicked, the component should toggle between displaying "Hello!" and "Goodbye!". Explain how to implement the functionality using React's state and event handling.

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Paul Deitel, Harvey Deitel, Abbey Deitel, "Internet & World Wide Web - How to Program", 5th edition, Pearson Education, 2020.
2. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" 5e, O'Reilly publishers, 2018.
3. Brad Dayley, Brendan Dayley, Caleb Dayley, 'Node.js, MongoDB and Angular Web Development', Addison-Wesley, Second Edition, 2018.

REFERENCES:

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2007.
2. Steven Holzener, "PHP – The Complete Reference", 1st Edition, Mc-Graw Hill, 2020
3. Fritz Schneider, Thomas Powell, "JavaScript – The Complete Reference", 3rd Edition, McGraw Hill Publishers, 2017.
4. Chris Northwood, 'The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', Apress; 1st edition, 2018
5. Kirupa Chinnathambi, 'Learning React: A Hands-On Guide to Building Web Applications Using React and Redux', Addison-Wesley Professional, 2nd edition, 2018.
6. Vasan Subramanian, 'Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node', Second Edition, Apress, 2019.

WEB REFERENCES:

1. https://developer.mozilla.org/en-US/docs/Glossary/PHP
2. https://www.mongodb.com/docs/
3. https://angular.dev/tutorials
4. https://developer.mozilla.org/en-US/docs/
5. https://react.dev/

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 19.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

OUTCOMES

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

1. Apply HTML and CSS to create interactive and dynamic websites. (K3)
2. Use JavaScript to develop interactive and dynamic website features. (K3)
3. Design and implement dynamic server-side applications using PHP. (K3)
4. Analyze Node.js and its features for efficient application development. (K4)
5. Develop applications using MongoDB for database management and storage. (K3)
6. Analyze and evaluate the features of Express and React for building web applications. (K4)

CO – PO, PSO MAPPING:

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

SEMESTER - IV

24AMTP401 - SDG NO. 4	APTITUDE SKILLS - II	L	T	P	CP	C
		0	0	2	2	0

PROBLEM SOLVING USING JAVA - PHASE 1

OBJECTIVES:

- Develop strong algorithmic problem-solving skills using Java
- Enable students to analyze problems and design efficient solutions
- Familiarize students with coding patterns used in technical interviews and prepare students for competitive programming and technical coding rounds

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

MODULE - I FOUNDATIONS OF JAVA PROBLEM SOLVING 16

Competitive programming mindset, Understanding problem statements and constraints, Java input and output handling, Time and space complexity, Asymptotic notations, Loop and recursion analysis, Arrays and strings problem patterns, Prefix sum, Sliding window, Two-pointer techniques.

MODULE - II SEARCHING, SORTING AND ADVANCED TECHNIQUES 15

Binary search patterns, Search on answer technique, Sorting-based problem solving, Stack and queue applications, Monotonic stack, Simulation problems, Recursion templates, Backtracking framework, Constraint-based problem solving.

MODULE - IIIDYNAMIC PROGRAMMING, GREEDY AND GRAPH BASICS14

Dynamic programming principles, Memorization and tabulation, One-dimensional and two-dimensional DP problems, Greedy strategies, Interval problems, Graph traversal basics – BFS and DFS, Competitive coding strategies.

TOTAL: 45 PERIODS

REFERENCES:

1. Herbert Schildt, Java: The Complete Reference, McGraw Hill.
2. E. Balagurusamy, Programming with Java, McGraw Hill Education

ONLINE RESOURCES

1. LeetCode – https://leetcode.com
2. HackerRank – https://www.hackerrank.com
3. GeeksforGeeks – Java and DSA Track

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.

Recommended by Board of Studies of CSE(AI&ML) dept. Meeting No. 05 Dated: 11.04.2026

CHAIRMAN Board of Studies Computer Science and Engineering (Artificial Intelligence and Machine Learning)

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.

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.

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

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. Interpret problem statements and develop Java programs with appropriate complexity analysis.
2. Apply array, string, searching, sorting, stack, and queue based problem-solving techniques.
3. Design solutions using recursion, backtracking, and dynamic programming approaches.
4. Solve real-time and placement-oriented problems using greedy techniques and graph traversal basics.
5. Demonstrate career and managerial skills. (K2)
6. Understand BIS standards for Information security and AI domain. (K2)

CO – PO, PSO MAPPING:

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

Recommended by
Board of Studies of CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

CHAIRMAN
Board of Studies
Computer Science and Eng
(Artificial Intelligence and Machine

SEMESTER - IV

24AMID401 - 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.
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.

Recommended by
Board of Studies of CSE(AIPHL) dept.
Meeting No. 05 Dated: 19.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

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)
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 CSE(AI&ML) dept.
Meeting No. 05 Dated: 17.04.2025

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

SEMESTER V

COURSE CODE: 24AMPC501	AI FOR HUMAN LANGUAGE UNDERSTANDING	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106108002	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24AMPT201,24AMPC301,24BSMA407					

OBJECTIVES:

- To understand the fundamentals of linguistics, semantic representation, and probabilistic language modelling techniques for text analysis.
- To apply text preprocessing methods and syntactic parsing techniques for structured linguistic analysis.
- To explore word representation techniques and semantic similarity methods for capturing meaning in text.
- To implement neural network architectures and pre-trained models for advanced natural language processing tasks.
- To analyze machine translation approaches and develop neural models for translating text between languages.
- To design and develop conversational systems using NLU, dialogue management, and chatbot frameworks.

MODULE - I INTRODUCTION TO LANGUAGE MODELING 8

Introduction to NLP - Components of NLP - Linguistics – Language Syntax and Structure:Words – Phrases – Clauses – Grammar – Word-Order Typology – Language Semantics: Lexical Semantic Relations – Semantic Networks and Models – Representation of Semantics – Text Corpora:Corpora Annotation and Utilities – Popular Corpora – Language Modeling: Unigram - Bigram – Trigram - N-gram– Evaluation of Language Models: Perplexity, Smoothing, Interpolation, Backoff.

MODULE - II TEXT PREPROCESSING AND PARSING 8

Word Tokenization – Sentence Tokenization – Filtering Stopwords – Stemming – Lemmatization – Term Frequency and Inverse Document Frequency (TF-IDF) – Parts of Speech Tagging – Named Entity Recognition -Context Free Grammars: Grammar Rules for English-Top-Down Parsing, Bottom-Up Parsing- CKY Parsing - Probabilistic Context-Free Grammars.

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

MODULE - III WORD EMBEDDINGS AND SEMANTIC ANALYSIS 7

Word Embeddings: Continuous Bag-of-Words (CBOW) – Skip-gram – Glove – Fast Text – Semantic Similarity Measures: Cosine Similarity – Euclidean Distance – Dot Product Similarity – Lexical Semantics: Lexical Semantics – Word Sense Disambiguation – Knowledge-Based Word Sense Disambiguation – Supervised Word Sense Disambiguation.

MODULE - IV DEEP LEARNING FOR NLP 8

Neural Networks for NLP: Introduction to Neural Networks – Feedforward Neural Networks – Sequence Models: Recurrent Neural Networks (RNN) – Long Short-Term Memory (LSTM) – Gated Recurrent Units (GRU) – Attention Mechanisms: Attention Mechanism – Self-Attention -multi-headed attention - Pre-trained Language Models: BERT – GPT – Model Adaptation: Fine-tuning Techniques.

MODULE - V MACHINE TRANSLATION 7

Need for Machine Translation – Problems of Machine Translation – MT Approaches – Direct Machine Translation – Rule-Based Machine Translation – Statistical Machine Translation (SMT) – Encoder–Decoder Architecture for Neural Machine Translation.

MODULE - VI CONVERSATIONAL AI AND CHATBOT SYSTEMS 7

Fundamentals of Conversational AI – Chatbot Architecture: Components and Conversational Flow Design – Core Components: Natural Language Understanding (NLU), Dialogue Management (DM), Natural Language Generation (NLG) – Chatbot Frameworks: Google Dialogflow, Microsoft Bot Framework, Amazon Lex, Rasa – Deployment Channels: Facebook Messenger, Google Assistant, Amazon Alexa, WhatsApp.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Text Analytics with Python: A Practitioner's Guide to Natural Language Processing, Dipanjan Sarkar, Second Edition, Apress,2019.
2. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition ,Jurafsky, David, and James H. Martin, Third Edition, Pearson Publication,2026.

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

REFERENCES:

1. Micheal McTear, Conversational AI: Dialogue Systems, Conversational Agents and chatbots, 2020, 1st Edition, Morgan and Claypool.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106106211
2. https://nptel.ac.in/courses/106105158

ONLINE RESOURCES:

1. https://freevideolectures.com/course/3739/natural-language processing-with-deep-learning
2. https:// freevideolectures. com/ course/ 4050 / nptel- applied-naturallanguage-processing
3. https://freevideolectures.com/course/2272/artiicial-intelligence/3

OUTCOMES

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

1. Apply linguistic concepts and language modeling techniques to process and analyze text data. (K3)
2. Examine text using preprocessing and parsing methods for better structural understanding. (K4)
3. Distinguish word embedding models according to their effectiveness in capturing semantic relationships in text. (K4)
4. Infer the suitability of neural network architectures and pre-trained models for NLP applications. (K4)
5. Compare neural machine translation models for achieving accurate language translation. (K4)
6. Analyze the design and performance of conversational AI and chatbot systems for real-world applications. (K4)

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

E-H—
CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

CO - PO, PSO MAPPING:

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

SEMESTER V

COURSE CODE: 24AMPW501	BIG DATA ANALYTICS WITH LABORATORY	L	T	P	CP	C
		3	0	2	5	4
NPTEL CODE: 106105167	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24AMPT201, 24AMPT301, 24AMPC302					

OBJECTIVES:

- To understand the fundamental concepts of Big Data and its applications
- To learn the Hadoop framework, including HDFS architecture and data handling
- To gain knowledge of NoSQL databases and their data models
- To understand the MapReduce programming model and YARN for data processing
- To explore data storage, processing techniques, and integration in Hadoop
- To learn Hadoop ecosystem tools (HBase, Pig, Hive) and basic data visualization techniques

MODULE - I INTRODUCTION TO BIG DATA AND ANALYTICS 7

Introduction to Big Data and Characteristics - Types of Analytics: Descriptive, Diagnostic, Predictive and Prescriptive - Structured vs Unstructured Data - Big

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

Data Applications and Industry Examples - Overview of Big Data Technologies - Cloud and Big Data - Mobile Business Intelligence - Crowd Sourcing Analytics

MODULE - II BIG DATA ECOSYSTEM AND HADOOP FRAMEWORK 8

Introduction to Hadoop - Hadoop Ecosystem and Architecture - Open Source Technologies - Hadoop Distributed File System (HDFS) Overview - HDFS Design and Concepts - Hadoop Data Flow - Hadoop Interfaces and Command Line - Scaling Out in Hadoop -Hadoop Streaming and Pipes

MODULE - III NOSQL DATA MANAGEMENT 8

Introduction to NoSQL - Aggregate Data Models - Key-Value and Document Data Models - Basics of Graph Databases - Distribution models - Concepts: Replication and Consistency - Introduction to Cassandra and Data Model - Cassandra examples – Cassandra clients

MODULE - IV MAPREDUCE AND YARN FRAMEWORK 8

MapReduce Concepts and Workflows - Anatomy of a MapReduce Job - Classic MapReduce Framework - YARN Architecture and Working - Job Scheduling in Hadoop - Shuffle and Sort Phase - MapReduce Types - Input and Output Formats

MODULE - V DATA PROCESSING AND STORAGE 7

Hadoop I/O - Data Integrity in Hadoop - Compression Techniques - Serialization - Avro Data Format - File-based Data Structures - Data Formats in Hadoop - Analyzing Data with Hadoop - Integration of Cassandra with Hadoop

MODULE - VI HADOOP ECO SYSTEM AND DATA VISUALISATION 7

HBase: Basic Concepts and Data Model - Pig: Pig Latin Basics - Hive: HiveQL Basics (DDL, Simple Queries) - Data Visualization: Line, Bar, Pie Charts - Scatter and Box Plot - Case Study : Installation of Hive along with practice examples.

LIST OF EXPERIMENTS:

1. Install Hadoop and configure Hadoop Distributed File System (HDFS) in standalone or pseudo-distributed mode.
2. Demonstrate basic HDFS commands for file creation, upload, download, replication, and deletion operations.
3. Develop a MapReduce program to perform Word Count analysis on a text dataset.

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

4. Implement Hadoop Streaming using Python scripts for simple data processing tasks.
5. Perform data storage and retrieval operations using Cassandra Query Language (CQL).
6. Create and manipulate Key-Value and Document-oriented data models using NoSQL databases.
7. Develop simple Pig Latin scripts to perform filtering, grouping, joining, and aggregation operations on datasets.
8. Create Hive tables and execute HiveQL queries including DDL commands and simple analytical queries.
9. Create data visualizations such as Line Charts, Bar Charts, Pie Charts, Scatter Plots, and Box Plots using Python libraries.
10. Perform case study implementation involving installation and execution of Hive with sample datasets.

TOTAL : 60 PERIODS

TEXT BOOK:

1. Seema Acharya and Subhashini Chellappan, Big Data and Analytics, 3rd Edition, Wiley India, 2023.
2. Raj Kamal and Preeti Saxena, Big Data Analytics: Introduction to Hadoop, Spark, and Machine Learning, 3rd Edition, McGraw Hill, 2023.
3. Tom White, "Hadoop: The Definitive Guide", O'Reilly, 4th Edition, 2015.

REFERENCES:

1. Jure Leskovec, Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
2. Dirk deRoos, Paul Zikopoulos, Roman Melnyk, Bruce Brown, Rafael Coss, Hadoop For Dummies, 3rd Edition, Wiley, 2023.
3. "Data Science and Big Data Analytics", EMC2 Education Services, 2013.

WEB REFERENCES:

1. https://nptel.ac.in/courses/110106072
2. https://archive.nptel.ac.in/courses/106/104/106104189/

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/110106072

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

OUTCOMES

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

1. Apply big data analytics methods to solve practical problems and demonstrate the use of different types of analytics in real-world scenarios. (K3)
2. Implement Hadoop ecosystem components and HDFS concepts to store and process large-scale data efficiently. (K3)
3. Examine NoSQL data models and evaluate their suitability for distributed data management systems. (K4)
4. Analyze MapReduce workflows and YARN architecture to achieve efficient distributed data processing. (K4)
5. Apply Hadoop data processing techniques, including compression, serialization, and data formats, for effective data management. (K3)
6. Infer meaningful insights from data using Hadoop ecosystem tools and appropriate visualization methods. (K4)

CO - PO, PSO MAPPING:

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

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

SEMESTER V

COURSE CODE: 24AIPC403	DEEP LEARNING	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: -	SYLLABUS VERSION 1.0	SDG NO. 3, 4, 11				
PRE-REQUISITE COURSES	24BSMA407,24AMPW401					

OBJECTIVES:

- To understand the basics of deep neural networks
- To understand CNN and RNN architectures of deep neural networks
- To implement different deep learning algorithms
- To explore autoencoders for feature extraction and dimensionality reduction.
- To understand generative models like VAEs, GANs, and Deep BeliefNetworks.
- To learn advanced architectures, including RBMs, contrastive learning,and emerging trends like federated learning and Neural ArchitectureSearch (NAS).

MODULE - I DEEP NETWORKS BASICS 8

Linear Algebra: Scalars – Vectors – Matrices and tensors; Probability Distributions –McCulloch Pitts Neuron-Thresholding Logic- Perceptrons-Perceptron Learning Algorithm-Bayesian learning, decision surfaces, and linear classifiers-Overfitting and underfitting-Bias and variance- Deep Networks: Deep feedforward networks; Regularization – Optimization.

MODULE - II CONVOLUTIONAL NEURAL NETWORKS 8

Convolutional Neural Networks-Architectural Overview, Motivation, Layers, Filters, Parameter sharing, Regularization-LeNet –AlexNet -ZF- Net-VGGNet-GoogLeNet –ResNet- Guided Back propagation- Deep Dream- Deep Art - Fooling Convolutional Neural Networks.

MODULE - III RECURRENT NEURAL NETWORKS 8

RNN Design Patterns: Acceptor – Encoder – Transducer-– Bidirectional RNN – Sequence to Sequence RNN-Deep Recurrent Networks – Recursive Neural Networks – Long Term Dependencies; Backpropagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTM.

Recommended in Board of Studies (BoS) Meeting No. 07 **held on** 21/4/25

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

MODULE - IV AUTO ENCODERS 7

Under complete Auto encoder - Regularized Autoencoder- sparse autoencoders- denoising autoencoders-Representational power, layer, size and depth of autoencoders- stochastic Encoders and Decoders- Contractive Encoders-Applications: Dimensionality Reduction, Anomaly Detection, Image Denoising- Comparison with PCA.

MODULE - V GENERATIVE MODELS 7

Introduction to Generative Models-Comparison with discriminative models-Probabilistic Generative Models-Variational Autoencoders -Deep Belief networks, Boltzmann Machines, Deep Boltzmann Machine, Generative Adversarial Networks: Momentum Optimizer, RMSProp, Adam

MODULE - VI ADVANCED ARCHITECTURE 7

Advanced Architectures: Restricted Boltzmann machines (RBMs), deep belief networks (DBNs).Contrastive learning (SimCLR, MoCo).Recent Trends:Reinforcement learning with deep networks, federated learning, and neural architecture search (NAS)

TOTAL : 45 PERIODS

TEXT BOOK:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.

REFERENCES

1. Salman Khan, Hossein Rahmani, Syed Afaq Ali Shah, Mohammed Bennamoun, "A Guide to Convolutional Neural Networks for Computer Vision", Synthesis Lectures on Computer Vision, Morgan & Claypool publishers, 2018.
2. Yoav Goldberg, "Neural Network Methods for Natural Language Processing", Synthesis Lectures on Human Language Technologies, Morgan & Claypool publishers, 2017.
3. Francois Chollet, "Deep Learning with Python", Manning Publications Co, 2018.
4. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 2018.

Recommended in Board of Studies (BoS) Meeting No. 07 **held on** 21/04/25

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

5. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.

WEB REFERENCES:

1. Dive into Deep Learning — Dive into Deep Learning 1.0.3 documentation
2. Generative Adversarial Networks (GANs) | Coursera
3. Practical Deep Learning for Coders - Practical Deep Learning
4. https://onlinecourses.nptel.ac.in/noc20_cs62/preview

ONLINE REFERENCES:

1. https://www.geeksforgeeks.org/deep-learning-tutorial/
2. https://www.simplilearn.com/tutorials/deep-learning-tutorial/deeplearning-algorithm
3. https://sites.google.com/view/cs502project/deep-learning-forbiology-a-tutorial/deep-learning-models-dnns-cnns-rnns-autoencoders
4. https://en.wikipedia.org/wiki/Types_of_artificial_neural_networks

OUTCOMES

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

1. Use neural network concepts to develop and train simple models for classification or prediction tasks. (K3)
2. Examine convolutional and pooling operations to analyze images and identify patterns for classification. (K4)
3. Apply Recurrent Neural Network and its variants for text analysis (K3)
4. Apply autoencoders for dimensionality reduction and feature extraction in real-world applications. (K3)
5. Implement generative models like VAEs, DBNs, and GANs for data generation and representation learning. (K3)
6. Analyze advanced deep learning architectures and emerging trends such as reinforcement learning and neural architecture search. (K4)

Recommended in Board of Studies (BoS) Meeting No. 07 **held on** 21/04/25

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	2	3	2
CO2	2	2	-	-	2	-	-	-	-	-	2	2	2
CO3	3	3	2	-	2	-	-	-	-	-	2	2	2
CO4	3	3	2	-	2	-	-	-	-	-	2	3	2
CO5	3	3	3	-	2	-	-	-	-	-	2	3	2
CO6	3	3	3	-	2	-	-	-	-	-	2	2	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. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learn

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. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

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. 06 **held on** 09/04/2026

E.H.—
CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

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: 24AMPL501	AI FOR HUMAN LANGUAGE UNDERSTANDING LABORATORY	L	T	P	CP	C
		0	0	4	4	2
NPTEL CODE: 106108002	SYLLABUS VERSION 1.0	SDG NO. 9, 11				
PRE-REQUISITE COURSES	24AMPT201,24AMPC301,24BSMA407					

OBJECTIVES:

- To understand and implement N-gram models and basic language modeling techniques.
- To apply text preprocessing methods for effective text analysis.
- To perform syntactic and semantic analysis using NLP techniques.

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

E.N—
CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

- To develop models for text representation and prediction.
- To build NLP applications such as sentiment analysis, spam detection, and fake news detection.
- To design advanced NLP systems like machine translation and chatbots.

LIST OF PROGRAMS

Implement the following programs

1. a) Write a python program to find all unigrams, bigrams and trigrams present in the given corpus.
   b) Implement a bigram model with Add-One smoothing and calculate the probability of the sentence "This is my cat" using Python.
2. a) Write a python program to perform tokenization by word and sentence using NLTK.
   b) Write a python program to eliminate stopwords using NLTK.
   c) Write a python program to perform stemming and lemmatization using NLTK.
3. a) Write a python program to perform Parts of Speech tagging using NLTK.
   b) Write a python program for chunking using NLTK.
4. a) Write a python program to perform Named Entity Recognition using NLTK.
   b) Write a python program to find Term Frequency and Inverse Document Frequency (TF-IDF).
5. Write a python program for CYK parsing (CockeYounger-Kasami Parsing) or Chart Parsing.
6. Write a Python program to train CBOW and Skip-gram Word2Vec models on a given text corpus. Analyze word relationships by finding similar words and visualizing embeddings.
7. Write a Python program to implement a language translation system that translates text from one language to another using any NLP library.
8. Write the python code to perform sentiment analysis using NLP .
9. Write the python code to detect Fake News using NLP.
10. Develop a Python program to implement a next word prediction model using a given text corpus.
11. Develop a Python program to build a spam filter using NLP techniques.
12. Develop a Python program to design and implement a chatbot using NLP techniques.

TOTAL : 45 PERIODS

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

Stand alone desktops with Python 30Nos.

OUTCOMES

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

1. Apply text preprocessing and language modeling techniques for text analysis. (K3)
2. Analyze syntactic and semantic features of text using NLP methods. (K4)
3. Design NLP applications such as classification, prediction, and conversational systems.(K4)

CO - PO, PSO MAPPING:

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

SEMESTER V

COURSE CODE: 24AIPL401	DEEP LEARNING LABORATORY	L	T	P	CP	C
		0	0	4	4	2
NPTEL CODE: 106106184	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24BSMA407, 24AMPW401					

OBJECTIVES:

- To understand the theoretical foundations, algorithms and methodologies of Neural Network.
- To design and develop an application using specific deep learning models.
- To provide practical knowledge in handling and analyzing real world applications.

Recommended in Board of Studies (BoS) Meeting No. 07 **held on** 21/04/25

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

LIST OF EXPERIMENTS:

1. Write a program to perform basic image processing operations such as histogram equalization, thresholding, edge detection (e.g., Canny or Sobel), morphological operations (e.g., dilation, erosion), and apply basic data augmentation techniques (e.g., rotation, flipping, scaling) on a sample image.
2. Write a Python program using TensorFlow/Keras or PyTorch to create and train a simple feedforward neural network on the MNIST dataset. Evaluate its performance and visualize the loss and accuracy curves.
3. Implement a Convolutional Neural Network (CNN) to recognize handwritten characters using a dataset such as EMNIST. Train, evaluate, and display predictions on test data with confidence scores.
4. Develop a deep learning-based face recognition system using Convolutional Neural Networks. Use a dataset like LFW or your custom dataset to train the model and test it on new images.
5. Write a Python program to implement a character-level or word-level language model using Recurrent Neural Networks (RNN). Train it on a text corpus (e.g., Shakespeare, news articles) and generate sample text.
6. Build and deploy a sentiment analysis model using LSTM on a dataset like IMDb or Twitter sentiment dataset. Use a simple web interface (optional) to input text and get sentiment output.
7. Implement a Sequence-to-Sequence (Seq2Seq) model to perform Part-of-Speech (POS) tagging on sentences. Use a labeled corpus like the Penn Treebank for training and testing.
8. Create a language generation model using an Encoder-Decoder neural network architecture. Train it on bilingual sentence pairs for a translation task or on English text for summarization.
9. Implement a Generative Adversarial Network (GAN) to generate new images from a given dataset (e.g., fashion-MNIST or CIFAR-10). Use the generated images to augment the original dataset and visualize the improvement in classification accuracy.
10. Build a recommendation system using deep learning from a sales dataset (e.g., transactional data from an e-commerce platform). Implement collaborative filtering or neural matrix factorization to suggest products to users.
11. Implement an image captioning system that generates textual descriptions of images using a combination of Convolutional Neural Networks (CNNs) for feature extraction and Long Short-Term Memory (LSTM) networks for sequence generation. Train the model on a dataset like MS COCO or Flickr 8k and evaluate it using BLEU or METEOR scores.

Recommended in Board of Studies (BoS) Meeting No. 09 **held on** 21/04/25

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

12. Use PyTorch to implement MoCo v2 or use a pre-trained MoCo model. Train it on a small image dataset (e.g., STL-10) and demonstrate how the learned embeddings improve classification accuracy when fine-tuned.

TOTAL : 45 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

Stand alone desktops with Python 30Nos.

OUTCOMES

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

1. Apply neural networks and deep learning concepts to solve real-world problems such as data prediction, feature learning, and image-related tasks using tools like TensorFlow/Keras. (K3)
2. Analyze and evaluate various deep learning architectures and optimization techniques for different machine learning tasks and practical applications. (K4)
3. Analyze and adapt deep learning solutions for complex, domain-specific tasks by integrating theoretical understanding with practical implementation techniques. (K4)

CO - PO, PSO MAPPING:

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

Recommended in Board of Studies (BoS) Meeting No. 07 **held on** 21/04/25

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

SEMESTER V

COURSE CODE: 24AMTP501	SKILL ENHANCEMENT	L	T	P	CP	C
		0	0	2	2	1
NPTEL CODE: -	SYLLABUS VERSION 1.0	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

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

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

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.

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

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

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)
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)

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

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: 24AMID501	PROTOTYPE DEVELOPMENT LABORATORY – I	L	T	P	CP	C
		0	0	2	2	1
NPTEL CODE: -	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24ESID101, 24ESID201, 24AIID301, 24AIID401					

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.
- 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.

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

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)

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

TOTAL : 30 PERIODS

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

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. 06 **held on** 09/04/2026

E-H—

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Lea 1)

PROFESSIONAL ELECTIVE - I

COURSE CODE: 24AMEL501	FOUNDATIONS OF COGNITIVE SCIENCE FOR ENGINEERS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 108105185	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24AMPC302, 24BSMA303, 24AMPW401					

OBJECTIVES:

- To understand the fundamental concepts and interdisciplinary nature of cognitive science
- To study human cognition including perception, memory, learning, and decision-making
- To explore the role of psychology and neuroscience in understanding cognitive processes
- To learn computational approaches to cognition including AI and knowledge representation
- To understand probabilistic reasoning and inference in cognitive systems
- To analyze learning models and their applications in intelligent systems

MODULE - I INTRODUCTION TO COGNITIVE SCIENCE 7

Introduction to cognitive Models-Definition and scope of Cognitive Science-Interdisciplinary nature: Philosophy, Psychology, Neuroscience, AI - Mental–Physical Relationship (Materialism vs Mentalism) -Logic and Mind Sciences -Overview of cognition: perception, attention, memory, learning, decision-making.

MODULE - II COGNITIVE PSYCHOLOGY AND NEROSCIENCE 8

Role of Psychology in Cognitive Science- Human Information Processing System- Cognitive Neuroscience Fundamentals- Brain Structure and Cognitive Functions- Core Cognitive Processes- Higher-Level Cognitive Functions.

MODULE - III COMPUTIONAL INTELLIGENCE 8

Type I & II Neurons-Integrate & Fire-Spike Response Models-Nonlinear neuron dynamics-Phase plane analysis-Parameter Estimation-Probabilistic neuron models-Building Spiking Neural Networks (SNN).

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

MODULE - IV PROBABILISTIC PROGRAMMING FOR COGNITION 7

Introduction to Probabilistic Programming - Probability Distributions and Random Variables - WebPPL Language Basics and Syntax - Integration with JavaScript Libraries - Random Computation and Simulation - Coroutines and Continuations - Enumeration and Inference Techniques.

MODULE - V INFERENCE MODELS OF COGNITION 8

Generative Models - Conditioning and Probabilistic Reasoning - Conditional Dependence - Causal vs. Statistical Dependence - Algorithms for Inference - Data Analysis in Cognitive Systems.

MODULE - VI LEARNING MODELS OF COGNITION 7

Learning as Conditional Inference - Language of Thought Hypothesis - Hierarchical Learning Models - Continuous Function Learning - Mixture Models - Deep Learning in Cognitive Systems- Applications of Cognitive Learning Models.

TOTAL : 45 PERIODS

TEXT BOOK:

1. José Luis Bermúdez, "Cognitive Science: An Introduction to the Science of the Mind", Cambridge University Press, 2020.
2. Russell, S. and Norvig, P., "Artificial Intelligence: A Modern Approach", Pearson, 3rd Edition, 2010.

REFERENCES

1. Daniel Kahneman, "Thinking, Fast and Slow", Farrar, Straus and Giroux, 2011.
2. Paul Thagard, "Mind: Introduction to Cognitive Science", MIT Press, 2nd Edition, 2005.
3. David Marr, "Vision: A Computational Investigation into the Human Representation and Processing of Visual Information", MIT Press, 2010.
4. Michael S. Gazzaniga, "Cognitive Neuroscience: The Biology of the Mind", W.W. Norton & Company, 2018.

WEB REFERENCES

1. MIT Open Courseware – Cognitive Science Courses

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

ONLINE RESOURCES

1. https://www.coursera.org
2. https://www.edx.org
3. https://cognitivesciencesociety.org

OUTCOMES

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

1. Identify the fundamental concepts and interdisciplinary principles of cognitive science in cognitive applications. (K3)
2. Apply cognitive processes such as perception, memory, and decision-making to analyze human cognition. (K3)
3. Utilize principles of cognitive psychology and neuroscience to interpret human behaviour and cognitive functions. (K3)
4. Develop computational models and basic AI techniques for representing cognitive processes. (K3)
5. Make use of probabilistic reasoning concepts and inference techniques in cognitive systems. (K3)
6. Solve simple real-world problems using learning models in cognitive systems. (K3)

CO - PO, PSO MAPPING:

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

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

PROFESSIONAL ELECTIVE - I

COURSE CODE: 24AMEL502	INTELLIGENT DATA RECOGNITION	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 108103192	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24AMPW401, 24AMPC301, 24AMPC302					

OBJECTIVES:

- To understand the fundamentals of intelligent systems and pattern recognition techniques
- To learn Bayesian decision theory and statistical classification methods for pattern analysis
- To implement parameter estimation techniques and probabilistic models for data recognition
- To analyze non-parametric classification techniques
- To build linear discriminant models and support vector machines for classification problems
- To explore artificial neural networks, backpropagation algorithms, and deep learning concepts for pattern recognition

MODULE - I FOUNDATIONS OF DATA RECOGNITION 7

Introduction to Intelligent Systems - Approaches to Pattern Classification - Decision Trees - Pattern Recognition Systems - The Design Cycle - Learning and Adaptation

MODULE - II BAYES DECISION THEORY CLASSIFIERS 8

Bayesian Decision Theory - Minimum-Error-Rate Classification - Classifiers - Discriminant Functions - Decision Surfaces - The Normal Density - Error Probabilities and Integrals - Bayesian Decision Theory - Discrete Features

MODULE - III BAYESIAN PARAMETER ESTIMATION 7

Maximum-Likelihood Estimation - Bayesian Estimation - Bayesian Parameter Estimation: Gaussian Case - Bayesian Parameter Estimation: General Theory - Problems of Dimensionality - Component Analysis and Discriminants - Expectation-Maximization (EM) - Hidden Markov Models

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

EH

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

MODULE - IV NON-PARAMETRIC TECHNIQUES 8

Density Estimation - Parzen Windows - kn-Nearest-Neighbor Estimation - The Nearest-Neighbor Rule - Metrics and Nearest-Neighbor Classification - Fuzzy Classification - Reduced Coulomb Energy Networks - Approximations by Series Expansions

MODULE - V LINEAR DISCRIMINANT FUNCTIONS 7

Linear Discriminant Functions and Decision Surfaces - Generalized Linear Discriminant Functions - The Two-Category Linearly Separable Case - Minimizing the Perceptron Criterion Function - Relaxation Procedures - Nonseparable Behavior - Minimum Squared-Error Procedures - The Ho-Kashyap Procedures - Support Vector Machines

MODULE - VI ARTIFICIAL NEURAL NETWORKS 8

Feedforward Operation and Classification - Backpropagation Algorithm - Error Surfaces - Backpropagation as Feature Mapping - Deep Neural - Networks for Pattern Recognition - Regularization - Complexity Adjustment - Pruning

TOTAL : 45 PERIODS

TEXT BOOK:

1. Richard O. Duda, Peter E. Hart, David G. Stork, "Pattern Recognition", 2nd Edition, Wiley, 2001.

REFERENCES:

1. Sergios Theodoridis, Pattern Recognition, Fifth Edition, Academic Press, 2020.
2. Michael R. Berthold, Christian Borgelt, Frank Höppner, and Frank Klawonn, Guide to Intelligent Data Analysis: How to Intelligently Make Sense of Real Data, Second Edition, Springer, 2020.
3. Shai Shalev-Shwartz and Shai Ben-David, Understanding Machine Learning: From Theory to Algorithms, Second Edition, Cambridge University Press, 2024.

WEB REFERENCES:

1. https://www.square-9.com/blog/beyond-automation-how-intelligent-data-recognition-enables-strategic-decision-making/
2. https://seeing-theory.brown.edu/bayesian-inference/index.html

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

3. https://towardsdatascience.com/comprehensive-guide-on-multiclass-classification-metrics-af34cf24753a

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106/106/106106137/
2. https://www.coursera.org/learn/machine-learning
3. https://github.com/scikit-learn/scikit-learn

OUTCOMES

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

1. Apply intelligent system concepts and pattern classification techniques to recognize and analyze data patterns. (K3)
2. Implement Bayesian decision theory and discriminant functions for statistical classification problems. (K3)
3. Use parameter estimation methods, EM algorithms, and Hidden Markov Models for probabilistic modeling and pattern analysis. (K3)
4. Apply non-parametric techniques such as k-nearest neighbor, Parzen windows, and fuzzy classification methods for decision making. (K3)
5. Utilize linear discriminant functions, perceptron learning, and Support Vector Machines for classification tasks. (K3)
6. Develop artificial neural network models using feedforward and backpropagation algorithms for complex pattern recognition applications. (K3)

CO - PO, PSO MAPPING:

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

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

E.N

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

PROFESSIONAL ELECTIVES - I

Course Code	Course Title	L	T	P	CP	C
24AMEL505	OBJECT DETECTION AND RECOGNITION SYSTEMS	3	0	0	3	3
NPTEL Code:- 106105216	Syllabus Version 1.1	SDG No: 4,9				
Pre-requisite Courses	24BSMA407, 24AMPT201, 24AMPW401					

OBJECTIVES:

- To understand the fundamental concepts of image formation and image processing
- To learn feature detection, matching, and alignment techniques
- To understand motion estimation and structure from motion
- To develop skills in 3D reconstruction
- To understand image-based rendering and recognition

MODULE - I INTRODUCTION AND IMAGE FORMATION 7

Introduction to Computer Vision – Image formation – Geometric Primitives and Transformations – Photometric Image Formation – Lighting – Reflections and Shading – Optics – The Digital Camera – Sampling and aliasing – Color – Compression.

MODULE - II IMAGE PROCESSING 7

Point Operators – Linear Filtering – More Neighbourhood Operators – Non-Linear Filtering - Bilateral Filtering – Binary image processing – Fourier Transforms – Pyramids and Wavelets – Geometric Transformations – Parametric transformations.

MODULE - III FEATURE DETECTION, MATCHING AND ALIGNMENT 8

Points and patches - Edges – Contours - Contour tracking – Lines and vanishing points - Segmentation – Graph based segmentation - Mean shift - Pairwise alignment – Normalized cuts - 2D and 3D feature-based alignment – Global alignment.

MODULE - IV STRUCTURE FROM MOTION AND MOTION ESTIMATION 8

Geometric intrinsic calibration - Pose estimation - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.

MODULE - V 3D RECONSTRUCTION 7

Shape from X – 3D scanning – Range data merging - Surface representations - Point-based representations- Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos – Estimating BRDFs.

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

MODULE - VI IMAGE-BASED RENDERING AND RECOGNITION 8

View interpolation - Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering - Recognition - Instance recognition - Face recognition - Object detection - Context and scene understanding.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications, Springer- Texts in Computer Science", Second Edition, 2022.

REFERENCES:

1. David A. Forsyth and Jean Ponce, "Computer Vision: A Modern Approach, Pearson Education", Second Edition, 2015.
2. Richard Hartley and Andrew Zisserman, "Multiple View Geometry in Computer Vision", Second Edition, Cambridge University Press, March 2004.
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006
4. E. R. Davies, "Computer Vision: Principles, Algorithms, Applications, Learning", Fifth Edition, Academic Press, Elsevier, 2018.

WEB REFERENCES:

1. https://www.coursera.org/learn/computer-vision-basics
2. https://www.coursera.org/specializations/computer-vision
3. https://www.edx.org/learn/computer-vision
4. https://opencv.org/courses/

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106105216
2. https://www.coursera.org/learn/computer-vision
3. https://www.udacity.com/course/introduction-to-computer-vision

OUTCOMES

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

1. Apply image formation and camera transformation concepts in computer vision applications. (K3)
2. Use image processing techniques such as filtering and transformations to analyze digital images. (K3)
3. Examine methods for detecting, matching, and segmenting image features for computer vision tasks. (K4)

RECOMMENDED IN BOARD OF STUDIES (BOS) MEETING NO. 06 HELD ON 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

4. Analyze motion estimation and structure-from-motion techniques for understanding dynamic scenes and 3D structures. (K4)
5. Use different methods to reconstruct three-dimensional models from multiple images. (K3)
6.Examine image rendering and recognition techniques for visual interpretation and object identification applications. (K4)

CO-PO, PSO MAPPING:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2
CO1	3	2	-	2	-	-	-	-	-	-	2	3	2
CO2	2	3	-	-	3	-	-	-	-	-	2	3	2
CO3	2	3	-	3	-	-	-	-	-	-	1	3	2
CO4	2	3	-	3	-	-	-	-	-	-	2	3	3
CO5	2	2	-	-	3	-	-	-	-	-	2	3	3
CO6	2	3	2	-	3	-	-	-	-	-	2	2	3

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineer
(Artificial Intelligence and Machine Learn

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24ITEL501	COMPUTER GRAPHICS AND MULTIMEDIA	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106103224	SYLLABUS VERSION 1.0	SDG NO. 4,9				
PRE-REQUISITE COURSES	24BSMA301 ,24AMPC302					

OBJECTIVES:

- To understand the fundamental concepts of graphics and multimedia.
- To understand the Two/Three-Dimensional Graphics and their Transformations
- To get knowledge about various Object representation methods and Visible Surface Detection methods
- To study the Multimedia concepts and various I/O technologies

MODULE - I OUTPUT PRIMITIVES 7

Output Primitives: Points and Lines – Line-Drawing algorithms: DDA and Bresenham's Algorithm – Loading frame Buffer – Line function – Circle-Generating algorithms: Midpoint Circle Generating Algorithm – Ellipse-generating algorithms. Attributes of Output Primitives: Line Attributes – Curve attributes – Color and Grayscale Levels – Area-fill attributes – Character Attributes.

MODULE - II 2D GRAPHICS 7

Basic Transformations – Matrix Representations – Composite Transformations – Other Transformations. 2D Viewing: The Viewing Pipeline – Viewing Co-ordinate Reference Frame – Window-to-Viewport Co-ordinate Transformation - 2D Viewing Functions – Clipping Operations.

MODULE - III 3D GRAPHICS 7

3D Geometric and Modeling Transformations – Translation - Rotation - Scaling- Composite Transformations - 3D Viewing – Viewing Pipeline - Viewing Coordinates - Projections - Clipping - Visible Surface Detection Methods.

Recommended in Board of Studies (BoS) Meeting No. 08 held on 18/05/2026

CHAIRMAN
Board of Studies
Information Technology

MODULE - IV ILLUMINATION, COLOR MODELS AND ANIMATION 8

Light Sources - Basic Illumination Models – Halftone Patterns and Dithering Techniques- Properties of Light - Standard Primaries and Chromaticity Diagram; Intuitive Colour Concepts - RGB Colour Model - YIQ Colour Model - CMY Colour Model - HSV Colour Model - HLS Colour Model - Colour Selection- Virtual Reality - Animation.

MODULE - V MULTIMEDIA SYSTEMS DESIGN AND FILE HANDLING 8

Multimedia Basics – Multimedia Applications – Multimedia System Architecture - Defining Objects for Multimedia Systems – Multimedia Data Interface Standards – Multimedia Databases - Compression and Decompression – Data and File Format Standards – Digital Voice and Audio – Video Image and Animation – Full Motion Video – Storage and Retrieval Technologies.

MODULE - VI HYPERMEDIA **8**

Multimedia Authoring and User Interface - Hypermedia Messaging - Mobile Messaging – Hypermedia Message Component – Creating Hypermedia Message – Integrated Multimedia Message Standards – Integrated Document Management – Distributed Multimedia Systems - Case Study: Blender Graphics -Blender Fundamentals–Drawing Basic Shapes – Modelling-Shading & Textures

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Donald Hearn and Pauline Baker M, "Computer Graphics", Prentice Hall, New Delhi,2007
2. Andleigh, P. K and KiranThakrar, "Multimedia Systems and Design", PHI, 2003

REFERENCES:

1. Judith Jeffcoate, "Multimedia in practice: Technology and Applications", PHI, 1998.
2. Foley, Vandam, Feiner and Hughes, "Computer Graphics: Principles and Practice", 3rd Edition, Pearson Education, 2013.
3. Jeffrey McConnell, "Computer Graphics: Theory into Practice", Jones and Bartlett Publishers,2006.
4. Hill F S Jr., "Computer Graphics", Maxwell Macmillan , 1990.
5. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, "Fundamentals of Computer Graphics", CRC Press, 2021.

Recommended in Board of Studies (BoS) Meeting No. 08 held on 19/05/2026

CHAIRMAN
Board of Studies
nation Technology

6. William M. Newman and Robert F.Sproull, "Principles of Interactive Computer Graphics", McGraw Hill 1979..

ONLINE RESOURCES:

1. https://www.blender.org/support/tutorials
2. http://www.doc.ic.ac.uk/~dfg/graphics/graphics.html
3. http://www.nptelvideos.in/2012/11/computer-graphics.html
4. http://cs.wellesley.edu/~cs110/lectures/M01-color/graphics.pdf
5. www.scratchapixel.com
6. http://dl.finebook.ir/book/9e/11032.pdf
7. https://www.blender.org/support/tutorials
8. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-837-computer-graphics-fall-2012/download-course-materials

OUTCOMES

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

1. Implement output primitives and drawing algorithms to create basic graphical objects with attributes. (K3)
2. Perform 2D transformations, viewing and clipping techniques using matrix representations. (K3)
3. Illustrate 3D transformations, projections and visible surface detection methods for object representation. (K3)
4. Utilize illumination models, color models and animation techniques for realistic graphics. (K3)
5. Apply multimedia system design concepts including architecture, databases and file handling techniques. (K3)
6. Construct hypermedia applications and create basic 3D scenes using Blender. (K3)

CO - PO, PSO MAPPING:

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

Recommended in Board of Studies (BoS) Meeting No. 08 held on 18/05/2026

CHAIRMAN
Board of Studies
Information Technology

CO6	3	2	2	-	3	-	-	-	-	-	-	2	2

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24ITEL502	GRAPH THEORY	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106105847	SYLLABUS VERSION 1.0	SDG NO. 9				
PRE-REQUISITE COURSES	24BSMA301 ,24AMPC402					

OBJECTIVES:

- Enable learners to apply graph theory concepts to solve real-world and computational problems.
- To introduce fundamental concepts of graph theory, including vertices, edges, paths, and connectivity.
- To utilize graph theory to model and solve practical problems in logistics, biology, and computer science.
- To apply algorithms for finding shortest paths, spanning trees, and network flow.

MODULE I FUNDAMENTALS OF GRAPHS **8**

Introduction to graphs - Basic properties of graphs - Definition and types of graphs (simple, multigraph, directed, weighted) - Graph representation (adjacency matrix, adjacency list) - Degree of vertices, Handshaking Lemma -Sub graphs and induced graphs - Complete and bi-partite graphs - Isomorphism of graphs.

MODULE II PATHS AND CONNECTIVITY **7**

Paths and circuits - Walks, paths, trails, circuits - Connected and disconnected graphs - Open and closed walks - Simple paths and cycles - Length of a path - Components of a graph - Cut vertices and bridges - Circuits and cycles in graphs - Directed and undirected cycles - Detection of cycles in graphs.

MODULE III EULER AND HAMILTONIAN GRAPHS **7**

Euler paths and circuits (Fleury's Algorithm) - Hamiltonian paths and cycles - Necessary and sufficient conditions - Eulerian Graphs - Hamiltonian cycles - Matrix representation of graphs - Chordal graphs -

Recommended in Board of Studies (BoS) Meeting No. 08 held on 12/05/2026

CHAIRMAN
Board of Studies
Information Technology

Weighted graphs.

MODULE IV Trees and Spanning Trees **9**

Definition and properties of trees - Spanning trees and minimal spa nning trees - Algorithms: Prim's and Kruskal's - Independence sets and covering in graphs - Minimum Spanning Trees (MST) - Concept of weighted graphs - Definition and significance of MST Applications (network design, cost minimization)- Algorithms for MST - Prim's Algorithm- Greedy approach - Step-by-step construction - Implementation logic..

MODULE V GRAPH COLORING AND PLANARITY **7**

Vertex coloring and chromatic number - Applications of graph coloring (scheduling, map coloring) - Planar graphs and Euler's formula – Cut Vertices and Cut edges - Edge connectivity - Vertex Colouring of graphs - Edge Colouring of graphs - The four-colour and five-colour theorems..

MODULE VI Applications of Graph Theory **7**

Perfect graphs – applications of graph in switching theory –Directed graphs or (Digraphs) - Shortest path algorithms (Dijkstra's Algorithm) Network flows (basic idea) - Applications in computer science, transportation, and social networks.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. A Textbook of Graph Theory – R. Balakrishnan & K. Ranganathan Year: 2012 (Springer edition)
2. Graph Theory with Applications to Engineering and Computer Science – Narsingh Deo Year: 1974 (Original Edition, Prentice-Hall) (Reprints available: 2004, 2017)
3. Introduction to Graph Theory – Douglas B. West Year: 1996 (1st Edition), 2001 (2nd Edition – widely used)

REFERENCES:

1. A Textbook of Graph Theory – R. Balakrishnan, K. Ranganathan – 1st Edition, 2012 – Volume 1
2. Graph Theory with Applications to Engineering and Computer Science – Narsingh Deo Reprint 2017
3. Introduction to Graph Theory – Douglas B. West – 2nd Edition, 2001
4. Graph Theory – Frank Harary – 1st Edition, 1969
5. Handbook of Graph Theory – Jonathan L. Gross, Jay Yellen, Ping Zhang – 2nd Edition, 2014 – Volume 1

Recommended in Board of Studies (BoS) Meeting No. 08 held on 12/05/2026

CHAIRMAN
Board of Studies
Information Technology

5. Graph Theory – J.A. Bondy, U.S.R. Murty – Graduate Texts in Mathematics, 2008 Edition
7. Algorithmic Graph Theory – Alan Gibbons – 1st Edition, 1985

ONLINE RESOURCES:

1. https://www.geeksforgeeks.org/dsa/graph-data-structure-and-algorithms/
2. https://www.geeksforgeeks.org/dsa/eulerian-path-and-circuit/
3. https://www.geeksforgeeks.org/quizzes/minimum-spanning-tree/
4. https://www.geeksforgeeks.org/dsa/graph-coloring-applications/
5. ONLINE REFERENCES:
6. https://www.getyoureducation.net/course/advanced-graph-theory
7. https://www.coursera.org/learn/graphs?utm_source=chatgpt.com
8. https://www.mygreatlearning.com/academy/learn-for-free/courses/introduction-to-graph-theory
9. https://nptel.ac.in/courses/111106050
10. https://nptel.ac.in/courses/111107058
11. https://ocw.mit.edu/courses/18-225-graph-theory-and-additive-combinatorics-fall-2023/

OUTCOMES :

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

1. Apply graph representations and basic properties to model problems (K3)
2. Analyze connectivity and solve problems involving paths and circuits (K3)
3. Apply Euler and Hamiltonian concepts to real-world problems (K3)
4. Construct and optimize spanning trees using standard algorithms (K3)
5. Apply graph coloring and planarity concepts in practical scenarios (K3)
6. Use graph algorithms to solve real-world applications (K3)

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	-	1	1	-	-	-	-	-	-	3	2

Recommended in Board of Studies (BoS) Meeting No. 08 held on 12/05/2026

CHAIRMAN
Board of Studies
Information Technology

CO3	3	3	1	1	1	-	-	-	-	-	-	3	2
CO4	3	3	2	1	2	-	1	-	-	-	1	3	3
CO5	3	2	2	1	1	-	1	-	-	-		2	2
CO6	3	3	2	2	2	1	1		1	1	1	3	3

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24ITEL511	DISTRIBUTED SYSTEMS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106106168	SYLLABUS VERSION 1.0	SDG NO. 9				
PRE-REQUISITE COURSES	24AMPC303 ,24AMPC402,24AMPT301					

OBJECTIVES:

- To understand foundations of Distributed Systems
- To introduce the idea of peer to peer services and file system
- To understand in detail the system level and support required for distributed system
- To understand the issues involved in studying process and resource management

MODULE - I INTRODUCTION 5

Introduction – Examples of Distributed Systems–Trends in Distributed Systems – Focus on resource sharing – Challenges. Case study: World Wide Web.

MODULE - II COMMUNICATION IN DISTRIBUTED SYSTEM 9

System Model – Inter process Communication - the API for internet protocols – External data representation and Multicast communication. Network virtualization: Overlay networks. Case study: MPI Remote Method Invocation and Objects: Remote Invocation – Introduction - Request-reply protocols - Remote procedure call - Remote method invocation. Case study: Java RMI - Group communication - Publish-subscribe systems - Message queues - Shared memory approaches - Distributed objects - Case study: Enterprise Java Beans -from objects to

components

MODULE - III PEER TO PEER SERVICES AND FILE SYSTEM 9

Peer-to-peer Systems – Introduction - Napster and its legacy - Peer-to-peer – Middleware - Routing overlays. Overlay case studies: Pastry, Tapestry- Distributed File Systems –Introduction - File service architecture – Andrew File system. File System: Features-File model -File accessing models - File sharing semantics. Naming: Identifiers, Addresses, Name Resolution – Name Space Implementation – Name Caches – LDAP.

MODULE - IV SYNCHRONIZATION AND REPLICATION 9

Introduction - Clocks, events and process states - Synchronizing physical clocks- Logical time and logical clocks - Global states – Coordination and Agreement – Introduction - Distributed mutual exclusion – Elections – Transactions and Concurrency Control– Transactions -Nested transactions – Locks – Optimistic concurrency control - Timestamp ordering – Atomic Commit protocols -Distributed deadlocks – Replication – Case study – Coda

MODULE - V PROCESS & RESOURCE MANAGEMENT 6

Process Management: Process Migration: Features, Mechanism - Threads: Models, Issues, Implementation. Resource Management: Introduction- Features of Scheduling Algorithms –Task Assignment Approach – Load Balancing Approach – Load Sharing Approach.

MODULE - VI DISTRIBUTED ALGORITHMS 7

Synchronous network model - Algorithms: leader election, maximal independent set -Asynchronous system model: I/O automata, operations on automata, fairness - Asynchronous shared memory model - Mutual exclusion: model, the problem, stronger conditions, lockout-free mutual exclusion algorithms, lower bound on the number of registers - Asynchronous network model - Asynchronous network algorithms: leader election in a ring and an arbitrary network.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.
2. Nancy A. Lynch, "Distributed Algorithms", Hardcourt Asia Pvt. Ltd., Morgan Kaufmann, 2000.

REFERENCES:

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and

Design", Prentice Hall of India, 2007.
2. Tanenbaum A.S., Van Steen M., "Distributed Systems: Principles and Paradigms", Pearson Education, 2007.
3. Liu M.L., "Distributed Computing, Principles and Applications", Pearson Education, 2004.
4. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers, USA, 2003.

ONLINE RESOURCES:

1. https://www.cs.helsinki.fi/u/jakangas/Teaching/DistSys/DistSys-08f-1.pdf
2. https://www.vidyarthiplus.com/vp/attachment.php?aid=43022

OUTCOMES

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

1. Apply the use of distributed system with architecture, trends, and resource sharing in World Wide Web.(K3)
2. Articulate various communication mechanisms in distributed systems, like RPC, RMI, multicast, message-oriented middleware, and network virtualization(K3)
3. Sketch the design and operation of peer-to-peer systems and distributed file systems.(K3)
4. Examine synchronization, coordination, and replication techniques with logical clocks, mutual exclusion, elections, transactions, and concurrency control mechanisms(K3)
5. Determine the key process and resource management strategies.(K3)
6. Re-enact the use of distributed algorithms for synchronous and asynchronous systems (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	-	-	-	-	-	-	-	2	2
CO3	2	2	2	-	-	-	-	-	-	-	-	2	2
CO4	2	2	2	2	-	-	-	-	-	-	-	2	2

Recommended in Board of Studies (BoS) Meeting No. 08 held on 12/05/2026

CHAIRMAN
Board of Studies
Information Technology

CO5	2	2	2	2	-	-	-	-	-	-	-	2	2
CO6	2	2	2	2	-	-	-	-	-	-	-	2	2

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24AIEP502	VISUAL PERCEPTION AND INTELLIGENT SYSTEMS LABORATORY WITH THEORY	L	T	P	CP	C
		1	0	4	5	3
NPTEL CODE: 106105216	SYLLABUS VERSION 1.0	SDG NO. 9,11				
PRE-REQUISITE COURSES	24AMPT201,24BSMA407					

OBJECTIVES

- To understand foundational visual processing operations, image representations, and projective geometry transformations.
- To master camera modelling parameters, calibration methodologies, and multi-view stereoscopic geometry principles.
- To evaluate feature detection mathematical operators and robust geometric model fitting algorithms.
- To study color space metrics and range data processing techniques for multidimensional vision pipelines.
- To implement classification, clustering, and dimensional reduction techniques for machine vision applications.
- To build intelligent system solutions utilizing state-of-the-art deep learning architectures.

MODULE-I FOUNDATIONS OF VISUAL PROCESSING AND PROJECTIVE GEOMETRY **8**

Image Representation - Digital Sampling - Quantization Formats - Fundamental Intensity Transformations - Mathematical Frameworks for 2D Projective Spaces - Affine Mappings - Geometric Transformations - Homogeneous Coordinates - Homography Matrix Properties - Estimation Methodologies for Homography Calculation - Homography in Planar Environments.

LIST OF EXPERIMENTS:

1. Implementation of basic spatial image filtering, histogram equalization, and affine transformations utilizing Python and OpenCV

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

libraries.
2. Formulation and estimation of a 2D homography matrix between separate planar viewpoints to execute image warping and perspective rectification.

MODULE - II CAMERA MODEL PHYSICS AND STEREOSCOPIC GEOMETRY 8

Pinhole Camera Model Structures - Intrinsic Camera Parameters - Extrinsic Orientation Configurations - Radial Distortion Dynamics - Camera Calibration Frameworks - Mathematical Foundations of Multi-View Epipolar Geometry - Essential Matrices - Fundamental Matrices - Stereo Correspondence Matching - 3D Depth Reconstruction Metrics.

LIST OF EXPERIMENTS:

1. Execute camera calibration routines using standard planar checkerboard targets to calculate intrinsic parameter arrays and eliminate lens distortion artifacts.
2. Build a depth-extraction pipeline via disparity map calculation from rectified stereoscopic pairs.

MODULE-III FEATURE EXTRACTION,MODEL FITTING AND MATCHING 7

Mathematical Operations for Edge Detection - Structural Corner Localizers - Scale-Space Representations - Advanced Local Descriptor Frameworks - Scale-Invariant Feature Transform (SIFT) - Speeded-Up Robust Features (SURF) - Oriented FAST and Rotated BRIEF (ORB) - Feature Matching Evaluation Metrics - Outlier Rejection Mechanics - Random Sample Consensus (RANSAC) Algorithm - Geometric Model Fitting Parameters.

LIST OF EXPERIMENTS:

1. Extract robust local keypoints using SIFT or ORB operators and execute feature matching across variable baseline viewpoints.
2. Develop an automated image-stitching application (panoramas) using mapped feature pairs optimized via RANSAC outlier elimination.

MODULE -IV MULTIDIMENSIONAL AND RANGE IMAGE PERCEPTION 8

Color Perception Physics - Mathematical Color Space Transformations - RGB Color Space - HSI Color Space - YCbCr Color Space - Color-Based Object Segmentation Algorithms - Vector-Space Color Processing - Range Data Acquisition Techniques - Depth Sensor Physics - 3D Point Cloud Representations - Coordinate Transformations - Surface Normal

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

Extraction Geometries.

LIST OF EXPERIMENTS:

1. Design a real-time object tracking and location mapping algorithm utilizing color threshold masks and morphological processing in HSI space.
2. Build a 3D point cloud visualizer to compute and project local surface normals from raw depth datasets.

MODULE- V PATTERN CLUSTERING AND DIMENSIONALITY REDUCTION 7

Supervised Statistical Learning Models for Image Analysis - Unsupervised Statistical Learning Models for Image Analysis - Implementation Strategies for K-Means Clustering - Implementation Strategies for Mean-Shift Clustering - Classical Object Categorization Paradigms - Dimensionality Reduction Theory - Principal Component Analysis (PCA) - Linear Discriminant Analysis (LDA) - Sparse Representations for Optimized Visual Features.

LIST OF EXPERIMENTS:

1. Program an image segmentation workflow using K-Means and Mean-Shift clustering methods to separate structural regions.
2. Implement an automated face-recognition architecture using the Eigenfaces paradigm powered by PCA dimensionality reduction.

MODULE-VI INTELLIGENT DEEP LEARNING ARCHITECTURES 8

Foundations of Neural Computational Layers - Multi-Layer Perceptrons (MLPs) - Convolutional Neural Networks (CNNs) for Spatial Vision - State-of-the-Art Architectures for Deep Object Detection - You Only Look Once (YOLO) - Single Shot Detector (SSD) - Semantic Pixel Labeling and Image Segmentation - Autonomous Visual Perception - Visual Perception Decision Matrices.

LIST OF EXPERIMENTS:

1. Build, train, and validate a custom multi-layer CNN configuration using a modern deep learning framework to categorize standard datasets.
2. Deploy an optimized, pre-trained object tracking system (e.g., YOLO framework) to parse and locate spatial classes within real-time streaming video inputs.

TOTAL: 45 PERIODS

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

LABORATORY REQUIREMENTS:

Standalone desktop with Ubuntu Linux, Python, Anaconda, Jupyter Notebook, OpenCV, NumPy, SciPy, Matplotlib, Scikit-image, Scikit-learn, Open3D, PyTorch/TensorFlow, and YOLO-30Nos.

TEXT BOOKS:

1. R. Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2nd Edition, 2022.
2. D. A. Forsyth and J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2nd Edition, 2012.
3. R. Hartley and A. Zisserman, "Multiple View Geometry in Computer Vision", Cambridge University Press, 2nd Edition, 2004.

REFERENCES:

1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing", Pearson Education, 4th Edition, 2018.
2. E. Trucco and A. Verri, "Introductory Techniques for 3-D Computer Vision", Prentice Hall, 1st Edition, 1998.
3. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning", MIT Press, 2016.

WEB REFERENCES:

1. NPTEL Computer Vision Course Portal (Course Code: 106105216).
2. OpenCV Open Source Computer Vision Documentation Library.

ONLINE RESOURCES:

1. https://opencv-python-tutroals.readthedocs.io
2. https://nptel.ac.in

OUTCOMES:

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

1. Apply fundamental spatial filtering operations and affine transformations to solve 2D projective geometry problems. (K3)
2. Analyze camera physics matrices and compute stereoscopic epipolar geometry configurations for 3D estimation. (K4)

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

3. Select robust local feature extractors and iterative model-fitting algorithms for scene alignment tasks. (K3)
4. Examine multidimensional color channels and structured 3D point cloud datasets to segment regional features. (K4)
5. Utilize statistical clustering algorithms and linear dimensionality reduction models for structural recognition. (K3)
6. Analyze and train intelligent deep learning neural network architectures for complex real-time target localizations. (K4)

CO - PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24AIEP503	AI INFRASTRUCTURE AND OPTIMIZATION TECHNIQUES LABORATORY WITH THEORY	L	T	P	CP	C
		1	0	4	5	3
NPTEL CODE: 106106238	SYLLABUS VERSION 1.0	SDG NO. 9,11				
PRE-REQUISITE COURSES	24AMPT201,24BSMA407,24AMPW401					

OBJECTIVE:

- To understand AI hardware, operating systems, cloud platforms, virtualization, and container technologies.
- To learn the design and implementation of computing infrastructures for AI applications.

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

- To develop skills in building and optimizing deep learning models using TensorFlow and PyTorch.
- To understand distributed AI computing, multi-GPU training, and scalable deep learning frameworks.
- To learn techniques for accelerating AI workloads, machine learning, and data processing pipelines.
- To develop AI-based solutions for real-world applications in domains such as healthcare and smart

MODULE-I AI SYSTEM HARDWARE AND SOFTWARE FOUNDATIONS **8**

Introduction to AI System Hardware - CPU - RAM - GPU - Interconnect - Storage - Network Controller-Introduction to AI Accelerators - GPUs- Introduction to System Software - Operating System - Virtualization Cloud - Introduction to Containers and IDE (Jupyter Demo) - Scheduling and Resource Management - Introduction to schedulers and orchestration tools-DeepOps - Deep-dive into Kubernetes with deployment of various AI-based services

LIST OF EXPERIMENTS

1. Deploy a simple AI/ML service using Kubernetes and monitor resource utilization
2. Create, deploy, and manage Docker containers for AI applications.

MODULE- II HIGH PERFORMANCE AI SYSTEMS AND PYTORCH **8**

DeepOps- Design principles for building High Performance compute clusters for AI -Implementation details for building High Performance compute clusters for AI -Frameworks for Accelerated Deep Learning Workloads - PyTorch -Frameworks for Accelerated Deep Learning Workloads - PyTorch-Accelerated PyTorch .

LIST OF EXPERIMENTS

1. Implement a neural network for image classification using PyTorch.
2. Configure a small AI compute cluster using virtualization or cloud instances.

MODULE-III TENSORFLOW AND TRAINING OPTIMIZATION **7**

Frameworks for Accelerated Deep Learning Workloads – TensorFlow- Frameworks for Accelerated Deep Learning Workloads – TensorFlow, Accelerated TensorFlow -Optimizing Deep Learning Training: Automated Mixed Precision - Optimizing Deep Learning Training: Transfer Learning

LIST OF EXPERIMENTS

1. Build and train a deep learning model using TensorFlow.
2. Fine-tune a pre-trained CNN model for a custom dataset

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

MODULE -IV DISTRIBUTED AI COMPUTING 7

Fundamentals of Distributed AI Computing: Multi-GPU and multi-node implementation (MPI, NCCL, RDMA) -Distributed AI Computing: Horovod - Challenges with Distributed Deep Learning Training Convergence - Fundamentals of Accelerating Deployment .

LIST OF EXPERIMENTS

1. Train a deep learning model using Horovod and compare performance.
2. Deploy a trained AI model using containerized inference services.

MODULE-V AI ACCELERATION AND DATA PIPELINES 7

Accelerating neural network inference in PyTorch and TensorFlow- Accelerated Data Analytics (Demo)- Accelerated Machine Learning - Scale Out with DASK- Web visualizations to GPU accelerated crossfiltering - Accelerated ETL Pipeline with SPARK.

LIST OF EXPERIMENTS

1. Optimize inference using TensorFlow or PyTorch acceleration techniques.
2. Design and execute an ETL pipeline using Spark for a large dataset.

MODULE-VI APPLIED AI USE CASES 8

Applied AI: Smart City (Intelligent Video Analytics)- Applied AI: Smart City (Intelligent Video Analytics) -Applied AI: Healthcare (Federated Learning, AI Assisted Annotation).

LIST OF EXPERIMENTS

1. Implement object detection and tracking on surveillance video streams.
2. Develop a basic annotation system using AI-assisted labeling techniques.

TOTAL :45 PERIODS

LABORATORY REQUIREMENTS:

Standalone desktop with Ubuntu Linux, Python, Anaconda, Jupyter Notebook, Docker, Kubernetes, PyTorch, TensorFlow, Horovod, Apache Spark, Dask, OpenCV, Label Studio, NumPy, Pandas, Matplotlib, and Scikit-learn-30 Nos.

TEXT BOOKS

1. Designing Machine Learning Systems: An Iterative Process for Production-Ready Applications, Author: Chip Huyen, Edition: 1st Edition, Publisher: O'Reilly Media , Year: 2022

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

2. Deep Learning , Authors: Ian Goodfellow, Yoshua Bengio, Aaron Courville ,Edition: 1st Edition , Publisher: MIT Press ,Year: 2016.
3. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Author: Aurélien Géron , Edition: 3rd Edition ,Publisher: O'Reilly Media ,Year: 2022

REFERENCES:

1. High Performance Python: Practical Performance Programming for Human, Authors: Micha Gorelick, Ian Ozsvald , Edition: 2nd Edition , Publisher: O'Reilly Media, Year: 2020
2. Distributed Machine Learning Patterns: Practical Machine Learning Solutions for Distributed and Collaborative Systems, Author: Yuan Tang , Edition: 1st Edition, Publisher: Manning Publications , Year: 2024

WEB REFERENCES:

1. PyTorch documentation — PyTorch 2.12 documentation
2. Deep Learning Institute (DLI) Training and Certification | NVIDIA
3. Kubernetes Documentation | Kubernetes
4. Overview - Spark 4.1.2 Documentation

ONLINE RESOURCES:

1. https://www.nvidia.com/en-in/training
2. https://www.tensorflow.org/learn

OUTCOMES:

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

1. Apply AI hardware, system software, virtualization, cloud computing, and container technologies to support AI applications. (K3)
2. Utilize design principles to build and configure high-performance computing (HPC) clusters for AI workloads using modern infrastructure practices.(K3)
3. Examine deep learning models using frameworks such as PyTorch and TensorFlow with acceleration techniques. (K4)
4. Apply distributed AI computing techniques using multi-GPU and multi-node systems with communication frameworks and tools(K3).
5. Infer the methods for accelerating AI workloads including inference optimization, scalable data analytics using Dask and ETL pipelines with Apache Spark.(K4).

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

6. Analyse real-world AI applications such as smart city systems and healthcare solutions using advanced techniques like federated learning and intelligent video analytics.(K4)

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	-	-	-	-	-	-	3	-
CO4	2	3	-	-		-	-	-	-	-	-	2	3
CO5	2	3	-	-	3	-	-	-	-	-	-	2	3
CO6	2	3	-	-	-	-	-	-	-	-	-	2	3

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24AIEP506	BUSINESS VISUALIZATION LABORATORY WITH THEORY	L	T	P	CP	C
		1	0	4	5	3
NPTEL CODE: 106106361	SYLLABUS VERSION 1.0	SDG NO. 4,9				
PRE-REQUISITE COURSES	24BSMA303,24AMPT301					

OBJECTIVES:

- To understand the fundamentals of business visualization and visual analytics.
- To apply visualization techniques for business intelligence and decision-making.
- To design interactive dashboards using modern visualization tools.
- To interpret business data using charts, graphs, and storytelling techniques.
- To analyze trends, patterns, and KPIs through visual analytics.
- To develop data-driven reports and presentations for enterprises.

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

MODULE- I INTRODUCTION TO BUSINESS VISUALIZATION **7**

Introduction to Business Analytics and Visualization - Importance of Data Visualization in Business - Types of Business Data: Descriptive, Predictive, and Prescriptive Analytics - Data Visualization Principles: Human Perception and Visual Cognition - Overview of Visualization Tools.

LIST OF EXPERIMENTS

1. Explore and visualize a business dataset using spreadsheet tools to identify key business metrics and trends.
2. Compare different chart types and evaluate their effectiveness for presenting descriptive, predictive, and prescriptive analytics.

MODULE II DATA PREPARATION AND EXPLORATORY VISUALIZATION **8**

Data collection and preprocessing - handling missing and inconsistent data - data transformation and aggregation - exploratory data analysis (EDA) - histograms - box plots - scatter plots - correlation analysis - visualization using spreadsheets and Python.

LIST OF EXPERIMENTS

1. Perform data cleaning, preprocessing, and transformation on a business dataset using Python.
2. Conduct Exploratory Data Analysis (EDA) using histograms, box plots, scatter plots, and correlation matrices.

MODULE III BUSINESS CHARTS AND DASHBOARD DESIGN **7**

Bar charts - pie charts - line charts - area charts - heat maps and tree maps - KPI visualization - dashboard design principles - interactive dashboards - visual hierarchy and layout design - case studies using Tableau/Power BI.

MODULE -IV STORY TELLING WITH DATA **8**

Data storytelling concepts - visual narratives and communication - choosing effective visuals - color theory and typography - business reporting techniques - infographics for business communication - ethical issues in data presentation.

LIST OF EXPERIMENTS

1. Create business charts (bar, line, pie, heat map, and treemap) to visualize organizational performance metrics.
2. Design an interactive business dashboard using Tableau or Power BI incorporating KPIs and visual filters.

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

MODULE- V ADVANCED BUSINESS VISUALIZATION TECHNIQUES 8

Time-series visualization - geographic and spatial visualization - network visualization - predictive visualization techniques - real-time business monitoring dashboards - visualization for marketing - finance - HR - and operations.

LIST OF EXPERIMENTS

1. Develop a visual story from a business dataset using appropriate charts, annotations, and narrative elements.
2. Create an infographic for business reporting using visualization and design principles.

MODULE -VI VISUALIZATION TOOLS AND BUSINESS APPLICATIONS 7

Tableau fundamentals - Microsoft Power BI - Google Data Studio (Looker Studio) - Python visualization libraries (Matplotlib, Seaborn, Plotly) - Visualization case studies.

LIST OF EXPERIMENTS

1. Build interactive business reports and dashboards using Tableau, Power BI, or Looker Studio.
2. Develop advanced visualizations using Python libraries such as Matplotlib, Seaborn, and Plotly for business decision-making.

TOTAL:45 PERIODS

LABORATORY REQUIREMENTS:

Standalone desktop with Python, Anaconda, Jupyter Notebook, LibreOffice Calc, Pandas, NumPy, Matplotlib, Seaborn, and Plotly-30 Nos.

TEXT BOOKS:

1. Cole Nussbaumer Knaflic, Storytelling with Data: A Data Visualization Guide for Business Professionals, 1st Edition, John Wiley & Sons, 2015, ISBN: 978-1119002253.
2. Stephen Few, Information Dashboard Design: The Effective Visual Communication of Data, 2nd Edition, Analytics Press, 2013, ISBN: 978-1938377006.
   (The 2nd Edition is the latest available edition.)
3. Kieran Healy, Data Visualization: A Practical Introduction, 1st Edition, Princeton University Press, 2018, ISBN: 978-0691181622.

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

REFERENCES:

1. Claus O. Wilke, Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures, 1st Edition, O'Reilly Media, 2019, ISBN: 978-1492031086.
2. Scott Murray, Interactive Data Visualization for the Web: An Introduction to Designing with D3, 2nd Edition, O'Reilly Media, 2017, ISBN: 978-1491921289

WEB REFERENCES:

1. https://matplotlib.org/stable/index.html
2. https://learn.microsoft.com/en-us/power-bi

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_mg14.
2. https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_mg09.
3. https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg07

OUTCOMES:

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

1. Apply business visualization principles and analytical techniques to represent business data effectively. (K3)
2. Analyze business data using exploratory visualization and statistical techniques. (K4)
3. Develop interactive charts, dashboards, and KPI visualizations using modern BI tools. (K3)
4. Infer data storytelling methods to communicate business insights through effective visual narratives. (K4)
5. Utilize advanced visualization techniques for time-series, geographic, and predictive business analytics. (K3)
6. Examine visualization tools and business applications for effective business decision-making and reporting. (K4)

CO - PO, PSO MAPPING:

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

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

CO3	3	2	-	-	3	-	-	-	-	-	-	2	3
CO4	2	3	-	-	2	-	-	-	-	-	-	2	2
CO5	3	2	-	-	2	-	-	-	-	-	-	2	2
CO6	2	3	-	-	2	-	-	-	-	-	-	3	2

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24AIEL513	INFORMATION SECURITY AND PRIVACY	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106106248	SYLLABUS VERSION 1.0	SDG NO. 4,9,16				
PRE-REQUISITE COURSES	24AMPT301, 24AMPC303,24AMPC402					

OBJECTIVES

- To introduce the fundamental principles of cyber security and information assurance.
- To understand governance, risk management, compliance, and security policy frameworks.
- To analyze cyber threats, vulnerabilities, attacks, and defense mechanisms.
- To study cryptographic techniques and access control mechanisms used in modern systems.
- To examine privacy concepts, privacy regulations, and data protection frameworks.
- To evaluate the economic, strategic, legal, and ethical dimensions of privacy and cyber security.

MODULE- I FOUNDATIONS OF CYBER SECURITY AND INFORMATION ASSURANCE 7

Introduction to Cyber Security- Information Security versus Cyber Security- Confidentiality-Integrity- Availability (CIA)- Security Goals- Threats- Vulnerabilities- Risk- Cyber Attacks- Security Breaches- Case Study: Target Data Breach.

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

MODULE -II SECURITY GOVERNANCE, COMPLIANCE AND POLICY MANAGEMENT **8**

Security Management Concepts- Governance- Risk and Compliance (GRC)- GRC Framework- Security Standards-Enterprise Information Security Policy- Issue- Specific Security Policy-System- Specific Security Policy.

MODULE -III RISK MANAGEMENT AND CONTINGENCY PLANNING **7**

Cyber Risk Identification- Risk Assessment- Risk Analysis- Risk Treatment and Control- Incident Response Planning- Disaster Recovery Planning- Business Continuity Planning-Cyber Crisis Management-Business Impact Analysis (BIA).

MODULE-IV CYBER SECURITY TECHNOLOGIES AND DEFENSE MECHANISMS **8**

Cyber Threat Landscape- Malware- Exploits- Defense Technologies-Network Security Technologies- Access Control Models- Authentication and Authorization- Security Standards and Protocols.

MODULE-V CRYPTOGRAPHY AND PRIVACY FOUNDATIONS **7**

Introduction to Cryptography- Symmetric and Asymmetric Cryptography- Cryptographic Applications- Information Privacy Concepts- Privacy Theories- Privacy Measurement Approaches.

MODULE-VI PRIVACY REGULATIONS, ECONOMICS AND STRATEGIC PERSPECTIVES **8**

Privacy Laws and Ethics- GDPR, Digital Personal Data Protection Act 2023- Aadhaar Privacy Issues-Data Breach Regulations- Economic Value of Privacy- Business Strategy and Privacy.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Whitman, M. E., & Mattord, H. J. Principles of Information Security, 7th Edition, Cengage Learning, Boston, USA, 2021.
2. Stallings, W. Cryptography and Network Security: Principles and Practice, 8th Edition, Pearson Education, New York, USA, 2023.
3. Peltier, T. R. Information Security Policies and Procedures: A Practitioner's Reference, 2nd Edition, Auerbach Publications (CRC Press), Boca Raton, Florida, USA, 2004.

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

REFERENCES:

1. Anderson, Ross Security Engineering: A Guide to Building Dependable Distributed Systems, 3rd Edition, Wiley Publishing, Indianapolis, USA, 2020.
2. Schneier, Bruce Applied Cryptography: Protocols, Algorithms, and Source Code in C, 20th Anniversary Edition, Wiley Publishing, Indianapolis, USA, 2015.
3. Bishop, Matt Computer Security: Art and Science, 2nd Edition, Addison-Wesley Professional, Boston, USA, 2018.
4. Solove, Daniel J. Understanding Privacy, 1st Edition, Harvard University Press, Cambridge, Massachusetts, USA, 2008.

WEB REFERENCES:

1. https://csrc.nist.gov/
2. https://www.nist.gov/cyberframework
3. https://csrc.nist.gov/pubs/sp/800/61/r2/final

ONLINE RESOURCES:

1. https://www.cisa.gov
2. https://www.nist.gov/cyberframework
3. https://owasp.org
4. https://gdpr-info.eu
5. https://www.meity.gov.in

OUTCOMES:

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

1. Apply cyber security principles, security objectives, and threat assessment concepts to identify and address security requirements in information systems and digital environments. (K3)
2. Demonstrate governance, risk, compliance, and security policy frameworks to support secure decision-making and organizational cyber security management. (K3)
3. Analyze cyber risks, security incidents, and organizational vulnerabilities to develop appropriate risk mitigation and contingency planning strategies. (K4)
4. Examine cyber defense technologies, access control mechanisms, and security solutions to safeguard digital infrastructure against evolving cyber threats. (K4)
5. Compare cryptographic techniques and privacy-preserving mechanisms to ensure secure communication, data confidentiality, and protection of personal information. (K4)

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

6. Utilize privacy regulations, legal frameworks, and the strategic implications of cyber security and data protection in organizational and societal contexts. (K3)

CO - PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24AIEL514	EMBEDDED SENSOR NETWORKS AND MIDDLEWARE ARCHITECTURES	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106105160	SYLLABUS VERSION 1.0	SDG NO. 3,4,9				
PRE-REQUISITE COURSES	24AMPC303, 24AMPC402					

OBJECTIVES:

- To understand the architecture and characteristics of wireless ad hoc networks.
- To analyze routing, MAC, transport, and multicasting protocols in MANETs.
- To study opportunistic networks and UAV-based communication systems.
- To understand wireless sensor network architecture and deployment.
- To analyze routing, congestion control, and security mechanisms in WSNs.
- To explore real-world applications and emerging trends in sensor networks.

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

MODULE I FUNDAMENTALS OF AD HOC NETWORKS **8**

Introduction to Wireless Ad Hoc Networks – Characteristics and Challenges of Ad Hoc Networks – Self-Organizing Behaviour of Wireless Ad Hoc Networks – Cooperation in Mobile Ad Hoc Networks – Architecture and Applications of MANETs – Design Issues in Embedded Wireless Networks

MODULE II PROTOCOLS IN MANETs **8**

MAC Protocols in MANETs- Routing Protocols in MANETs- Proactive Routing- Reactive Routing, Hybrid Routing- Multicasting in MANETs- Mobility Models- Transport Protocols for MANETs.

MODULE III ADVANCED MOBILE AD HOC NETWORKS **7**

Opportunistic Mobile Networks- Delay Tolerant Networking- Store-Carry-Forward Communication- UAV Network Architecture- Communication Models- Applications of UAV Networks- Integration with Embedded Sensor Systems.

MODULE IV UAV NETWORKS AND WIRELESS SENSOR NETWORKS **7**

Introduction to Wireless Sensor Network- Sensor Node Architecture- Embedded Sensing Platforms- Coverage and Placement Strategies- Mobile Wireless Sensor Networks-Middleware Concepts- Middleware Services for Resource Management and Data Integration.

MODULE V WIRELESS SENSOR NETWORKS **8**

Coverage and Placement Strategies- Mobile Wireless Sensor Networks- Medium Access Control in Wireless Networks- Routing Protocols in WSNs- Congestion and Flow Control Mechanisms.

MODULE VI ADVANCED WSN APPLICATIONS AND SECURITY **7**

Underwater Sensor Networks – Security Issues in Wireless Sensor Networks – Secure Communication Mechanisms – Hardware Design of Sensor Nodes – Real-Life Deployment of Wireless Sensor Networks – Emerging Embedded Sensor Network Applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Carlos de Morais Cordeiro and Dharma P. Agrawal, Ad Hoc and Sensor Networks: Theory and Applications, 2nd Edition, World Scientific Publishing, 2011.
2. C. Siva Ram Murthy and B. S. Manoj, Ad Hoc Wireless Networks: Architectures and Protocols, 1st Edition, Pearson Education (Prentice Hall PTR), 2004.

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

3. Kazem Sohraby, Daniel Minoli and Taieb Znati, Wireless Sensor Networks: Technology, Protocols and Applications, 1st Edition, John Wiley & Sons, 2007.

REFERENCES:

1. Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, Wiley.
2. Ian F. Akyildiz and Mehmet Can Vuran, Wireless Sensor Networks, Wiley.
3. Mohammad Ilyas, The Handbook of Ad Hoc Wireless Networks, CRC Press.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106105160
2. https://datatracker.ietf.org/wg/manet/about/
3. https://www.sciencedirect.com/topics/computer-science/wireless-ad-hoc-network
4. https://owasp.org/www-project-internet-of-things/

ONLINE RESOURCES:

1. NPTEL – Wireless Ad Hoc and Sensor Networks
2. IEEE Communications Society Digital Library
3. https://www.cisco.com
4. https://www.sciencedirect.com

OUTCOMES

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

1. Apply the concepts and characteristics of wireless ad hoc networks and self-organizing systems. (K3)
2. Utilize routing, MAC and transport protocols for efficient communication in MANETs. (K3)
3. Analyze opportunistic mobile networks and UAV network architectures for various applications. (K4)
4. Apply wireless sensor network architectures, deployment strategies and medium access mechanisms. (K3)
5. Infer routing, congestion control and performance issues in wireless sensor networks. (K4)
6. Examine security mechanisms, underwater sensor networks and real-life WSN deployments. (K4)

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

CO - PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - I

COURSE CODE: 24AIEL518	IOT BASED SMART SYSTEMS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106105166	SYLLABUS VERSION 1.0	SDG NO. 9,11				
PRE-REQUISITE COURSES	24AMPC402					

OBJECTIVES:

- To understand the fundamental concepts, architecture, and enabling technologies of the Internet of Things (IoT).
- To learn IoT communication protocols, networking technologies, sensors, and actuators used in smart systems.
- To design and develop IoT solutions using embedded platforms, microcontrollers, and rapid prototyping techniques.
- To explore cloud computing, edge/fog computing, data analytics, machine learning, and security aspects in IoT environments.
- To develop and evaluate IoT-based smart applications for domains such as smart cities, healthcare, agriculture, transportation, and Industry 4.0.

MODULE- I INTRODUCTION TO INTERNET OF THINGS 8

Introduction to IoT – Evolution of IoT – Characteristics of IoT – IoT Architecture – Physical Design of IoT – Logical Design of IoT – IoT Enabling Technologies – Sensors and Actuators – IoT Communication Models – IoT Applications and Challenges.

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

MODULE -II IoT NETWORKS AND COMMUNICATION PROTOCOLS **8**

Network Fundamentals – IPv4 and IPv6 – TCP/IP Protocol Suite – Wireless Sensor Networks – RFID and NFC – ZigBee – Bluetooth Low Energy (BLE) – Wi-Fi – LoRaWAN – MQTT – CoAP – AMQP – IoT Gateway Concepts.

MODULE- III IoT SYSTEM DESIGN AND DEVELOPMENT **7**

IoT Design Methodology – Embedded Systems for IoT – Microcontrollers and Single Board Computers – Arduino and Raspberry Pi Overview – Sensor Interfacing – Actuator Control – Data Acquisition Systems – IoT Software Frameworks – Rapid Prototyping of IoT Solutions.

MODULE-IV CLOUD, DATA ANALYTICS AND SECURITY IN IoT **7**

Cloud Computing for IoT – IoT Data Management – Edge and Fog Computing – Data Analytics for IoT – Machine Learning in IoT – IoT Security Requirements – Authentication and Authorization – Privacy Preservation – Secure Communication Protocols – Cybersecurity Challenges in Smart Systems.

MODULE- V SMART SYSTEMS AND INDUSTRIAL IoT **7**

Smart Home Systems – Smart Buildings – Smart Agriculture – Smart Healthcare – Smart Transportation – Smart Grid Applications – Industrial IoT (IIoT) – Industry 4.0 Concepts – Predictive Maintenance – Digital Twin Technology.

MODULE -VI IoT APPLICATION DEVELOPMENT AND CASE STUDIES **8**

IoT Application Development Life Cycle – Smart City Solutions – Environmental Monitoring Systems – Intelligent Energy Management – Connected Vehicles – Wearable IoT Devices – AI-enabled Smart Systems – Recent Trends in IoT – Case Studies and Future Directions.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things: A Hands-On Approach, Universities Press, 2015.
2. Raj Kamal, Internet of Things: Architecture and Design Principles, 2nd Edition, McGraw Hill Education (India), 2021, ISBN: 978-9390727384.
3. Adrian McEwen and Hakim Cassimally, Designing the Internet of Things, Wiley Publications, 2014.

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

REFERENCES:

1. Maciej Kranz, Building the Internet of Things, Wiley, 2016.
2. Dieter Uckelmann, Architecting the Internet of Things, Springer, 2018.
3. Samuel Greengard, The Internet of Things, MIT Press, 2021.
4. Brian Russell and Drew Van Duren, Practical Internet of Things Security, Packt Publishing, 2018.

WEB REFERENCES:

1. https://www.geeksforgeeks.org/electronics-engineering/internet-of-things-iot-enabling-technologies/
2. https://www.ibm.com/think/topics/internet-of-things
3. https://www.pcbonline.com/blog/iot-protocols.html
4. https://www.google.com/search?q=https://www.libelium.com/iot-case-studies/

ONLINE RESOURCES:

1. http://onlinecourses.nptel.ac.in
2. http://www.netacad.com
3. http://www.coursera.org
4. http://www.edx.org
5. http://thingspeak.com

OUTCOMES

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

1. Apply IoT architectures, components, and communication models to develop IoT solutions. (K3)
2. Analyze IoT networking technologies and communication protocols used in smart systems. (K4)
3. Utilize IoT design methodologies to develop smart applications using sensors and actuators. (K3)
4. Examine cloud-based IoT systems with data analytics and security mechanisms. (K4)
5. Analyze Industrial IoT and smart system applications in various domains. (K4)
6. Discover IoT-enabled smart solutions for real-world challenges using emerging technologies. (K4)

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

CO - PO, PSO MAPPING:

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

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

PROFESSIONAL ELECTIVE - II

COURSE CODE: 24AMEL503	INTELLIGENT USER INTERFACES	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106106701	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24AMPC301, 24AMPC302, 24BSMA303					

OBJECTIVES:

- To introduce the fundamental concepts, principles, and evolution of Intelligent User Interfaces (IUI).
- To understand human factors, user behavior, cognitive aspects, and user modeling techniques in intelligent systems.
- To study models and theories related to Human–Computer Interaction and intelligent interface design.
- To explore mobile and web-based intelligent interfaces and adaptive interaction techniques.
- To understand advanced interaction paradigms including multimodal, context-aware, and AI-driven interfaces.
- To develop the ability to design, evaluate, and integrate intelligent UI/UX solutions across platforms.

MODULE - I BASICS OF INTELLIGENT USER INTERFACES 7

Introduction to Intelligent User Interfaces – Evolution and Need for Intelligent Interfaces – Characteristics of IUI – Human-Computer Interaction Foundations – User-Centered Design – Components of Intelligent Interfaces – Interaction Models – Interface Styles – Ergonomics – Intelligent Interaction Paradigms – Introduction to Usability and User Experience Requirements.

MODULE - II USER MODELING AND HUMAN FACTORS IN IUI 9

User Modeling Concepts – User Profiles and Preferences – Human Interaction with Intelligent Systems – Human Characteristics and Cognitive Factors – Human Considerations in Intelligent Environments – Human Interaction Speeds – Context Awareness – Understanding User Intent and Behavior.Screen Designing for Intelligent Interfaces: Design Goals – Adaptive Screen Design – Organizing Interface Elements – Dynamic Content Presentation – Navigation and Flow – Visual Composition – Information Presentation and Retrieval – Personalized Content Delivery – Technological Considerations in Intelligent Interface Design.

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

EM

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

MODULE - III MODELS AND THEORIES IN INTELLIGENT HCI 7

Cognitive Models for Intelligent Systems – AI-Based HCI Models – Socio-Organizational Issues and Stakeholder Requirements – Communication and Collaboration Models – Context-Aware Computing – Hypermedia Systems – Multimedia Interfaces – Intelligent Web Technologies.

MODULE - IV MOBILE AND CONTEXT-AWARE INTELLIGENT INTERFACES 8

Mobile Intelligent Ecosystem – Mobile Platforms – Application Frameworks – Context-Aware Mobile Applications – Adaptive Mobile Interfaces – Intelligent Widgets and Applications – Mobile Information Architecture – Personalized Mobile Experiences – Elements of Mobile Intelligent Design – Tools and Case Studies.

MODULE - V WEB-BASED INTELLIGENT USER INTERFACES 7

Intelligent Web Interfaces – Adaptive Web Systems – Personalized Recommendation Systems – Intelligent Navigation Support – Conversational Interfaces and Chatbots – Web Information Architecture – AI-driven Web Design – Case Studies and Applications.

MODULE - VI ADVANCED INTERACTION AND AI INTEGRATION CONCEPTS 7

Advanced Interaction Paradigms – Natural User Interfaces – Multimodal Interfaces – Voice and Gesture-Based Interaction – AI Integration in UI/UX – Cross-Platform Intelligent Design – Usability Evaluation Methods – Explainable AI in Interfaces – Design Consistency and Accessibility Principles

TOTAL : 45 PERIODS

TEXT BOOK:

1. Julie A. Jacko, "Human Computer Interaction Handbook", CRC Press, 2023.
2. Helen Sharp, Yvonne Rogers, Jenny Preece, "Interaction Design: Beyond Human–Computer Interaction", 6th Edition, Wiley, 2023.

REFERENCES:

1. Jeff Johnson, "Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Guidelines", Morgan Kaufmann, 3rd Edition, 2020.
2. Dix, Finlay, Abowd, and Beale, "Human–Computer Interaction", Pearson Education, 5th Edition, 2023.

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

WEB REFERENCES:

1. https://freevideolectures.com/course/4491/nptel-introduction-human-computer-interaction
2. https://www.interaction-design.org

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc23_cs116

OUTCOMES

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

1. Utilize the concepts, components, and principles of Intelligent User Interfaces and Human–Computer Interaction in interface design. (K3)
2. Use user characteristics, cognitive factors, and user models to design adaptive and intelligent interfaces.(K3)
3. Employ HCI models, communication theories, and intelligent interaction techniques in designing user interfaces.(K3)
4. Implement mobile and web-based intelligent interfaces using context-aware and personalized approaches.(K3)
5. Demonstrate usability, accessibility, and user experience methods in assessing interface design quality.(K3)
6. Execute AI-enabled interaction techniques and cross-platform design principles in intelligent interface applications.(K3)

CO - PO, PSO MAPPING:

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

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engi...
(Artificial Intelligence and Machine Learning)

PROFESSIONAL ELECTIVE - II

COURSE CODE: 24AMEL504	DECISION MAKING UNDER UNCERTAINTY	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 110106134	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24BSMA303, 24AMPC301					

OBJECTIVES:

- To understand the fundamentals of decision making under uncertainty using probabilistic models and graphical representations such as Bayesian Networks.
- To analyze and solve decision problems using utility theory, decision networks, Game Theory, and sequential decision-making techniques.
- To apply learning and optimization methods to handle model and state uncertainty, including reinforcement learning and Partially Observable Markov Decision Process frameworks.
- To understand cooperative decision-making approaches in multi-agent systems under uncertain environments.

MODULE - I PROBABILISTIC MODELS 8

Introduction to Decision Making - Methods for Designing Decision Agents- Representation: Degrees of Belief and Probability, Probability and Joint Distributions - Bayesian Network Representation- Inference: Exact and Approximate- Parameter Learning: Maximum Likelihood, Bayesian Parameter and Nonparametric Learning- Structure Learning.

MODULE - II DECISION PROBLEMS 7

Utility Theory: Constraints on Rational Preferences, Utility Functions, Maximum Expected Utility Principle, Utility Elicitation, Multiple Variable Utility Functions, - Decision Networks: Evaluating Decision Networks, Value of Information, Creating Decision Networks- Games: Dominant Strategy Equilibrium, Nash Equilibrium, Behavioural Game Theory.

MODULE - III SEQUENTIAL PROBLEMS 8

Formulation - Dynamic Programming- Structured Representations- Linear Representations- Approximate Dynamic Programming: Local Approximation and Global Approximation- Online Methods: Forward Search, Branch and

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

Bound Search, Sparse Sampling, Monte Carlo Tree Search- Direct Policy Search: Objective Function- Local Search Methods- Cross Entropy Methods- Evolutionary Methods.

MODULE - IV MODEL UNCERTAINTY 7

Exploration and Exploitation Multi-Armed Bandit Problems, Bayesian Model Estimation, Exploration Strategies (Ad Hoc and Optimal) - Maximum Likelihood Model-Based Methods: Randomized and Prioritized- Bayesian Model-Based Methods- Model-Free Methods- Generalization.

MODULE - V STATE UNCERTAINTY 7

Formulation: Partially Observable Markov Decision Processes, Policy Execution, Belief-State Markov Decision Processes- Belief Updating- Exact Solution Methods- Offline Methods- Online Methods.

MODULE - VI COOPERATIVE DECISION MAKING 8

Formulation: Decentralized POMDPs- Properties: Differences with POMDPs, Dec-POMDP Complexity- Generalized Belief States- Notable Subclasses: Dec-MDPs, ND-POMDPs, MMDPs- Exact Solution Methods- Approximate Solution Methods- Communication.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Christos Dimitrakakis, Ronald Ortner "Decision Making Under Uncertainty and Reinforcement Learning: Theory and Algorithms" December 2022.
2. Mykel J. Kochenderfer "Decision Making Under Uncertainty: Theory and Application (MIT Lincoln Laboratory Series), July 2015.

REFERENCES:

1. Vincent A. W. J. Marchau, Warren E. Walker Pieter J. T. M. Bloemen , Steven W. Popper "Decision Making under Deep Uncertainty: From Theory to Practice" Springer, April 2019.
2. Steven W Popper, Warren E Walker, Pieter J T M Bloemen "Decision Making Under Deep Uncertainty" Saint Philip Street Press, October 2020.

WEB REFERENCES:

1. https://plato.stanford.edu/entries/logic-ai/
2. https://www.aaai.org/

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

OUTCOMES

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

1. Examine probabilistic models, Bayesian network representations, inference methods, and parameter learning techniques for decision making under uncertainty (K4).
2. Analyze utility functions, decision networks, and game-theoretic models for evaluating decision problems (K4).
3. Inspect sequential decision-making problems using dynamic programming, approximation methods, online search techniques, and policy search methods (K4).
4. Compare exploration strategies, Bayesian and model-based estimation methods, and model-free approaches for handling model uncertainty (K4).
5. Analyze Partially Observable Markov Decision Processes, belief-state representations, belief updating, and solution methods under state uncertainty (K4).
6. Examine decentralized POMDPs, generalized belief states, cooperative decision-making subclasses, and communication-based solution methods (K4).

CO - PO, PSO MAPPING:

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

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

E-H—
CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

PROFESSIONAL ELECTIVE - II

COURSE CODE: 24AMEP501	EDGE AI AND COGNITIVE IOT LABORATORY WITH THEORY	L	T	P	CP	C
		1	0	4	5	3
NPTEL CODE: 106104242	SYLLABUS VERSION 1.0	SDG NO. 9, 11				
PRE-REQUISITE COURSES	24AMPC301, 24AMPC402, 24AMPW401					

OBJECTIVES:

- To understand the fundamentals of Edge Artificial Intelligence (Edge AI), Internet of Things (IoT), and Cognitive IoT systems along with their applications and ethical considerations.
- To gain knowledge of embedded edge devices, sensor interfacing, communication protocols, and edge-to-cloud integration for intelligent IoT applications.
- To develop programming skills using Raspberry Pi and OpenCV for real-time data acquisition, processing, and Edge AI implementation.
- To understand machine learning, efficient deep learning models, and computer vision techniques for Cognitive IoT applications.
- To design and implement intelligent monitoring, automation, and decision-making systems using Edge AI and Cognitive IoT concepts.
- To apply security mechanisms, authentication methods, and secure communication techniques for Cognitive IoT platforms and edge devices.

MODULE - I INTRODUCTION TO EDGE AI **10**

Introduction to Edge AI and Internet of Things (IoT) – Need for Edge AI – Benefits and Challenges of Edge AI – Edge AI vs Cloud AI – Edge computing architecture – Embedded edge devices and Raspberry Pi platform – Applications of Edge AI in object tracking, intelligent monitoring, automation, and signal transformation – Responsible AI, AI ethics, black-box models and bias – Introduction to Raspberry Pi GPIO programming and device interfacing.

Experiments:

1. Design and implementation of GPIO-based LED blinking for basic edge device initialization.
2. Design and implementation of PWM-based LED brightness control using GPIO programming.
3. Design and implementation of composite GPIO control using LED, buzzer, and push-button.

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

MODULE - II SENSORS AND COMMUNICATION SYSTEMS FOR EDGE AI 10

Introduction to Sensors - Types of Sensors: Acoustic and Vibration Sensors, Motion and Position Sensors, Visual and Scene Sensors, Force and Tactile Sensors - Sensor Interfacing and Data Acquisition - Telecommunication Protocols for Sensor Communication: LoRa, LoRaWAN, ZigBee - Edge-to-Cloud Communication - MQTT Publish-Subscribe Communication.

Experiments:

1. Design and implementation of temperature and humidity sensing using a DHT11 sensor interfaced with Raspberry Pi Model.
2. Design and implementation of motion detection using a PIR sensor and ultrasonic sensor for edge-based monitoring applications.
3. Design and implementation of sensor data transmission using MQTT publish-subscribe communication between edge devices.

MODULE - III EDGE DEVICE PROGRAMMING AND ALGORITHMS 10

Programming using Raspberry Pi - SSH-Based Remote Access - Pi Camera Interfacing - Image and Video Processing using OpenCV - Feature Engineering - Real-Time Data Processing - Multimodal Data Fusion - Artificial Intelligence Algorithms for Edge Applications - Optimization Techniques for Edge Devices - On-Device Inference and Training - Edge-to-Cloud Integration - IoT Cloud Platforms using Firebase, Google Cloud, and ThingSpeak.

Experiments:

1. Design and implementation of on-device image classification or object recognition using lightweight AI models on Raspberry Pi.
2. Design and implementation of edge-to-cloud environmental monitoring using IoT platforms

MODULE - IV COGNITIVE IOT SYSTEMS AND APPLICATIONS 10

Introduction to Cognitive IoT (CIoT) - CIoT Architecture - Data Flow in a CIoT- Cognitive Capabilities offered by CIoT Platforms- Classification of cognitive capabilities - Cognitive Capabilities for Consumer and Enterprise Markets - Major Cognitive IoT Platforms - CIoT Use Cases and Deployment.

Experiments:

1. Design and implementation of smart room monitoring using temperature and motion sensors with automatic control.
2. Design and implementation of Intelligent fan control based on real-time temperature analysis and adaptive decision making.

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

E.M—
CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

MODULE - V AI AND MACHINE LEARNING FOR COGNITIVE IOT 10

Machine Learning for CIoT – Supervised and unsupervised learning concepts – Sensor data analytics and classification – Overview of efficient Deep Learning models for CIoT – Computer vision for Cognitive IoT using OpenCV – Object detection and intelligent monitoring.

Experiments:

1. Design and implementation of sensor data classification using machine learning on Raspberry Pi.
2. Design and implementation of object detection using Pi camera and OpenCV.

MODULE - VI SECURITY IN COGNITIVE IOT 10

Security in CIoT - Security in the Data and Network Layer of CIoT - Identity and Access Management: Authentication, Authorization, and Audit Trial Framework (AAA)- Défense-in-Depth - Core Security Mechanisms -Data and Network Security- Cloud and Virtualization Security- Device and Application Security.

Experiments:

1. Design and implementation of user authentication and secure device access control on Raspberry Pi
2. Design and implementation of secure sensor data transmission using encrypted MQTT communication.

TOTAL : 60 PERIODS

TEXT BOOK:

1. Daniel Situnayake and Jenny Plunkett. "AI at the Edge. Solving Real-World Problems with Embedded Machine Learning " O'Reilly Media, Inc.", 2023.
2. Pethuru Raj; Anupama C. Raman; Harihara Subramanian "Cognitive Internet of Things: Enabling Technologies, Platforms, and Use Cases", 1st Edition.,2022.

REFERENCES:

1. Xiaofei Wang, Yiwen Han, Victor C. M. Leung et al., Edge AI: Convergence of Edge Computing and Artificial Intelligence, 1st Edition, Springer, 2020.
2. Neeraj Kumar Aaisha Makkar "Machine Learning in Cognitive IoT" CRC Press, 1st Edition, 2020.

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

WEB REFERENCES:

1. https://nptel.ac.in/courses/106104449
2. https://www.coursera.org/learn/edge-ai-fundamentals
3. https://ieeexplore.ieee.org/document/11184150

ONLINE RESOURCES:

1. https://github.com/microsoft/edgeai-for-beginners?WT.mc_id=academic-105485-koreyst
2. https://link.springer.com/book/10.1007/978-3-030-04946-1

OUTCOMES

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

1. Examine the implementation of Edge Artificial Intelligence concepts in real-world applications to understand their practical benefits. (K4)
2. Analyze the role and integration of sensors, processors, and embedded hardware in Edge AI systems to support intelligent decision-making. (K4)
3. Inspect feature engineering, signal processing, and AI algorithms used in edge devices for efficient data processing. (K4)
4. Infer the architecture, platforms, and deployment strategies of Cognitive IoT systems for diverse applications. (K4)
5. Compare various cognitive intelligence technologies used in CIoT applications based on their functionalities. (K4)
6. Distinguish security mechanisms and threats in Cognitive IoT systems to ensure secure and reliable operation. (K4)

CO - PO, PSO MAPPING:

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

Recommended in Board of Studies (BoS) Meeting No. 06 **held on** 09/04/2026

E.N—
CHAIRMAN
Board of Studies
Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24ITEL503	CLOUD COMPUTING	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106105167	SYLLABUS VERSION 1.0	SDG NO. 9, 11, 13				
PRE-REQUISITE COURSES	24ITPW401					

OBJECTIVES:

- To interpret the basics of cloud computing.
- To learn about concepts of virtualization and virtualization infrastructure.
- To understand the principles of Cloud Architecture, Design challenges and Infrastructure.
- To explore and experiment various Cloud deployment environments.
- To learn about the security issues in the cloud environment.

MODULE - I CLOUD ARCHITECTURE AND MODELS 7

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud Characteristics – Cloud deployment models – Cloud service models – Pros and Cons of Cloud.

MODULE - II INTRODUCTION TO VIRTUALIZATION 8

Basics of Virtualization – Virtualization Types – Implementation Levels of Virtualization – Virtualization Structures / Tools and Mechanisms – Virtualization of CPU, Memory, I/O Devices – Virtual Clusters and Resource management – Virtualization for Data-Center Automation – Virtualization Support and Disaster Recovery – Taxonomy of Virtual Machines – Create VM Cluster using VMWare or Virtual Box and deploy an application.

MODULE - III CLOUD INFRASTRUCTURE 8

Cloud Infrastructure: Architectural design of compute and storage clouds – Layered cloud architecture Development – Design Challenges – Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.

MODULE - IV CLOUD DEPLOYMENT ENVIRONMENT 7

Parallel Programming Framework: Hadoop Map Reduce – Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack – OpenNebula – Aneka.

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 12/05/2026

CHAIRMAN
Board of Studies
Information Technology

MODULE - V CLOUD SECURITY 7

Data Security and Storage; Identity and Access Management (IAM) – IAM Challenges – IAM Architecture and Practice; Security Management in the Cloud – Security Management Standards – SaaS, Paas and IaaS Availability Management – Access Control; Security-As-A-Service.

MODULE - VI CLOUD SIMULATOR & CLOUD APPLICATIONS 8

CloudSim – Architecture - Cloudlets – VM creation – Broker – VM allocation – Hosts – Data Center. Web Service Architecture – Web service APIs – Web service authentication - Web service authentication methods - Technologies and the processes required when deploying web services; Deploying a web service from inside and outside a cloud architecture, advantages and disadvantages.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Kai Hwang, Geoffery C Fox, Jack J Dongarra, "Distributed and Cloud Computing: Clus- ters, Grids, Clouds and the Future of Internet", 1st Edition, Morgan Kaufman Publisher, Oxford, an Imprint of Elsevier, 2012.
2. Srinivasan A, Suresh J, "Cloud Computing: A practical Approach for Learning and Implementation", Pearson Education India, 2014.

REFERENCES:

1. Tim Mather, Subra Kumaraswamy, Shahed Latif , "Cloud Security and Privacy: an enterprise perspective on risks and compliance", O'Reilly Media, 2009.
2. Danielle Ruest, Nelson Ruest, "Virtualization: A Beginner's Guide", McGraw-Hill Osborne Media, 2009.
3. James E Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
4. William von Hagen, "Professional Xen Virtualization", Wrox Publications, January, 2008.
5. David Marshall, Wade A Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006.
6. Ronald L. Krutz, Russell Dean Vines, "Cloud Security – A comprehensive Guide to Secure Cloud Computing", Wiley, 2010. 3. Rajkumar Buyya, Christian Vecchiola, S.TamaraiSelvi, "Mastering Cloud Computing", Tata McGraw Hill,2013.

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 12/05/2026

CHAIRMAN
Board of Studies
Information Technology

7. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", first edition, McGrawHill Osborne Media, 2009.

ONLINE RESOURCES:

1. National Institute of Standards and Technology - https://www.nist.gov/itl/cloud
2. Amazon Web Services Documentation - https://docs.aws.amazon.com
3. Microsoft Azure Learn - https://learn.microsoft.com/azure
4. Google Cloud Docs - https://cloud.google.com/docs
5. OpenStack Foundation - https://www.openstack.org
6. https://onlinecourses.nptel.ac.in/noc24_cs118/announcements
7. https://www.coursera.org/browse/information-technology/cloud-computing
8. https://www.edx.org/learn/cloud-computing
9. https://aws.amazon.com/training/learn-about/cloud-practitioner/
10. https://learn.microsoft.com/en-us/training/paths/azure-fundamentals/
11. https://www.cloudskillsboost.google/paths/11

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply cloud computing architecture concepts, including distributed system models and NIST reference architecture, to solve real-world cloud scenarios. (K3)
2. Implement virtualization techniques to create virtual machines, manage virtual clusters, and utilize tools like VMware or VirtualBox. (K3)
3. Use cloud infrastructure design principles to develop scalable compute and storage solutions with efficient resource provisioning. (K3)
4. Build applications using parallel programming frameworks and cloud platforms such as Hadoop, AWS, Azure, and Google App Engine. (K3)
5. Apply cloud security mechanisms, including identity and access management (IAM), access control, and data protection strategies. (K3)
6. Model cloud simulation tools like CloudSim and web service technologies to model, deploy, and evaluate cloud-based applications. (K3)

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 12/05/2026

CHAIRMAN
Board of Studies
Information Technology

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	2	2	3	-	3	-	-	-	-	-	-	2	2
CO3	2	2	3	-	3	-	-	-	-	-	2	2	2
CO4	2	2	3	-	3	-	-	-	-	-	2	2	2
CO5	2	2	3	-	2	-	-	-	-	-	-	2	2
CO6	2	2	3	-	3	-	-	-	-	-	2	2	2

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24ITEL510	ADVANCED ANALYSIS OF ALGORITHMS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106105704	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24ITPC301					

In-
Insert text here
text here

OBJECTIVES:

- To understand advanced algorithmic analysis techniques including amortized analysis.
- To study advanced data structures and network flow algorithms.
- To analyze matching problems and stable matching algorithms.
- To explore randomized algorithms and order statistics techniques.
- To understand computational complexity, NP-completeness and reductions.
- To examine approximation algorithms for NP-hard optimization problems

MODULE - I AMORTIZED ANALYSIS & ADVANCED DATA STRUCTURES 8

Introduction to Amortized Complexity – Aggregate Method – Accounting Method – Potential Function Method – Applications of Amortized Analysis – Fibonacci Heaps: Structure, Operations, Amortized Cost Analysis and Applications.

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 12/05/2026

CHAIRMAN
Board of Studies
Information Technology

MODULE - II NETWORK FLOW ALGORITHMS 8

Maximum Flow Problem – Flow Networks – Ford-Fulkerson Method – Edmond-Karp Algorithm– Dinic's Algorithm – Push-Relabel Method – Correctness and Complexity Analysis.

MODULE - III MATCHING AND FLOW APPLICATIONS 8

Applications of Maximum Flow – Hall's Marriage Theorem – Maximum Bipartite Matching –König's Theorem – Edmonds' Blossom Algorithm for Maximum Matching in General Graphs – Stable Matching Problem – Gale-Shapley Algorithm.

MODULE - IV ORDER STATISTICS, STRING MATCHING AND RANDOMIZED ALGORITHMS 7

Order Statistics – Selection Algorithms – String Matching Techniques – Introduction to Randomized Algorithms – Karger's Minimum Cut Algorithm – Karger-Stein Algorithm – Analysis of Randomized Algorithms..

MODULE - V COMPUTATIONAL COMPLEXITY & NP - COMPLETENESS 7

Lower Bounds on Sorting – Decision and Optimization Problems – Complexity Classes P and NP – Introduction to NP-Completeness – Polynomial-Time Reductions – NP-Completeness Proof Techniques and Examples.

MODULE - VI APPROXIMATION ALGORITHMS 8

Approximation Algorithms – Approximation Ratio – Approximation Algorithm for 3SAT – Metric Traveling Salesman Problem (Metric TSP) – Performance Guarantees – Limitations of Approximation Algorithms.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, " Introduction to Algorithms", Fourth Edition, MIT Press, 2022.
2. Jon Kleinberg and Éva Tardos, "Algorithm Design", First Edition, Pearson Education, 2006.

REFERENCES:

1. Vijay V. Vazirani, "Approximation Algorithms", Springer, First Edition, 2003.
2. Sanjoy Dasgupta, Christos Papadimitriou and Umesh Vazirani, "Algorithms", McGraw-Hill Education, First Edition, 2008.

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 12/05/2026

CHAIRMAN
Board of Studies
Information Technology

3. Michael T. Goodrich, Roberto Tamassia and Michael H. Goldwasser, "Data Structures and Algorithms in Python", Wiley, Second Edition, 2013.
4. Dexter C. Kozen, "The Design and Analysis of Algorithms", Springer, First Edition, 1992.
5. Christos H. Papadimitriou, "Computational Complexity", Addison-Wesley, First Edition,1994.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106105704
2. https://nptel.ac.in/courses/106106131
3. https://ocw.mit.edu
4. https://online.stanford.edu
5. https://visualgo.net

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply amortized analysis techniques and advanced data structures to evaluate algorithmic efficiency. (K3)
2. Analyze and implement maximum flow algorithms for network optimization problems. (K4)
3. Solve matching problems using graph-theoretic algorithms and stable matching techniques. (K4)
4. Apply order statistics, string matching and randomized algorithms to computational problems. (K3)
5. Examine computational complexity classes and prove NP-completeness using polynomial-time reductions. (K4)
6. Design and analyze approximation algorithms for NP-hard optimization problems. (K5)

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 12/05/2026

CHAIRMAN
Board of Studies
Information Technology

CO - PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24ITEL512	PARALLEL ALGORITHMS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106103359	SYLLABUS VERSION 1.0	SDG NO. 9				
PRE-REQUISITE COURSES	24BSMA201, 24AMPC302,24AMPC303					

OBJECTIVES:

- To introduce the design principles of parallel algorithms
- To understand various models of parallel computation (PRAM, EREW, CREW, CRCW and DCM) and Performance analysis metrics such as cost, speedup and efficiency.
- To learn fundamental parallel algorithms for sorting and Searching
- To apply parallel algorithms to solve matrix operations, algebraic and Geometry problems.
- To apply parallel algorithm techniques in solving real-world computational problems

MODULE - I INTRODUCTION TO PARALLEL ALGORITHMS 7

Introduction to Parallel Algorithms-Parallel Programming Paradigms-Parallel Architecture-Need for Parallel Algorithms-Serial vs Parallel Computation-Concepts of Concurrency and Parallelism-Overview of Models of Computation-Applications of Parallel Algorithms

Recommended in Board of Studies (BoS) Meeting No. 08 held on 12/05/2026

CHAIRMAN
Board of Studies
Information Technology

MODULE - II MODELS & COMPLEXITY ANALYSIS 8

Introduction to PRAM Model-PRAM Model (EREW, CREW, CRCW)-Distributed Computing Model (DCM – basics)-Work, Time Complexity, Cost Optimality-Brent's Theorem (basic idea)-Analysis of Parallel Algorithms

MODULE - III PERFORMANCE AND BASIC PARALLEL TECHNIQUES 7

Performance Measures: cost, speedup, efficiency-Work-time analysis-Basic Parallel Techniques-Parallel Prefix (Scan) Computation-Pointer Jumping Technique-Divide and Conquer Approach-Parallel Reduction Operations-Synchronization and Communication overheads

MODULE - IV PARALLEL SORTING & SEARCHING 8

Sorting Networks and Bitonic Sort & odd-Even Transposition Sort-Cole's Merge sort-Sorting on Linear Array-Sorting in EREW, CREW, CRCW-Parallel Searching: Linear and Binary Search-Performance Comparison

MODULE - V ALGEBRAIC, GRAPH & GEOMETRY ALGORITHMS 7

Matrix Transposition-Matrix Multiplication (Matrix–Matrix, Matrix–Vector)-Connected Components-Minimum Spanning Tree-All-Pairs Shortest Paths-Computational Geometry Problems

MODULE - VI ADVANCED PREFIX ALGORITHMS AND APPLICATIONS 8

Prefix Sums (Advanced)-Job Sequencing Problem-Knapsack Problem-Integer Addition and Multiplication-Speedup, Efficiency, Scalability-Amdahl's Law and Gustafson's Law-Applications in AI, Big Data, Scientific Computing

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar , "Introduction to Parallel Computing" , Edition: 2nd Edition, 2003.
2. Joseph JáJá , "Introduction to Parallel Algorithms", Addison-Wesley ,1992

REFERENCES:

1. Xavier & Iyengar, "Introduction to Parallel Algorithms", Wiley, 1998.
2. Sanders et al., "Sequential and Parallel Algorithms and Data Structures", Springer, 2019.
3. Barry Wilkinson & Michael Allen, "Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers", Pearson, 2005.

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 12/05/2026

CHAIRMAN
Board of Studies
Information Technology

4. Selim G. Akl , "Design and Analysis of Parallel Algorithms", Prentice Hall, 1989.

ONLINE RESOURCES:

1. https://www.mindluster.com/lesson/221422-video?
2. https://slidetodoc.com/pram-model-lecture-3-efficient-parallel-algorithms-comp/
3. https://www.geeksforgeeks.org/dsa/bitonic-sort/
4. https://onlinecourses-archive.nptel.ac.in/noc19_cs17/preview1
5. https://www.nptelprep.in/courses/106104120/materials
6. https://ocw.mit.edu/search/?q=parallel%20algorithms&t=Algorithms%20and%20Data%20Structures

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply parallel algorithm design principles to solve computational problems using appropriate models.(K3)
2. Apply PRAM models (EREW, CREW, CRCW) and distributed computing concepts to implement parallel solutions.(K3)
3. Apply performance analysis metrics such as cost, speedup, efficiency and work-time analysis to evaluate parallel algorithms(K3)
4. Implement parallel sorting and searching algorithms.(K3)
5. Apply parallel algorithms to solve matrix operations, graph problems and computational geometry problems.(K3)
6. Apply parallel algorithms to solve real-world problems(K3)

CO - PO, PSO MAPPING:

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

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 12/05/2026

CHAIRMAN
Board of Studies
Information Technology

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24AIEP501	SOFTWARE DESIGN PATTERNS FOR INTELLIGENT AUTOMATION LABORATORY WITH THEORY	L	T	P	CP	C
		1	0	4	5	3
NPTEL CODE: 106105182	SYLLABUS VERSION 1.0	SDG NO. 9, 11				
PRE-REQUISITE COURSES	24AMPT201,24AMPC302,24AMPC301					

OBJECTIVES:

- To understand the software development lifecycles and agile paradigms tailored for intelligent automation.
- To learn advanced object-oriented modeling techniques for non-deterministic automated environments.
- To master creational design patterns for dynamic object instantiation in robotics and process automation.
- To study structural integration patterns to streamline data normalization and wrap complex libraries.
- To implement behavioral design patterns to orchestrate real-time decision-making systems.
- To examine system reliability, software quality metrics, and continuous refactoring strategies.

MODULE - I AUTOMATION LIFECYCLES AND AGILE PROJECT MANAGEMENT 8

Evolution of Software Engineering Paradigms to Autonomous, Data-Driven Systems - Traditional Lifecycles (Waterfall, V-Model) - Iterative and Continuous Paradigms for AI and Intelligent Automation - Agile Engineering Practices - Scrum Framework - DevSecOps Pipelines for Automated Software Generation - DevSecOps Pipelines for Machine Learning Models.

LIST OF EXPERIMENTS:

1. Build an automated DevOps pipeline featuring blue-green deployment strategies for an Intelligent Document Processing (IDP) scoring model.
2. Develop an agile tracking dashboard to monitor runtime model drift and automated system performance metrics.

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

MODULE - II REQUIREMENTS ANALYSIS AND ADVANCED OBJECT-ORIENTED MODELING **8**

Requirement Elicitation Techniques for Non-Deterministic Automation Workflows - Functional Requirements - Non-Functional Requirements - Latency Requirements - Safety Boundaries - Drift Observability - Core Object-Oriented Analysis and Design (OOAD) Principles - Encapsulation - Polymorphism - Inheritance - Dynamic Binding - Application of OOAD Principles to Multi-Agent Automation Architectures.

LIST OF EXPERIMENTS:

1. Draft an automated Software Requirement Specification (SRS) mapping multi-threaded failure modes for a smart warehouse sorting robot.
2. Develop an object-oriented abstract hardware wrapper layer using polymorphism to process inputs from diverse sensor types dynamically.

MODULE - III SYSTEM MODELING AND CREATIONAL ORCHESTRATION PATTERNS **7**

Unified Modeling Language (UML) Structural and Behavioral Modeling for Complex Automation Platforms - Class Diagrams - Use Case Diagrams - Sequence Diagrams - Statechart Diagrams - Coupling Metrics in Automation Components - Cohesion Metrics in Automation Components - Introduction to Creational Design Patterns - Singleton Pattern for Hardware Configurations - Factory Method Pattern for Instantiating Polymorphic RPA Bots and Web Scrapers - Abstract Factory Pattern for Instantiating Polymorphic RPA Bots and Web Scrapers.

LIST OF EXPERIMENTS:

1. Generate interactive UML sequence and statechart diagrams capturing communication flows within an autonomous drone delivery system.
2. Implement a thread-safe Singleton telemetry manager and an Abstract Factory pattern to instantiate Web, Desktop, and Mobile UI automation drivers at runtime.

MODULE - IV STRUCTURAL INTEGRATION AND DATA NORMALISATION PATTERNS **8**

Deep Dive into Structural Software Relationships - Adapter Pattern for Standardizing Heterogeneous Legacy Enterprise APIs - Facade Pattern for Abstracting Massive and Complex Machine Learning and AI Inference Libraries - Proxy Pattern for Controlling Resource-Heavy Edge Computing Nodes - User Interface (UI) Design Principles - Human-in-the-Loop Automation Dashboards.

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

LIST OF EXPERIMENTS:

1. Build a structural Adapter to ingest unstructured data streams (JSON, XML, CSV) into a unified enterprise automation pipeline.
2. Create a Facade interface to simplify a multi-layered Natural Language Processing (NLP) framework for an automated customer support routing tool.

MODULE - V BEHAVIORAL SYNCHRONIZATION AND STATE-DRIVEN AUTOMATION 7

Coding Standards for Automation Scripts - Test-Driven Development (TDD) - Clean Code Implementations for Automation Scripts - Introduction to Behavioral Design Patterns - Strategy Pattern for Dynamic Algorithmic Trading - Strategy Pattern for Operational Routing - Observer Pattern for Real-Time Event-Driven Sensor Alerts - State Pattern for Orchestrating Robot Execution Phases.

LIST OF EXPERIMENTS:

1. Code an Observer-driven notification engine that triggers real-time responses based on network anomaly detection thresholds.
2. Design a robotic picking-arm state controller using the State pattern to seamlessly transition between scanning, grasping, and docking phases.

MODULE - VI QUALITY ASSURANCE, RELIABILITY AND ARCHITECTURAL PATTERNS 7

Software Quality Assurance (SQA) Metrics - Reliability Estimation Models - Fallback Exception-Handling Paradigms for Autonomous Software - Architectural Patterns - Model-View-Controller (MVC) - Microservices Architecture - Event-Driven Architecture (EDA) - Utilization of CASE Tools - Generative Programming Assistants for Automated Refactoring - Generative Programming Assistants for Performance Optimization.

LIST OF EXPERIMENTS:

1. Write structured unit test suites using Mocking frameworks to isolate and validate an autonomous decision matrix without calling live external APIs.
2. Execute an automated structural code refactoring script to eliminate structural smells and improve operational throughput in a legacy RPA macro workflow.

TOTAL : 45 PERIODS

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

LABORATORY REQUIREMENTS:

Standalone desktop with Python, Anaconda, Visual Studio Code, Git, Jenkins, Docker, PlantUML, Selenium, PyTest, Mock, SonarQube Community Edition, Pandas, NumPy, and Matplotlib-30 Nos.

TEXT BOOKS

1. Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides, "Design Patterns: Elements of Reusable Object-Oriented Software", Pearson Education, 1st Edition, 2015.
2. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 4th Edition, Pearson Education, 2021.
3. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", McGraw Hill Higher Education, 8th Edition, 2019.

REFERENCES:

1. Robert C. Martin, "Clean Code: A Handbook of Agile Software Craftsmanship", Prentice Hall, 1st Edition, 2008.
2. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc., First Edition, 2008.
3. Alan Shalloway and James R. Trott, "Design Patterns Explained: A New Perspective on Object-Oriented Design", Addison-Wesley, 2nd Edition, 2004.

WEB REFERENCES:

1. NPTEL Software Engineering Course Portal
2. O'Reilly Design Patterns Digital Resource Library

ONLINE RESOURCES:

1. https://docs.cloud.google.com/architecture/mlops-continuous-delivery-and-automation-pipelines-in-machine-learning
2. https://learn.microsoft.com/en-us/dotnet/architecture/modern-web-apps-azure/architectural-principles
3. https://www.geeksforgeeks.org/java-singleton-design-pattern-practices-examples/
4. https://www.google.com/search?q=https://refactoring.guru/design-patterns/behavioral

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

OUTCOMES:

At the end of this course, the students should be able to:

1. Utilize modern agile life cycles and DevSecOps pipelines to autonomous automation workflows. (K3)
2. Analyze requirement specifications and model object-oriented structural designs for complex multi-agent systems. (K4)
3. Implement creational design patterns for dynamic runtime component orchestration. (K3)
4. Analyze structural integration patterns to unify disparate data streams and complex libraries. (K4)
5. Apply behavioral design patterns to construct state-driven and event-driven automation architectures. (K3)
6. Examine system quality metrics, execute automated refactoring, and establish comprehensive test coverage. (K4)

CO - PO, PSO MAPPING:

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

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24AIEP504	AI FOR ENTERPRISES DATA ANALYTICS LABORATORY WITH THEORY	L	T	P	CP	C
		1	0	4	5	3
NPTEL CODE: 110104513	SYLLABUS VERSION 1.0	SDG NO. 8, 9				
PRE-REQUISITE COURSES	24AMPT201,24AMPT301					

OBJECTIVES:

- To provide knowledge of advanced R programming concepts, data structures, and functional programming techniques for data science applications.
- To enable students to perform data visualization and exploratory data analysis using R and ggplot2 packages.
- To develop skills in data preprocessing, cleaning, transformation, and handling of complex datasets including date and time objects.
- To impart statistical analysis knowledge including descriptive statistics, probability distributions, and inferential statistical techniques using R.
- To train students in regression analysis, time-series modelling, and panel data methods for predictive analytics.
- To introduce advanced machine learning and classification techniques such as quantile regression, logit, and probit models for data-driven decision making.

MODULE - I FUNDAMENTALS OF R PROGRAMMING AND DATA VISUALIZATION 7

Introduction and Background of R Programming – Installation and Setup – Working Directory – Packages and Libraries – Arithmetic, Assignment, Comparison and Logical Operators – Data Types – Vector Creation and Manipulation – Sequence, Repetition, Sorting and Random Number Generation – User Defined Functions – lapply(), sapply(), tapply() – Factor Variables – Indexing – Data Coercion – Conditional Statements – Basic Data Visualization using R – Bar Chart, Pie Chart, Histogram, Density Plot and Boxplot – Plot Customization – Legends, Colors, Axis Labels, Chart Titles – Overlay Plots.

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

LIST OF EXPERIMENTS:

1. Installation and setup of R environment, packages, libraries, and implementation of basic R programming constructs.
2. Creation and manipulation of vectors, matrices, lists, factors, and implementation of user-defined functions in R.
3. Implementation of data visualization techniques using basic R plots such as bar chart, pie chart, histogram, density plot, and boxplot.

MODULE - II ADVANCED VISUALIZATION AND DATA WRANGLING 7

Introduction to ggplot2 – Key Components – Aesthetic Attributes: Color, Size and Shape – Faceting Techniques – Plot Geometries – Smoother, Boxplot, Jitter Plot, Histogram and Frequency Polygon – Time Series Visualization – Axes Modification – Correlation Matrix Visualization – Exploratory Data Analysis – Reading and Writing Data – Exporting and Saving Dataframes – Data Cleaning and Handling – Missing Value Treatment – Adding Rows and Columns – Wide and Long Data Formats – Merging Dataframes.

LIST OF EXPERIMENTS:

1. Design and customization of advanced data visualizations using ggplot2 including faceting, smoothing, and correlation plots.
2. Reading, writing, cleaning, transforming, and merging datasets using data wrangling techniques in R.

MODULE - III DATE-TIME HANDLING AND BASIC STATISTICS 7

Date and Time Handling in R – Current Date and Time – POSIXct and POSIXlt Classes – Parsing Dates – Date and Time Components – Date Arithmetic – Time Zones – Time Intervals, Periods and Durations – Rounding and Truncating Dates – Measures of Central Tendency – Measures of Variability – Measures of Shape – Summary Statistics by Group – Outlier Detection and Treatment – Truncation and Winsorization.

LIST OF EXPERIMENTS:

1. Handling date and time objects using POSIX classes, date arithmetic, time intervals, and time-zone operations.
2. Computation of descriptive statistics, outlier detection, and implementation of probability distributions and sampling methods using R.

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

MODULE - IV PROBABILITY, INFERENTIAL STATISTICS AND HYPOTHESIS TESTING 8

Probability Distributions – Binomial and Normal Distribution – Sampling Distribution – Types of Sampling – Probability and Non-Probability Sampling – One Sample and Two Sample Tests – Z-Test and T-Test – Proportion Test – Variance Test – Analysis of Variance (ANOVA) – One-Way and Two-Way ANOVA.

LIST OF EXPERIMENTS:

1. Implementation of hypothesis testing techniques including t-test, z-test, proportion test, variance test, and ANOVA.

MODULE - V REGRESSION AND TIME SERIES MODELLING 8

Introduction to Model Building and Evaluation – Simple and Multiple Linear Regression – Assumptions of Regression – Linearity and Normality – Model Fitting and Interpretation – Regression Diagnostics – Autocorrelation and Heteroscedasticity Tests – Robust Standard Errors – Visualization of Regression Results – Introduction to Time Series Modelling – Time Series Properties – Panel Data Methods – Pooled OLS – Fixed Effect and Random Effect Models – Diagnostic Tests – Residual Analysis and Robust Estimation.

LIST OF EXPERIMENTS:

1. Development and evaluation of simple and multiple linear regression models including residual analysis and visualization.
2. Implementation of time-series modelling, panel data analysis, quantile regression, and classification models such as logit and probit regression.

MODULE - VI ADVANCED NONLINEAR AND CLASSIFICATION MODELS 8

Quantile Regression – Quantile Data Manipulation and Visualization – Outlier Treatment – Diagnostic Tests – Residual Analysis – Robust Estimation – Introduction to Classification Algorithms – Linear Probability Models – Logit and Probit Regression Models – Thresholding and Classification Matrix – ROC Curve – Maximum Likelihood Estimation – Parameter Interpretation – Goodness-of-Fit Measures.

LIST OF EXPERIMENTS:

1. Implementation of quantile regression, quantile data visualization, outlier treatment, and robust estimation techniques.
2. Implementation of classification models such as Linear Probability Model (LPM), Logit Regression, and Probit Regression, including ROC curve analysis, classification matrix, and goodness-of-fit evaluation.

TOTAL : 45 PERIODS

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

LABORATORY REQUIREMENTS:

Standalone desktop with R Programming Environment, RStudio Desktop (Open Source Edition), LibreOffice Calc, and relevant open-source R packages-30 Nos

TEXT BOOKS

1. Hadley Wickham and Garrett Grolemund, R for Data Science, O'Reilly Media, 2023.
2. Norman Matloff, The Art of R Programming: A Tour of Statistical Software Design, No Starch Press, 2011.

REFERENCES:

1. Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, Springer, 2021.
2. Roger D. Peng, R Programming for Data Science, Leanpub Publications, 2020.
3. Hadley Wickham, ggplot2: Elegant Graphics for Data Analysis, Springer, 2016.

WEB REFERENCES:

1. https://cran.r-project.org/
2. https://r4ds.hadley.nz/
3. https://ggplot2.tidyverse.org/

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/110104513
2. https://www.coursehero.com/file/119859021/AI-in-the-enterprisedocx/

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply advanced R programming concepts, data structures, and functional programming techniques for data analysis applications. (K3)
2. Develop effective data visualizations and perform exploratory data analysis using R and ggplot2 packages. (K3)
3. Examine data pre-processing, cleaning, transformation, and handling of structured and unstructured datasets. (K4)

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

4. Analyze datasets using descriptive statistics, probability distributions, and inferential statistical methods. (K4)
5. Build regression, time-series, and panel data models for predictive analytics applications. (K3)
6. Examine advanced classification and nonlinear modelling techniques such as quantile regression, logit, and probit models for data-driven decision making. (K4)

CO - PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24AIEP505	ARTIFICIAL INTELLIGENCE APPLICATIONS IN ROBOTICS LABORATORY WITH THEORY	L	T	P	CP	C
		1	0	4	5	3
NPTEL CODE: 106107001	SYLLABUS VERSION 1.0	SDG NO. 4, 9				
PRE-REQUISITE COURSES	24AMPT201,24AMPC301					

OBJECTIVES:

- To understand the fundamentals of Artificial Intelligence and Robotics and their applications in intelligent robotic systems.
- To explore Python programming, Robot Operating System (ROS), and simulation tools for robotic applications.
- To apply robot perception, motion planning, and navigation techniques in autonomous robotic systems.

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

- To develop computer vision and object recognition solutions using machine learning and deep learning techniques.
- To analyse and implement AI-based learning, decision-making, and navigation algorithms for robotics applications.
- To perform laboratory experiments related to intelligent robotics, human-robot interaction, and AI-enabled robotic systems.

MODULE - I FUNDAMENTALS OF AI AND ROBOTICS 8

Introduction to Robotics: Components, Types, and Applications - Introduction to Artificial Intelligence and its Role in Robotics - Python Programming for Robotics Applications - Robot Operating System (ROS): Architecture, Nodes, Topics, and Services - Robot Perception: Sensors and Environment Representation - Fundamentals of Robot Navigation and Motion Planning - Robotic Simulation using ROS and Virtual Environments.

LIST OF EXPERIMENTS

1. Installation and configuration of Python, ROS, and Gazebo simulation environment.
2. Create and simulate a mobile robot in ROS/Gazebo.

MODULE - II ROBOT CONTROL AND MOTION PLANNING 7

Fundamentals of Robot Control Systems - Motion Control in Mobile and Autonomous Robots - Trajectory Generation and Path Planning - Motion Planning Algorithms for Intelligent Robots - Obstacle Avoidance Techniques - Autonomous Navigation Strategies - Simulation and Implementation of Robot Control and Navigation using ROS.

LIST OF EXPERIMENTS

1. Implement path planning algorithms in a simulated robot environment.
2. Simulate obstacle avoidance and autonomous navigation using ROS.

MODULE - III COMPUTER VISION AND OBJECT RECOGNITION 8

Fundamentals of Computer Vision and Image Processing - Artificial Neural Networks (ANN) - Supervised Learning for Object Recognition - Deep Learning-Based Object Detection - YOLOv8 for Real-Time Object Recognition - Applications of Computer Vision in Robotics.

LIST OF EXPERIMENTS

1. Perform image processing operations using OpenCV.
2. Implement object detection using YOLOv8 on images and videos.

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

MODULE - IV MACHINE LEARNING AND AI-BASED NAVIGATION 7

Fundamentals of Machine Learning - Python Libraries and Tools for Machine Learning Implementation - Reinforcement Learning - Deep Reinforcement Learning - Simultaneous Localization and Mapping (SLAM) - AI-Based Navigation in Autonomous Robots.

LIST OF EXPERIMENTS

1. Develop a reinforcement learning model for autonomous navigation.
2. Implement SLAM for mapping and localization in a simulated environment.

MODULE - V INTELLIGENT NAVIGATION AND HUMAN-ROBOT INTERACTION 8

Intelligent Navigation and Human-Robot Interaction: Decision-Making Algorithms for Robotics - Path Planning and Obstacle Avoidance - A Algorithm for Navigation - Natural Language Processing and Speech Recognition - Chatbots and Generative AI - Human-Robot Interaction and Emotion-Aware Robotic Systems.

LIST OF EXPERIMENTS

1. Implement the A* path-planning algorithm for robot navigation.
2. Develop a speech recognition and chatbot-based interaction system using NLP.

MODULE - VI AI ROBOTICS APPLICATIONS AND FUTURE TRENDS 7

AI Robotics Applications and Future Trends: Robot Hardware and Sensors - Application Domains of AI Robotics - AI Applications in Humanoid, Mobile, and Industrial Robots - Current Trends in Artificial Intelligence - Ethics and Safety in AI Robotics - Robot Demonstration using ROS - Future Trends and Career Opportunities.

LIST OF EXPERIMENTS

1. Simulate sensor data acquisition and environment perception in ROS.
2. Develop a mini project integrating ROS, Computer Vision, Machine Learning, or NLP for an intelligent robotic application.

TOTAL : 45 PERIODS

LABORATORY REQUIREMENTS:

Standalone desktop with Python, Anaconda, Jupyter Notebook, ROS, Gazebo, OpenCV, TensorFlow/PyTorch, YOLOv8, OpenAI Gym, NumPy, Pandas, Matplotlib, Scikit-learn, and NLTK-30 Nos.

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

TEXT BOOKS

1. Robotics, Vision and Control, Peter Corke, Springer, 2nd Edition, 2017.
2. Programming Robots with ROS, Morgan Quigley, Brian Gerkey, William D. Smart, O'Reilly Media, 2015.
3. Introduction to Autonomous Robots, Nikolaus Correll, Bradley Hayes, David Wingate, et al., MIT Press, 2022.

REFERENCES:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, Pearson, 4th Edition, 2021.
2. Probabilistic Robotics, Sebastian Thrun, Wolfram Burgard, Dieter Fox, MIT Press, 2005.
3. Learning OpenCV 4 Computer Vision with Python, Joseph Howse and Joe Minichino, Packt Publishing, 2020.
4. Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 2016.
5. Reinforcement Learning: An Introduction, Richard S. Sutton and Andrew G. Barto, MIT Press, 2nd Edition, 2018.
6. Human-Robot Interaction, Christoph Bartneck, Dana Kulić, Elizabeth Croft, Susana Zoghbi, Cambridge University Press, 2020.

WEB REFERENCES:

1. https://gazebosim.org/docs
2. https://theconstructcore.bitbucket.io/openai_ros/index.html?
3. https://wiki.ros.org/ROS/Tutorials

ONLINE RESOURCES:

1. https://www.coursera.org/specializations/robotics
2. https://nptel.ac.in
3. https://www.theconstruct.ai

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply ROS tools, robot perception techniques, and simulation environments to model and analyse robotic systems. (K3)
2. Implement robot control, motion planning, and autonomous navigation algorithms using ROS-based platforms. (K3)

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/01/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

3. Analyse computer vision, neural networks, and YOLO-based object detection techniques for robotic perception tasks. (K3)
4. Apply machine learning, reinforcement learning, and SLAM techniques for intelligent robot navigation and localization. (K4)
5. Analyse intelligent navigation, path planning, NLP, and speech-based human-robot interaction systems. (K4)
6. Analyse AI-enabled robotic applications, ethical issues, and emerging trends in intelligent robotics. (K4)

CO - PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24AIEL515	DATA PRIVACY AND PROTECTION TECHNIQUES	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106105001	SYLLABUS VERSION 1.0	SDG NO. 4, 9, 16				
PRE-REQUISITE COURSES	24AMPT301,24AMPC402					

OBJECTIVES:

- To understand privacy principles, regulations, and data protection frameworks.
- To apply cryptographic techniques to secure sensitive information effectively.
- To explore Privacy-Enhancing Technologies for secure data processing.

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

- To design privacy-preserving systems for real-world applications securely.
- To evaluate privacy risks and implement compliance measures for secure data governance.

MODULE - I FOUNDATIONS OF DATA PRIVACY AND LEGAL FRAMEWORKS 8

Introduction to Data Privacy and Data Protection – Personally Identifiable Information (PII) and Sensitive Data – Privacy vs Data Protection – Privacy Challenges in Digital Systems – GDPR – CCPA – Digital Personal Data Protection Act (DPDP), India – Data Subject Rights – Consent Management – Data Minimization – Purpose Limitation – Privacy Governance and Compliance Frameworks.

MODULE - II DATA PROTECTION AND CRYPTOGRAPHY 7

Fundamentals of Cryptography – Symmetric Encryption (AES) – Asymmetric Encryption (RSA, ECC) – Data at Rest and Data in Transit – TLS/SSL Protocols – Hash Functions and Data Integrity – Password Security – Key Generation – Key Rotation – Secure Key Storage – Key Revocation – Cryptographic Best Practices.

MODULE - III PRIVACY-ENHANCING TECHNOLOGIES (PETS) 8

Introduction to Privacy-Enhancing Technologies (PETS) – Fully Homomorphic Encryption (FHE) – Introduction to Torus-FHE – Recent Trends in FHE – Bootstrapping Efficiency – Hardware Implementation of FHE – Compiler Optimizations for FHE – Searchable Encryption – Searchable Symmetric Encryption (SSE) – Security Proofs in Searchable Symmetric Encryption – Functional Encryption – Attribute-Based Encryption.

MODULE - IV DIFFERENTIAL PRIVACY AND SECURE COMPUTATION 8

Introduction to Differential Privacy (DP) – Information-Theoretic Measures of Differential Privacy – Differential Privacy Techniques and Proofs – Practical Applications of Differential Privacy – Secure Multi-Party Computation (SMPC) – Applications of Secure Multi-Party Computation – Oblivious Transfer (OT) Protocols – Zero-Knowledge Proofs.

MODULE - V CONFIDENTIAL COMPUTING AND PRIVACY ENGINEERING 7

Trusted Architectures – Confidential Computing Fundamentals – Trusted Execution Environments (TEEs) – Intel SGX – Intel TDX – Limitations of TEEs

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

for Confidential Computing – Role-Based Access Control (RBAC) – Attribute-Based Access Control (ABAC) – Privacy by Design – Secure Software Development Life Cycle (SSDLC) – Data Loss Prevention (DLP).

MODULE - VI PRIVACY ENGINEERING APPLICATIONS AND RISK MANAGEMENT 7

Anonymization and Pseudonymization – Data Masking – Tokenization – Privacy Impact Assessment (PIA) – Data Protection Impact Assessment (DPIA) – Data Auditing and Monitoring – Incident Response and Data Breach Management – Privacy Engineering Frameworks – Privacy-Preserving Search Engines – Privacy Computations in Smart Grids – Privacy-Preserving Machine Learning (PPML) – Emerging Trends in Privacy Engineering.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Ninghui Li, Min Lyu, Dong Su and Weining Yang, "Differential Privacy: From Theory to Practice", Morgan & Claypool Publishers, 2016.
2. Wes McKinney, "Python for Data Analysis", O'Reilly Publications, 2022.
3. Khaled El Emam and Luk Arbuckle, "Anonymizing Health Data", O'Reilly Media, 2013.

REFERENCES:

1. Yehuda Lindell and Jonathan Katz, "Introduction to Modern Cryptography", CRC Press, 2020.
2. Oded Goldreich, "Foundations of Cryptography", Cambridge University Press.
3. Cynthia Dwork and Aaron Roth, "The Algorithmic Foundations of Differential Privacy", Now Publishers.
4. Joseph Near and Chiké Abuah, "Programming Differential Privacy", OpenDP Publications.
5. Kai Rannenberg, Prokopios Drogkaris, and Cédric Lauradoux (Eds.), Privacy Technologies and Policy, Springer, 2024.

WEB REFERENCES:

1. https://gdpr-info.eu/
2. https://oag.ca.gov/privacy/ccpa
3. https://csrc.nist.gov/
4. https://homomorphicencryption.org/
5. https://www.google.com/search?q=https://edpb.europa.org/

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

ONLINE RESOURCES:

1. https://opendp.org/
2. https://homomorphicencryption.org/
3. https://www.microsoft.com/en-us/research/project/differential-privacy/
4. https://www.nist.gov/privacy-framework
5. https://www.openmined.org/

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply the concepts of data privacy, data protection, and global privacy regulations. (K3)
2. Apply cryptographic techniques and key management mechanisms to protect sensitive data. (K3)
3. Analyze and implement Privacy-Enhancing Technologies such as FHE, SSE, Functional Encryption, and Attribute-Based Encryption. (K4)
4. Apply Differential Privacy, Secure Multi-Party Computation, Oblivious Transfer, and Zero-Knowledge Proofs for privacy-preserving data processing. (K3)
5. Design privacy-aware systems using confidential computing technologies, TEEs, and privacy-by-design principles. (K3)
6. Examine privacy risks and develop privacy engineering solutions for real-world applications including machine learning, search engines, and smart grids. (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	–	–	–	–	–	–	–	–	–	3	2
CO3	2	3	–	–	–	–	–	–	–	–	–	3	2
CO4	2	3	–	–	–	–	–	–	–	–	–	3	3
CO5	2	2	–	–	–	–	–	–	–	–	–	3	3
CO6	2	3	–	–	–	–	–	–	–	–	–	3	3

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24AIEL516	SMART BUILDING AND AUTOMATION SECURITY	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 124107003	SYLLABUS VERSION 1.0	SDG NO. 3, 4, 9				
PRE-REQUISITE COURSES	24AMPC303, 24AMPC402					

OBJECTIVES:

- To understand the concepts and evolution of Futurist Architecture and Intelligent Buildings.
- To learn the components, technologies, and automation systems used in intelligent buildings.
- To analyze the integration of HVAC, lighting, security, and energy management systems.
- To explore BIM, VR, AI, and advanced digital technologies in intelligent building design.
- To evaluate building performance in terms of sustainability, occupant comfort, health, and productivity.
- To develop future-oriented intelligent building solutions aligned with smart city and net-zero objectives.

MODULE - I FOUNDATIONS OF FUTURIST ARCHITECTURE 9

Origins of the Futurist Movement - The Futurist Manifesto. Principles of Futurist Architecture - Antonio Sant'Elia: Life and Vision - Città Nuova: The Future City Imagined - Futurist Aesthetic and Technology - Impact and Legacy of Futurist Architecture - Revival and Reinterpretation of Futurist Architecture. Transition to Smart and Intelligent Buildings - Definition and Core Concepts of Intelligent Buildings.

MODULE - II INTELLIGENT BUILDING SYSTEMS — HISTORY, COMPONENTS AND AUTOMATION 7

History and Evolution of Intelligent Buildings, Benefits and Challenges of Intelligent Buildings, Basic Components and Technologies of Smart Buildings, Building Automation Systems (BAS) — Structure and Functions, BAS — Design, Implementation, and Integration.

Recommended in Board of Studies (BoS) Meeting No. 08 held on 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

MODULE - III CONTROL STRATEGIES, HVAC AND ADVANCED BUILDING TECHNOLOGIES 7

Case Studies of BAS in Intelligent Buildings, Control Strategies for Energy Efficiency and Comfort, Integration with HVAC, Lighting, and Security, Smart Lighting — Fundamentals and Protocols, Smart Lighting — Case Studies

MODULE - IV INTELLIGENT HVAC, SECURITY SYSTEMS & BIM 8

Intelligent HVAC - Core Components - Intelligent HVAC AI Optimization - Intelligent HVAC Integration, Tools, and Challenges. Building Security - Access Control and Surveillance - Building Security Networked Systems and Standards. BIM, Virtual Reality and Data-Driven Design - BIM for Intelligent Building Design and Management - Virtual Reality in Architecture - Trans-Architecture: Beyond Physical Boundaries.

MODULE - VI DESIGNING, EVALUATING & EXPERIENCING INTELLIGENT BUILDINGS 7

Designing Intelligent Buildings - Evaluating Intelligent Buildings - Green Buildings and Human Performance - Thermal Environment - Productivity and Environmental Factors - Sick Building Syndrome.

MODULE - VI FUTURE DIRECTIONS — SUSTAINABILITY, AI & THE INTELLIGENT CITY 7

Planning, Design, and Management Recommendations for Intelligent Buildings - Net-Zero and Carbon-Positive Intelligent Buildings - AI and Machine Learning in Building Management - Intelligent Buildings within Smart Cities - Future Frontiers and Course Synthesis.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Intelligent Buildings: Design Management and Operation by Clements, Derek, Croome, Thomas Telford, Ltd.
2. Visionary Architecture: Unbuilt Works of the Imagination by Burden, Ernest, McGraw-Hill Professional.
3. Intelligent Building and Building Automation by Shengwei Wang, Spon press.
4. Berghaus, G. (Ed.). (2012). International futurism in arts and literature (Vol. 13). Walter de Gruyter.

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

REFERENCES:

1. Asim, F., & Shree, V. (2018). A Century of Futurist Architecture: From Theory to Reality. p-ISSN: 2349-8404; e-ISSN: 2349-879X. Krishi Sanskriti Publications.
2. de Paor-Evans, A. (2016). Futurism: Futurist Architecture. Routledge Encyclopedia of Modernism.

WEB REFERENCES:

1. https://www.ibm.com/think/topics/building-automation
2. https://www.trane.com/commercial/north-america/us/en/products-systems/smart-building-technology.html
3. https://centaur.reading.ac.uk/76976/1/Manuscript%20-%20SBS%20-%20For%20CENTAUR.pdf

ONLINE RESOURCES:

1. https://www.khanacademy.org/math/statistics-probability
2. https://www.coursera.org/learn/machine-learning
3. https://developers.google.com/machine-learning
4. https://towardsdatascience.com
5. https://scikit-learn.org

OUTCOMES:

At the end of this course, the students should be able to:

1. Analyze the principles of Futurist Architecture and their influence on intelligent building development. (K4)
2. Apply Building Automation Systems and smart building technologies to improve building operations. (K3)
3. Analyze integrated HVAC, lighting, and security strategies for intelligent building management.(K4)
4. Utilize BIM, virtual reality, and advanced building technologies in intelligent building design and operation. (K3)
5. Examine sustainability, occupant well-being, and environmental factors in intelligent building design. (K4)
6. Infer AI and machine learning techniques in intelligent building management within smart city environments.(K4)

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

CO - PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - II

COURSE CODE: 24AIEL517	INTRODUCTION TO SMART AND SECURE SYSTEMS	L	T	P	CP	C
		3	0	0	3	3
NPTEL CODE: 106105195	SYLLABUS VERSION 1.0	SDG NO. 4, 9, 16				
PRE-REQUISITE COURSES	24AMPC402					

OBJECTIVES:

To understand the fundamentals of Industry 4.0, industrial communication, sensing, actuation, and networking technologies.

- To analyze enabling technologies such as Cyber Physical Systems (CPS), Artificial Intelligence (AI), Big Data Analytics, AR/VR, and Industrial Cybersecurity.
- To understand IIoT architectures, business models, communication layers, and industrial data processing frameworks.
- To apply industrial networking, machine learning, cloud/fog computing,

7

Introduction - Sensing & Actuation - Communication Part I - Communication Part II - Networking Part I - Networking Part II. Industry 4.0 - Globalization and Emerging Issues - The Fourth Revolution - LEAN Production Systems - Smart and Connected Business Perspective - Smart Factories.

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

MODULE - II ENABLING TECHNOLOGIES FOR INDUSTRY 4.0 7

Industry 4.0 - Cyber Physical Systems and Next Generation Sensors - Collaborative Platform and Product Lifecycle Management - Augmented Reality and Virtual Reality - Artificial Intelligence - Big Data and Advanced Analysis. Cybersecurity in Industry 4.0 - Basics of Industrial IoT - Industrial Processes Part I - Industrial Processes Part II - Industrial Sensing & Actuation - Industrial Internet Systems.

MODULE - III INDUSTRIAL IOT ARCHITECTURE AND BUSINESS MODELS 7

IIoT Introduction - Industrial IoT - Business Model and Reference Architecture - IIoT Business Models Part I - IIoT Business Models Part II - IIoT Reference Architecture Part I - IIoT Reference Architecture Part II. Industrial IoT Layers - IIoT Sensing Part I - IIoT Sensing Part II - IIoT Processing Part I - IIoT Processing Part II - IIoT Communication Part I.

MODULE - IV INDUSTRIAL NETWORKING AND DATA ANALYTICS 8

Industrial IoT Layers - IIoT Communication Part II - IIoT Communication Part III - IIoT Networking Part I - IIoT Networking Part II - IIoT Networking Part III. Industrial IoT - Big Data Analytics and Software Defined Networks - IIoT Analytics Introduction - Machine Learning and Data Science Part I - Machine Learning and Data Science Part II - R and Julia Programming - Data Management with Hadoop.

MODULE - V SECURITY, CLOUD, FOG COMPUTING AND INDUSTRIAL APPLICATIONS 8

Industrial IoT - Big Data Analytics and Software Defined Networks - SDN in IIoT Part I - SDN in IIoT Part II - Data Center Networks. Industrial IoT - Security and Fog Computing - Cloud Computing in IIoT Part I - Cloud Computing in IIoT Part II - Fog Computing in IIoT - Security in IIoT Part I - Security in IIoT Part II. Industrial IoT Application Domains - Factories and Assembly Line - Food Industry.

MODULE - VI ADVANCED IIOT APPLICATIONS AND INDUSTRIAL CASE STUDIES 8

Industrial IoT Application Domains - Healthcare - Power Plants - Inventory Management and Quality Control - Plant Safety and Security (Including AR and VR Safety Applications) - Facility Management. Industrial IoT Application Domains - Oil, Chemical and Pharmaceutical Industry - Applications of UAVs in

Industries. Real Case Studies - Case Study I: Milk Processing and Packaging Industries - Case Study II: Manufacturing Industries Part I - Case Study III: Manufacturing Industries Part II - Case Study IV: Student Projects Part I - Case Study V: Student Projects Part II - Case Study VI: Virtual Reality Lab - Case Study VII: Steel Technology Lab.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Industry 4.0: The Industrial Internet of Things,Author: Alasdair Gilchrist Publisher: Apress, 2016.
2. Internet of Things: A Hands-On Approach, Authors: Arshdeep Bahga, Vijay Madisetti Publisher: Universities Press, 2015
3. Raj Kamal, Internet of Things: Architecture and Design Principles, 3rd Edition, McGraw Hill, 2024.

REFERENCES:

1. Fog and Edge Computing: Principles and Paradigms, Publisher: Wiley, 2019
2. Security and Privacy in Internet of Things (IoTs): Models, Algorithms and Implementations, Publisher: CRC Press, 2016
3. Machine Learning, Publisher: McGraw-Hill, 1997.
4. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton and Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, 2nd Edition, Cisco Press, 2024.

WEB REFERENCES:

1. https://www.researchgate.net/publication/305848081_Industry_40
2. https://www.researchgate.net/publication/304568537_Introducing_Industry_40
3. https://www.kngac.ac.in/elearning-portal/ec/admin/contents/4_18KP2CS07_20210129022344 24.pdf

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106105195
2. https://www.ibm.com/think/topics/industry-4-0
3. https://www.geeksforgeeks.org/computer-networks/introduction-to-internet-of-things-iot-set-1/

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

OUTCOMES:

At the end of this course, the students should be able to:

1. Apply the concepts of Industry 4.0, industrial sensing, actuation, communication, networking, and smart manufacturing systems.(K3)
2. Make use of Cyber Physical Systems, AI, AR/VR, Big Data technologies, and cybersecurity mechanisms used in Industry 4.0 environments.(K3)
3. Analyze Industrial IoT architectures, business models, sensing, processing, and communication layers for industrial applications.(K4)
4. Apply industrial networking, machine learning, big data analytics, software-defined networking, and Hadoop-based frameworks for IIoT systems.(K3)
5. Infer cloud computing, fog computing, SDN, and security solutions for industrial IoT deployments.(K4)
6. Examine IIoT solutions for industrial sectors such as healthcare, manufacturing, power plants, food processing, pharmaceuticals, and smart facilities using real-world case studies.(K4)

CO - PO, PSO MAPPING:

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

Recommended in Board of Studies (BoS) Meeting No. 08 **held on** 09/04/2026

CHAIRMAN
Board of Studies
Artificial Intelligence and Data Science

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

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+"*

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

MJF LN. LEO MUTHU