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 - VIII

SEMESTERS

REGULATIONS

2020

Academic Year 2022-23 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.

QUALITY POLICY

We at Sri Sai Ram Engineering College are committed to build a better Nation through Quality Education with team spirit. Our students are enabled to excel in all values of Life and become Good Citizens. We continually improve the System, Infrastructure and Service to satisfy the Students, Parents, Industry and Society.

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 CURRICULUM AND SYLLABI
Regulations 2020

SEMESTER I

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20BSMA101	Engineering Mathematics-I	3	1	0	4	4
2	20HSEN101	Technical English-I	3	0	0	3	3
3	20BSPH101	Engineering Physics	3	0	0	3	3
4	20BSCY101	Engineering Chemistry	3	0	0	3	3
5	20ESCS101	Problem solving and Programming in C	3	0	0	3	3
6	20ESGE101	Engineering Graphics	1	2	0	3	3
PRACTICAL							
7	20BSPL101	Physics and Chemistry Laboratory	0	0	3	3	1.5
8	20ESPL101	Programming in C Laboratory	0	0	3	3	1.5
VALUE ADDITIONS - I							
9	20TPHS101	Skill Enhancement	0	0	2	2	1
10	20HSMG101	Personal Values	2	0	0	2	0
11	20HSTA101	Heritage of Tamils	1	0	0	1	1
TOTAL						**30**	**24**

SEMESTER II

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20BSMA204	Discrete Structures	3	1	0	4	4
2	20HSEN201	Technical English – II	3	0	0	3	3
3	20BSPH203	Physics for Information Science	3	0	0	3	3
4	20BSCY201	Environmental Science and Engineering	3	0	0	3	3
5	20ESIT202	Python Programming	3	0	0	3	3
6	20CBPC201	Data Structures & Algorithms	3	0	0	3	3
PRACTICALS							
7	20ESPL201	Python Programming Laboratory	0	0	3	3	1.5
8	20CBPL202	Data Structures & Algorithms Laboratory	0	0	3	3	1.5
9	20ESGE201	Engineering Practices Laboratory	0	0	3	3	1.5
VALUE ADDITIONS - II							
10	20TPHS201	Skill Enhancement	0	0	1	1	0
11	20HSMG201	Interpersonal Values	2	0	0	2	0
12	20HSTA201	Tamils and Technology	1	0	0	1	1
TOTAL						**32**	**24.5**

SEMESTER III

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20BSMA302	Probability & Statistical Modeling	3	1	0	4	4
2	20AIPC302	Fundamentals of Machine Learning Techniques	3	0	0	3	3
3	20AIPC401	Fundamentals of Artificial Intelligence	3	0	0	3	3
4	20CSPC301	Object Oriented Programming	3	0	0	3	3
5	20CSPC402	Database Management Systems	3	0	0	3	3
PRACTICAL							
6	20AIPL301	Probability & Statistical Modeling Laboratory	0	0	3	3	1.5
7	20AMPL301	Data Science and Machine Learning Laboratory	0	0	3	3	1.5
8	20CSPL402	Database Management Systems Laboratory	0	0	3	3	1.5
VALUE ADDITIONS - III							
9	20AMTE301	Live-in-Lab–I	0	0	2	2	1
10	20AMTP301	Skill Enhancement	0	0	1	1	0
TOTAL						**28**	**21.5**

SEMESTER IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20BSMA404	Linear Algebra and its Applications	3	1	0	4	4
2	20ITPC401	Design and Analysis of Algorithms	3	0	0	3	3
3	20CSPC401	Operating Systems	3	0	0	3	3
4	20AMPC401	Nature Inspired Computing Techniques	3	0	0	3	3
5	20AIPC502	Deep Learning	3	0	0	3	3
6	20CSPW401	Computer Networks with Lab	3	0	2	5	4
PRACTICAL							
7	20AIPL401	DAA and AI Laboratory	0	0	3	3	1.5
8	20AIPL501	Deep Learning Laboratory	0	0	3	3	1.5
9	20AMTE401	Live-in-Lab–II	0	0	2	2	1
VALUE ADDITIONS - IV							
10	20AMTP401	Skill Enhancement	0	0	2	2	1
11	20MGMC401	Constitution of India	2	0	0	2	0
TOTAL						**33**	**25**

SEMESTER V

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20AMPW501	Data Visualization Techniques with Lab	3	0	2	5	4
2	20AMPC501	Computer Vision & Image Processing	3	0	0	3	3
3	20AIPC503	Natural language Processing and Chatbot	3	0	0	3	3
4	20AMPC502	IoT & Edge Computing	3	0	0	3	3
5	20XXELXXX	Professional Elective-I	3	0	0	3	3
PRACTICAL							
6	20AMPL501	Computer Vision & Image Processing Laboratory	0	0	3	3	1.5
7	20AIPL502	NLP & Chatbot Laboratory	0	0	3	3	1.5
8	20AIPL503	IoT Laboratory	0	0	3	3	1.5
VALUE ADDITIONS - V							
9	20AMTE501	Live-in-Lab–III	0	0	2	2	1
10	20AMTP501	Skill Enhancement	0	0	2	2	1
TOTAL						**30**	**22.5**

SEMESTER VI

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20AIPC601	Robotics Process Automation	3	0	0	3	3
2	20AIPC403	Advanced Machine Learning	3	0	0	3	3
3	20AIPW602	Big Data Analytics with Lab	3	0	2	5	4
4	20XXELXXX	Professional Elective-II	3	0	0	3	3
5	20XXOEXXX	Open Elective-I	3	0	0	3	3
PRACTICAL							
6	20AIPL601	Robotics Laboratory	0	0	3	3	1.5
7	20AIPL403	Advanced Machine Learning Laboratory	0	0	3	3	1.5
8	20HSPL501	Communication and Soft Skills Lab	0	0	2	2	1
9	20AMPJ601	Innovative Design Project	0	0	2	2	1
VALUE ADDITIONS - VI							
10	20AMTP601	Skill Enhancement	0	0	2	2	1
TOTAL						**29**	**22**

SEMESTER VII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20AIPC701	Cloud Computing	3	0	0	3	3
2	20HSMG601	Principles of Engineering Management	3	0	0	3	3
3	20AMPC701	Generative Deep Learning	3	0	0	3	3
4	20XXELXXX	Professional Elective-III	3	0	0	3	3
5	20XXOEXXX	Open Elective–II	3	0	0	3	3
PRACTICAL							
6	20AIPL701	Cloud Computing Laboratory	0	0	3	3	1.5
7	20AMPJ701	Project Phase–I	0	0	4	4	2
VALUE ADDITIONS - VII							
8	20AMTP701	Skill Enhancement	0	0	2	2	1
TOTAL						**24**	**19.5**

SEMESTER VIII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20XXELXXX	Professional Elective-IV	3	0	0	3	3
PRACTICAL							
2	20AMPJ801	Project Phase–II	0	0	8	8	4
TOTAL						**11**	**7**

CREDIT DISTRIBUTION

Category	BS	ES	HS	EL	PC+PL	PW	OE	TE	PJ	TP	IS	MC	TOTAL
Credit	29.5	12	10	9	67.5	12	9	3	7	7	3	0	169
Percentage	17.5	7.1	5.9	5.3	39.9	7.1	5.3	1.8	4.1	4.1	1.8	0	100

*IS-Internship

PROFESSIONAL ELECTIVES - I

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20AMEL501	Ethics and Policy Issues in AI Computing	3	0	0	3	3	AI
2	20AMEL502	Evolution of AI Languages	3	0	0	3	3	AI
3	20AMEL503	Data Mining	3	0	0	3	3	ML
4	20AIEL507	Human Computer Interaction	3	0	0	3	3	ML
5	20AIEL505	Social Network Analysis	3	0	0	3	3	Systems & Computing
6	20CBEL604	Computer Graphics & Multimedia	3	0	0	3	3	Systems & Computing
7	20AMEL504	Data and Information security	3	0	0	3	3	IoT & Cyber Security
8	20AMEL505	Data Science for Internet of Things	3	0	0	3	3	IoT & Cyber Security
9	20ITEL806	Pattern Recognition Techniques	3	0	0	3	3	Healthcare
10	20AIEL504	Intellectual Property Rights and Design Thinking	3	0	0	3	3	Management

PROFESSIONAL ELECTIVES - II

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20AMEL601	AI for Cybersecurity	3	0	0	3	3	AI
2	20AMEL602	Virtual Reality and Augmented Reality	3	0	0	3	3	AI
3	20AMEL603	FuzzySystems	3	0	0	3	3	ML
4	20AMEL604	Statistics for Business Analytics	3	0	0	3	3	ML
5	20AMEL605	Data Acquisition System	3	0	0	3	3	Systems & Computing
6	20CBEL504	Web Technology	3	0	0	3	3	Systems & Computing
7	20AIEL601	Ethical Hacking and System Defence	3	0	0	3	3	IoT & Cyber Security
8	20AMEL607	Software and Programming in IoT	3	0	0	3	3	IoT & Cyber Security
9	20AMEL608	Sensors and Transducers in Healthcare	3	0	0	3	3	Healthcare
10	20AMEL609	Accounting and Financial Management	3	0	0	3	3	Management

PROFESSIONAL ELECTIVES - III

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20AIEL705	Expert System	3	0	0	3	3	AI
2	20AMEL701	Decision Making under Uncertainty	3	0	0	3	3	AI
3	20AIEL710	Game Theory	3	0	0	3	3	ML
4	20AMEL702	Sentiment Analysis	3	0	0	3	3	ML
5	20AIEL706	Cognitive Computing	3	0	0	3	3	Systems & Computing
6	20CSEL703	Information Retrieval Techniques	3	0	0	3	3	Systems & Computing
7	20AMEL703	Industry IoT 4.0	3	0	0	3	3	IoT & Cyber Security
8	20AMEL704	IoT for Smart Cities	3	0	0	3	3	IoT & Cyber Security
9	20AMEL705	Healthcare Analytics	3	0	0	3	3	Healthcare
10	20AIEL711	Entrepreneurship	3	0	0	3	3	Management

PROFESSIONAL ELECTIVES - IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20AIEL714	Artificial Intelligence Search Methods for Problem Solving	3	0	0	3	3	AI
2	20AIEL719	Business Intelligence	3	0	0	3	3	AI
3	20AMEL711	Deep Reinforcement Learning	3	0	0	3	3	ML
4	20AMEL712	Knowledge Engineering and Inference	3	0	0	3	3	ML
5	20AMEL601	Microservices and DevOps	3	0	0	3	3	Systems & Computing
6	20ITEL708	Full Stack Software Development	3	0	0	3	3	Systems & Computing
7	20AIEL711	Cyber Crime & Computer Ethics	3	0	0	3	3	IoT & Cyber Security
8	20AIEL716	Secure Cloud Computing	3	0	0	3	3	IoT & Cyber Security
9	20AMEL713	Biometric Systems	3	0	0	3	3	Healthcare
10	20AMEL714	Sustainable Business Models	3	0	0	3	3	Management

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.

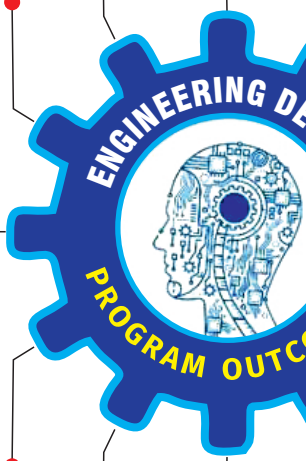
PROGRAM SPECIFIC OUTCOMES (PSOs)

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.

PROGRAMME OUTCOMES(POs)

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



01 Engineering knowledge
Apply the basic principle and knowledge of mathematics, science and engineering principles to solve technical problems.

02 Problem Analysis
Identify and analyze complex engineering problems reaching logical conclusions using the basic principles of mathematics, science and engineering.

03 Development of solutions
Design solutions for well-defined technical problems and assist with the design of systems, components or processes to meet specified needs.

04 Investigate complex problems
Perform investigations, use research based knowledge and conduct experiments, analyze and interpret the results to provide valid conclusions.

05 Modern tool usage
Create, select and apply the latest techniques, resources and modern engineering / IT tools to develop appropriate solutions with an understanding of the limitations.

06 The Engineer and Society
Apply reasoning based on contextual knowledge to assess societal, legal and cultural issues with competency in professional engineering practices.

07 Environment & Sustainability
Demonstrate professional skills, knowledge and contextual reasoning to assess / environmental / societal issues for sustainable development.

08 Apply ethical principles
Apply ethical principles and commit to professional ethics and responsibilities based on the norms of professional engineering pratices.

09 Individual & Teamwork
Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary professional settings.

10 Communicate effectively
Communicate effectively amongst the engineering community, being able to comprehend & write effective reports, make presentations & give/receive clear instructions.

11 Project management
Demonstrate knowledge and apply the principles of engineering & management in their own / team projects in multidisciplinary environments.

12 Life-long learning
Recognize the need for, and have the preparation, ability to engage in independent and life-long learning in the context of technological change.

SEMESTER - I

20BSMA101 SDG NO. 4 & 9	ENGINEERING MATHEMATICS-I	L	T	P	C
		3	1	0	4

OBJECTIVES:

The intent of this course is

- To understand and gain knowledge in the concepts of matrix algebra
- To introduce the notion of limits, continuity, differentiation and maxima and minima of functions
- To acquaint the concept of definite and improper integrals and their applications
- To provide an understanding of double and triple integrals
- To acquire knowledge in representing elementary and periodic functions as an infinite series

UNIT I MATRICES **12**

Symmetric, skew symmetric and orthogonal matrices; Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem(excluding proof) – Reduction of a Quadratic form to Canonical form using Orthogonal Transformation - Nature of Quadratic forms.

UNIT II DIFFERENTIAL CALCULUS **12**

Limit, continuity, Differentiation rules - Maxima and Minima of functions of one variable, partial derivatives, Taylor's series for functions of two variables, Jacobian, Maxima & Minima of functions of several variables, saddle points, Method of Lagrange multipliers.

UNIT III INTEGRAL CALCULUS **12**

Evaluation of definite and improper integral - Techniques of Integration- Substitution rule - Integration by parts, Integration of rational functions by partial fraction, Integration of irrational functions - Applications of definite integrals to evaluate surface areas and volumes of revolution.

UNIT IV MULTIPLE INTEGRALS **12**

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

UNIT V SEQUENCES AND SERIES **12**

Introduction to sequences and series – power series – Taylor's series – series for exponential, trigonometric, logarithmic, hyperbolic functions – Fourier series – Half range Sine and Cosine series – Parseval's theorem.

TOTAL: 60 PERIODS

TEXTBOOKS:

1. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.
2. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 11th Reprint, 2010.

REFERENCES:

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic Geometry", 9th Edition, Pearson, Reprint, 2002.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
3. T. Veerarajan, "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi, 2008.
4. N.P. Bali and Manish Goyal, "A text-book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.
5. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40th Edition, 2014.

WEB REFERENCES:

1. https://math.mit.edu/~gs/linearalgebra/ila0601.pdf
2. http://ocw.mit.edu/ans7870/18/18.013a/textbook/HTML/chapter30/
3. https://ocw.mit.edu/courses/mathematics/18-02sc-multivariable-calculus-fall-2010/2.-partial-derivatives/
4. http://ocw.mit.edu/ans7870/18/18.013a/textbook/HTML/chapter31/

ONLINE RESOURCES:

1. https://www.khanacademy.org/math/linear-algebra/alternate-bases/eigen-everything/v/linear-algebra-introduction-to-eigenvalues-and-eigenvectors
2. https://www.khanacademy.org/math/differential-calculus

OUTCOMES:

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

1. Understand the concepts of symmetric, skew symmetric, orthogonal matrices, properties of Eigen values and eigen vectors, the nature of a quadratic form, sequences and series, power series representation of

functions, series representation of exponential, trigonometric logarithmic and hyperbolic functions. (K2)

2. Compute the eigen values, eigen vectors of a matrix, diagonalize the quadratic form using orthogonal transformation and find the inverse and higher powers of a matrix using Cayley Hamilton theorem. (K3)
3. Calculate the limit, derivative, partial derivatives, Jacobians of simple functions and evaluate integrals of single variable using the rules of integration. (K3)
4. Determine the Taylor series representation of functions of one variable and two variables and evaluate maxima and minima of functions of one variable, two variables and several variables. (K3)
5. Evaluate double integrals using change of order technique, double and triple integrals using change of variables technique and calculate surface areas and volume of solids of revolution. (K3)
6. Compute the Fourier series, Sine and Cosine series representation of functions defined in a period and use Fourier series and Parseval's theorem to find the value of infinite series. (K3)

CO - PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	-	-	-	-	-	-	-	1
CO2	3	3	2	1	-	-	-	-	-	-	-	1
CO3	3	3	2	1	-	-	-	-	-	-	-	1
CO4	3	3	2	1	-	-	-	-	-	-	-	1
CO5	3	3	2	1	-	-	-	-	-	-	-	1
CO6	3	3	2	1	-	-	-	--	-	-	-	1

SEMESTER - I

20HSEN101 SDG NO. 4	TECHNICAL ENGLISH - I	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To develop the basic LSRW skills of the students
- To encourage the learners to adapt to listening techniques
- To help learners develop their communication skills and converse fluently in real contexts
- To help learners develop general and technical vocabulary through reading and writing tasks

- To improve the language proficiency for better understanding of core subjects

UNIT I INTRODUCTION 9

Listening – short texts – formal and informal conversations - **Speaking** – basics in speaking – speaking on given topics & situations – recording speeches and strategies to improve - **Reading –** critical reading – finding key information in a given text – shifting facts from opinions - **Writing –** free writing on any given topic – autobiographical writing - **Language Development** – tenses – voices- word formation: prefixes and suffixes – parts of speech – developing hints

UNIT II READING AND LANGUAGE DEVELOPMENT 9

Listening - long texts - TED talks - extensive speech on current affairs and discussions -Speaking – describing a simple process – asking and answering questions - **Reading** comprehension – skimming / scanning / predicting & analytical reading – question & answers – objective and descriptive answers –identifying synonyms and antonyms - process description - **Writing** instructions – **Language Development** – writing definitions – compound words - articles – prepositions

UNIT III SPEAKING AND INTERPRETATION SKILLS 9

Listening - dialogues & conversations - **Speaking** – role plays – asking about routine actions and expressing opinions - **Reading** longer texts & making a critical analysis of the given text - **Writing** – types of paragraph and writing essays – rearrangement of jumbled sentences - writing recommendations - **Language Development** – use of sequence words - cause & effect expressions - sentences expressing purpose - picture based and newspaper based activities – single word substitutes

UNIT IV VOCABULARY BUILDING AND WRITING SKILLS 9

Listening - debates and discussions – practicing multiple tasks – self introduction – **Speaking** about friends/places/hobbies - **Reading** -Making inference from the reading passage – Predicting the content of the reading passage - **Writing** – informal letters/e-mails - **Language Development** - synonyms & antonyms - conditionals – if, unless, in case, when and others – framing questions.

UNIT V LANGUAGE DEVELOPMENT AND TECHNICAL WRITING 9

Listening - popular speeches and presentations - Speaking - impromptu speeches & debates - **Reading** - articles – magazines/newspapers **Writing** – essay writing on technical topics - channel conversion – bar diagram/ graph –

picture interpretation - process description - **Language Development** – modal verbs - fixed / semi-fixed expressions – collocations

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Board of Editors. Using English: A Coursebook for Undergraduate Engineers and Technologists. Orient Blackswan Limited, Hyderabad: 2015.
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai, 2011.

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://swayam.gov.in/nd1_noc19_hs31/preview
2. http://engineeringvideolectures.com/course/696

ONLINE RESOURCES:

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

OUTCOMES:

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

1. Comprehend conversations and talks presented in English (K2)
2. Speak fluently in informal and formal contexts (K1)
3. Read articles of any kind and be able to comprehend (K2)
4. Write technical concepts in simple and lucid style (K2)
5. Prepare informal letters and e-mails efficiently (K3)
6. Present technical concepts and summaries in correct grammar and vocabulary (K1)

CO - PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	-	-	-	-	1	-	-	3	-	-
CO2	1	-	-	-	-	-	-	-	-	3	-	-
CO3	-	-	-	-	-	-	-	-	-	-	3	2
CO4	-	3	-	-	-	-	-	-	2	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-
CO6	-	-	-	-	-	-	3	-	-	-	2	-

SEMESTER - I

20BSPH101 SDG NO. 4	ENGINEERING PHYSICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To educate and enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology

UNIT I CRYSTAL PHYSICS 9

Single crystalline, Polycrystalline and Amorphous materials - single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal - Miller indices - Interplanar distance - Powder diffraction method - Debye Scherer formula - Calculation of number of atoms per unit cell - Atomic radius - Coordination number - packing factor for SC, BCC, FCC and HCP structures - Polymorphism and allotropy - Diamond and Graphite structure (qualitative) - Growth of single crystals: Solution and Melt growth Techniques.

UNIT II PROPERTIES OF MATTER 9

Elasticity - Stress - strain diagram and its uses - Poisson's ratio - Relationship between three moduli of elasticity (qualitative) - Factors affecting elastic modulus and tensile strength - 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 - stress due to bending in beams.

UNIT III QUANTUM PHYSICS 9

Black body radiation - Planck's theory (derivation) - Compton effect: theory -

wave particle duality - electron diffraction - progressive waves - wave equation - concept of wave function and its physical significance - Schrödinger's wave equation - Time independent and Time dependent equations - particle in a box (one dimensional motion) - Tunneling (qualitative) - scanning tunneling microscope.

UNIT IV LASERS AND FIBER OPTICS **9**

Lasers: population of energy levels, Einstein's A and B coefficients derivation - pumping methods - resonant cavity, optical amplification (qualitative) - three level and four level laser - CO_2 laser - Semiconductor lasers: Homojunction and Heterojunction.

Fiber optics: Principle, Numerical aperture and Acceptance angle - Types of optical fibers (material, refractive index, mode) - Losses associated with optical fibers - Fiber Optical Communication system (Block diagram) - Fiber optic sensors: pressure and displacement.

UNIT V THERMAL PHYSICS **9**

Transfer of heat energy - thermal expansion of solids and liquids - bimetallic strips - thermal conduction, convection and radiation - heat conduction in solids (qualitative) - thermal conductivity - Forbe's and Lee's disc method: theory and experiment - conduction through compound media (series and parallel) - thermal insulation - applications: heat exchangers, refrigerators and solar water heaters.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. D.K. Bhattachary & 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& P.G. Kshirshagar, "A textbook of Engineering Physics", S. Chand & Co Ltd. 2016.

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.

OUTCOMES :

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

1. Understand the basics of crystals, structures and crystal growth techniques (K3)
2. Select a right choice of materials based on their properties for potential applications / acquire fundamental knowledge on elasticity and its applications relevant to the field of engineering (K3)
3. Apply the advanced physics concepts of quantum theory to characterize the matter (K4)
4. Understand the basic concepts in laser and its types and fiber optics (K3)
5. Acquire adequate knowledge on the fundamental concepts of thermal properties of materials (K2)
6. Evaluate the applications of powder diffraction method, optical fibers in sensors, quantum mechanical tunneling and thermal materials in expansion joints and heat exchangers (K4)

CO - PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	-	-	-	-	-	-	-	1
CO2	3	2	3	3	-	-	2	-	-	-	-	3
CO3	3	3	3	2	-	-	3	-	-	-	-	2
CO4	3	3	3	3	-	-	-	-	-	-	-	3
CO5	3	3	3	3	-	-	3	-	-	-	-	3
CO6	3	3	3	3	-	-	3	-	-	-	-	3

SEMESTER - I

20BSCY101 SDG NO. 4,6&7	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques
- To illustrate the principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials
- To categorize types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels
- To demonstrate the principles and generation of energy in batteries, nuclear reactors, solar cells, windmills and fuel cells
- To recognize the applications of polymers, composites and nano-materials in various fields

UNIT I WATER TECHNOLOGY AND SURFACE CHEMISTRY 9

Water Technology : Introduction – Hard water and Soft water. Hardness of water – types – expression of hardness (numerical problems). Boiler troubles – scale and sludge, priming and foaming, caustic embrittlement and boiler corrosion. Treatment of boiler feed water – Internal treatment (carbonate, phosphate, calgon, colloidal and sodium aluminate conditioning). External treatment – Ion exchange process, Zeolite process –Domestic water treatment (break point chlorination) –Desalination of brackish water – Reverse Osmosis.

Surface Chemistry: Adsorption – types – adsorption of gases on solids – adsorption of solutes from solution – applications of adsorption –role of adsorbents in catalysis and pollution abatement.

UNIT II ELECTROCHEMISTRY AND CORROSION 9

Electrochemistry: Cells – types (electrochemical and electrolytic cell) Redox reaction – single electrode potential (oxidation potential and reduction potential) – measurement and applications –Nernst equation (derivation and problems) – electrochemical series and its significance.

Corrosion: Causes, factors and types – chemical and electrochemical corrosion (galvanic, differential aeration). Corrosion control – material selection and design aspects, cathodic protection methods (sacrificial anodic and impressed current cathodic method) and corrosion inhibitors. Paints: Constituents and its functions. Electroplating of Copper and electroless plating of Nickel.

UNIT III FUELS AND COMBUSTION 9

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 gases (LPG). Biofuels – Gobar gas and Biodiesel.

Combustion of Fuels: Introduction – calorific value – higher and lower calorific values- theoretical calculation of calorific value – flue gas analysis (ORSAT Method).

UNIT IV ENERGY SOURCES AND STORAGE DEVICES 9

Energy sources: Nuclear fission – nuclear fusion – differences between nuclear fission and fusion – nuclear chain reactions – nuclear energy – light water nuclear power plant – breeder reactor – solar energy conversion – solar cells – wind energy.

Storage devices: Batteries – types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium–ion–battery), fuel cells – H_2 -O_2 fuel cell and super capacitors.

UNIT V POLYMERS AND NANOMATERIALS 9

Polymers: Classification – types of polymerization – mechanism (Free radical polymerization) –Engineering polymers: Nylon–6, Nylon–6,6, Teflon, Kevlar and PEEK – preparation, properties and uses – Plastic and its types – Conducting polymers – types and applications. Composites – definition, types, polymer matrix composites – FRP.

Nanomaterials: Introduction – Nanoparticles, Nanoclusters, Nanorods, Nanotubes (CNT: SWNT and MWNT) and Nanowires – Properties (surface to volume ratio, melting point, optical and electrical), Synthesis (precipitation, thermolysis, hydrothermal, electrodeposition, chemical vapour deposition, laser ablation, sol-gel process) and Applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015.
2. P. C. Jain and Monika Jain, "Engineering Chemistry" DhanpatRai Publishing Company (P) LTD, New Delhi, 2015.
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

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.

OUTCOMES

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

1. Identify the origin of water resources and develop innovative methods to produce soft water for industrial use and potable water at cheaper cost. (K2)
2. Recognize the basic design of adsorption systems and its industrial applications and the basics concepts of electrochemistry to understand battery technology. (K2)
3. Apply the principles of electrochemistry to corrosion process and the applications of protective coatings to overcome the corrosion. (K3)
4. Disseminating the knowledge about the chemistry of fuels and combustion and its application in various levels.. (K2)
5. Acquire the basics of non-conventional sources of energy and understand the principles and the reaction mechanism of batteries and fuel cells. (K3)
6. Illustrate the synthesis and applications of polymers, composites and nano-materials. (K2)

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	-	-	1	2	-	-	-	-	1
CO2	3	2	2	2	1	1	2	-	-	-	-	3
CO3	3	2	3	2	1	1	2	-	-	-	1	1
CO4	3	1	2	2	-	1	2	-	-	-	1	1
CO5	3	2	3	1	1	1	2	-	-	-	1	3
CO6	3	2	3	1	-	1	1	-	-	-	1	2

SEMESTER - I

20ESCS101 SDG NO. 4&9	PROBLEM SOLVING AND PROGRAMMING IN C	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand about 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

UNIT I INTRODUCTION TO PROGRAMMING AND ALGORITHMS FOR PROBLEM SOLVING 10

The Basic Model of Computation, Programming Paradigms- Program Development Life Cycle - Algorithm –Pseudo Code – Flow Chart - Programming Languages - Compilation - Linking and Loading - Testing and Debugging - Documentation - Control Structures – Algorithmic Problem Solving- Problems Based on Sequential, Decision Making - Branching and Iteration.

UNIT II BASICS OF C PROGRAMMING 8

Structure of C program - C programming: Data Types – Storage Classes - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions – Input / Output Statements - Assignment Statements – Decision making Statements - Switch Statement - Looping Statements – Pre-Processor Directives - Compilation Process

UNIT III ARRAYS AND STRINGS 9

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.

UNIT 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 – 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.

UNIT V STRUCTURES and FILE PROCESSING 9

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.

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: Transaction Processing Using Random Access Files – Command Line Arguments.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.
2. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2012.

REFERENCES:

1. Paul Deitel and Harvey Deitel, "C How to Program", Seventh edition, Pearson Publication.
2. Jeri R. Hanly & Elliot B. Koffman, "Problem Solving and Program Design in C", Pearson Education, 2013.
3. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.
6. Kanetkar Y, "Let us C", BPB Publications, 2007.
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/programming_books/gnu_c_programming_tutorial
2. https://nptel.ac.in/courses/106105171
3. https://swayam.gov.in/nd1_noc19_cs42/preview

OUTCOMES:

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

1. Develop efficient algorithms for solving a problem. (K2)
2. Use the various constructs in C to develop simple applications. (K3)
3. Design and Implement applications using Array & Strings. (K3)
4. Develop applications using Functions and Pointers. (K6)
5. Design and Develop applications using Structures. (K3)
6. Design and Develop applications using Files. (K4)

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	1	1	-	2	2	-	3	2	3
CO2	3	3	3	3	2	-	1	1	2	2	3	3	2	3
CO3	3	3	3	3	2	1	1	1	2	-	3	-	3	2
CO4	3	3	3	3	2	1	-	1	2	2	3	3	1	2
CO5	3	3	3	3	2	1	1	1	2	2	3	3	2	1
CO6	3	3	3	3	2	1	1	1	2	2	3	3	3	2

SEMESTER - I

20ESGE101 SDG NO. 4,6,7, 9, 12,14 &15	ENGINEERING GRAPHICS	L	T	P	C
		1	2	0	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

CONCEPTS AND CONVENTIONS (Not for Examination) 3

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning- Projection of Points

UNIT I PLANE CURVES AND FREEHAND SKETCHING 6+9

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

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF LINES AND PLANE SURFACE 6+9

Orthographic projection- principles-Principal planes- Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method- Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 6+9

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6+9

Sectioning of prisms, pyramids, cylinder and cone in simple vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and truncated solids in vertical position – Prisms, pyramids cylinder and cone.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+9

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinder, cone- Perspective projection of simple solids-Prisms, pyramids and cylinder by visual ray method.

TOTAL: 78 PERIODS

TEXT BOOKS:

1. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.
2. T. Jeyapoovan, "Engineering Graphics using AUTOCAD", Vikas Publishing House Pvt Ltd, 7th Edition.

REFERENCES:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
2. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
3. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
4. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
5. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
6. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
7. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.

WEB REFERENCES:

1. https://nptel.ac.in/courses/112/103/112103019/

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/105/104/105104148/

PUBLICATION OF BUREAU OF INDIAN STANDARDS:

1. IS10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods

OUTCOMES:

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

1. Relate thoughts and ideas graphically in a neat fashion and ability to perform sketching of engineering curves used in engineering practices, multiple views of objects. (K1)
2. Understand the concepts of orthographic projections for basic geometrical constructions. (K2)
3. Acquire the knowledge of orthographic projection in three dimensional object. (K2)
4. Develop knowledge about Sectioning and apply interior shapes of solids. (K3)
5. Analyze the concepts of design in developing various 3 dimensional projections. (K4)
6. Build a strong foundation to analyze the design in various dimensions. (K4)

CO - PO , PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	2	2	-	2	2	2
CO2	3	2	2	-	-	-	-	-	2	2	-	2	2	2
CO3	3	2	2	-	-	-	-	-	2	2	-	2	2	2
CO4	3	2	2	-	-	-	-	-	2	2	-	2	2	2
CO5	3	2	2	-	-	-	-	-	2	2	-	2	2	2
CO6	3	2	2	-	-	-	-	-	2	2	-	2	2	2

SEMESTER - I

20BSPL101 SDG NO. 4	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
		0	0	3	1.5

PHYSICS LABORATORY

OBJECTIVES:

- To acquaint the students with practical knowledge of physics principles in various fields such as optics, thermal physics and properties of matter for developing basic experimental skills
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis

LIST OF EXPERIMENTS (Any 5 Experiments)

1. Determination of Young's modulus by non-uniform bending method.
2. Determination of rigidity modulus –Torsion pendulum.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
4. (a) Determination of wavelength and particle size using Laser.
   (b) Determination of acceptance angle in an optical fiber.
5. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
6. Determination of specific resistance of a given coil of wire – Carey Foster's bridge.
7. Determination of wavelength of mercury spectrum – spectrometer grating.
8. Determination of band gap of a semiconductor.
9. Determination of Hall coefficient by Hall Effect experiment.
10. Determination of solar cell characteristics.

LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS / 6 (max.) STUDENTS PER EXPERIMENT

1. Young's modulus by non-uniform bending method-experimental set-up – 12 sets
2. Rigidity modulus - Torsion pendulum experimental set-up – 12 sets
3. Ultrasonic Interferometer to determine velocity of sound and compressibility of liquid – 6 sets
4. (a) Experimental set-up to find the wavelength of light, and to find particle size using Laser – 6 sets
   (b) Experimental set-up to find acceptance angle in an optical fiber – 6 sets
5. Lee's disc method- experimental set up to find thermal conductivity of a bad conductor – 6 sets
6. Experimental set-up to find specific resistance of a coil of wire-Carey Foster's Bridge – 6 sets
7. Experimental set-up to find the wavelength of mercury spectrum-spectrometer grating – 6 sets
8. Experimental set-up to find the band gap of a semiconductor – 12 sets
9. Experimental set-up to find the Hall coefficient by Hall Effect Experiment – 6 sets

10. Experimental set-up to study characteristics of solar cells – 6 sets

TEXTBOOKS:

1. J.D. Wilson& C.A. Hernandez Hall "Physics Laboratory Experiments" Houghton Mifflin Company, New York, 2010.
2. M.N. Srinivasan, S. Balasubramanian &R. Ranganathan, "Practical Physics", S. Chand & Sons educational publications, New Delhi, 2011.
3. R. Sasikumar, "Practical Physics", PHI Learning Pvt. Ltd., New Delhi, 2011.

CHEMISTRY LABORATORY

(Any five experiments to be conducted)

OBJECTIVES:

- To acquaint the students with practical knowledge of the basic concepts of chemistry, the student faces during the course of their study in the industry and engineering field
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis
- To understand and develop experimental skills for building technical competence

LIST OF EXPERIMENTS (Any five experiments to be conducted)

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water samples.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Determination of strength of given hydrochloric acid using pH meter.
6. Conductometric titration of strong acid vs strong base.
7. Estimation of iron content of the given solution using potentiometer.
8. Estimation of iron content of the water sample using spectrophotometer (1, 10- Phenanthroline / thiocyanate method).
9. Estimation of sodium and potassium present in water using flame photometers.
10. Determination of molecular weights of polymers using Ostwald's Viscometer.

LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS / 6 (MAX.) STUDENTS PER EXPERIMENT.

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample - 6 sets
2. Determination of total, temporary & permanent hardness of water by EDTA method - 6 sets
3. Determination of DO content of water sample by Winkler's method - 6sets
4. Determination of chloride content of water sample by argentometric method – 6 sets
5. Determination of strength of given hydrochloric acid using pH meter - 6 sets
6. Conductometric titration of strong acid vs strong base - 6 sets
7. Estimation of iron content of the given solution using potentiometer - 6 sets
8. Estimation of iron content of the water sample using spectrophotometer (1,10- Phenanthroline / thiocyanate method) - 2 sets
9. Estimation of sodium and potassium present in water using flame photometer - 2 sets
10. Determination of molecular weights of polymer using Ostwald's Viscometer. - 6 sets

TOTAL: 30 PERIODS

TEXT BOOKS:

1. Vogel's Textbook of Quantitative Chemical Analysis (8th edition, 2014).

OUTCOMES:

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

1. Apply the principles of thermal physics and properties of matter to evaluate the properties of materials and to determine the physical properties of liquid using ultrasonic interferometer. (K1)
2. Understand measurement technique and usage of new instruments in optics for real time application in engineering. (K2)
3. Apply the knowledge of semiconductor materials to evaluate the band gap and Hall coefficient of materials and to study the characteristics of solar cell for engineering solutions. (K3)
4. Apply the different techniques of quantitative chemical analysis to generate experimental skills in building technical competence.(K2)

5. Apply basic techniques used in chemistry laboratories for water analyses/purification and estimates the ions/metal ions present in domestic/industry wastewater. (K2)
6. Utilize the fundamental laboratory techniques for analyses such as volumetric titrations, conductometric, potentiometric and spectroscopy. (K2)

CO- PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	1	3	3	2	2	1	1	3
CO2	3	3	3	3	3	3	3	2	2	2	2	3
CO3	3	3	3	3	3	3	3	2	1	1	2	3
CO4	3	2	3	3	1	1	2	2	2	2	3	2
CO5	3	2	3	3	1	1	2	2	2	2	3	2
CO6	3	2	3	3	1	1	2	2	2	2	3	2

SEMESTER - I

20ESPL101 SDG NO. 4&9	PROGRAMMING IN C LABORATORY	L	T	P	C
		0	0	3	1.5

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 leap year or not? (Hint: not every centurion year 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 Armstrong number or not?

6. Write a program tocheck 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 display array elements using two dimensional arrays.
10. Write a program to perform swapping using function.
11. Write a program to display all prime numbers between two intervals using functions.
12. Write a program to reverse a sentence using recursion.
13. Write a program to get the largest element of an array using the function.
14. Write a program to concatenate two string.
15. Write a program to find the length of String.
16. Write a program to find the frequency of a character in a string.
17. Write a program to store Student Information in Structure and Display it.
18. 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.
19. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.
20. Count the number of account holders whose balance is less than the minimum balance using sequential access file.

TOTAL: 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C compiler 30 Nos.

(or)

Server with C compiler supporting 30 terminals or more.

OUTCOMES:

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

1. Solve some simple problems leading to specific applications. (K3)
2. Demonstrate C programming development environment, compiling, debugging, linking and executing a program. (K3)
3. Develop C programs for simple applications making use of basic constructs, arrays and strings. (K4)
4. Develop C programs involving functions and recursion. (K4)

5. Develop C programs involving pointers, and structures. (K6)
6. Design applications using sequential and random access file. (K4)

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	1	1	-	2	2	-	3	2	3
CO2	3	3	3	3	2	-	1	1	2	2	3	3	2	3
CO3	3	3	3	3	2	1	1	1	2	-	3	-	3	2
CO4	3	3	3	3	2	1	-	1	2	2	3	3	1	2
CO5	3	3	3	3	2	1	1	1	2	2	3	3	2	1
CO6	3	3	3	3	2	1	1	1	2	2	3	3	3	2

SEMESTER - I

20TPHS101 SDG NO. 4&5	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To enrich social network ethics
- To develop and enhance browsing culture
- To understand the concepts of networking
- To promote self professionalism
- To acquire knowledge about various digital identification procedures

UNIT I SOCIAL NETWORK ETIQUETTES **6**

Introduction to social network – Social Networking Etiquettes - Pros and Cons - Usage of Facebook, Instagram, WhatsApp , Telegram, Youtube, Evolution of Android and IOS, Introduction to Linkedin & Benefits. (Practicals – Official Mail id- Linkedin Id Creation, Linkedin Profile Bulilding , Facebook Id and Creation and Modifying the existing FB ID)

UNIT II BROWSING CULTURE **6**

Introduction to browsing – Search Engines-Google - Bing -Yahoo!-AOL -MSN –DuckDuckGo ,browsers, phishing – Cookies - URL – https:// extensions , browsing history, Incognito mode- VPN – Pros and Cons – Book mark.

UNIT III NETWORKING **6**

Basics of networking - LAN, MAN, WAN, Introduction to network topologies, Protocols , IP Commands (Command line prompt), Define online complier and editor (Practicals – Find Your System IP,Ping Command, Firewall Fortinet, Basic DOS Commands)

UNIT IV PROFESSIONALISM **6**

Dress Code, Body Language, Appropriate Attire ,Communication Skills, Interview preparation – Introducing yourself - How to greet Superiors, Importance of Eye Contact During conversation.

UNIT V DIGITAL IDENTIFICATION **6**

Introduction to NAD - Importance of Aadhar, PAN Card, Passport, Bank Account, Bar Code, QR scan, Payment Gateway (Gpay, Phone Pe, UPI, BHIM, Paytm), Mobile Banking (Practicals - NAD registration Step by Step, Linking bank account with netbanking , Register for payment gateway).

TOTAL : 30 PERIODS

WEB REFERENCES :

Unit I: Social Network Etiquettes:

1. https://sproutsocial.com/glossary/social-media-etiquette/
2. https://www.shrm.org/resourcesandtools/tools-and-samples/hr-qa/pages/socialnetworkingsitespolicy.aspx
3. https://www.frontiersin.org/articles/10.3389/fpsyg.2019.02711/full
4. https://medium.com/@sirajea/11-reasons-why-you-should-use-telegram-instead-of-whatsapp-ab0f80fbfa79
5. https://buffer.com/library/how-to-use-instagram/
6. https://www.webwise.ie/parents/what-is-youtube/
7. https://www.androidauthority.com/history-android-os-name-789433/
8. https://www.mindtools.com/pages/article/linkedin.htm

Unit II: Browsing Culture:

1. https://sites.google.com/site/bethanycollegeofteacheredn/unit--ict-connecting-with-world/national-policy-on-information-and-communication-technology-ict/accessing-the-web-introduction-to-the-browser-browsing-web
2. https://www.wordstream.com/articles/internet-search-engines-history
3. https://www.malwarebytes.com/phishing/
4. https://www.adpushup.com/blog/types-of-cookies/

5. https://www.eff.org/https-everywhere
6. https://www.sciencedirect.com/topics/computer-science/browsing-history\
7. https://www.vpnmentor.com/blog/pros-cons-vpn/
8. https://www.tech-wonders.com/2016/10/use-hush-private-bookmarking-extension-chrome.html

Unit III:Networking

1. https://www.guru99.com/types-of-computer-network.html
2. https://www.studytonight.com/computer-networks/network-topology-types
3. https://www.cloudflare.com/learning/network-layer/what-is-a-protocol/
4. https://www.howtogeek.com/168896/10-useful-windows-commands-you-should-know/
5. https://paiza.io/en

Unit IV : Professionalism

1. https://career.vt.edu/develop/professionalism.html
2. https://englishlabs.in/importance-dress-code/
3. https://www.proschoolonline.com/blog/importance-of-body-language-in-day-to-day-life
4. https://www.thespruce.com/etiquette-of-proper-attire-1216800
5. https://shirleytaylor.com/why-are-communication-skills-important/
6. https://www.triad-eng.com/interview-tips-for-engineers/
7. https://www.indeed.co.in/career-advice/interviewing/interview-question-tell-me-about-yourself
8. https://toggl.com/track/business-etiquette-rules/

Unit V: Digital Identification

1. https://nad.ndml.in/nad-presentation.html
2. https://www.turtlemint.com/aadhaar-card-benefits/
3. https://www.bankbazaar.com/pan-card/uses-of-pan-card.html
4. https://www.passportindex.org/passport.php
5. https://consumer.westchestergov.com/financial-education/money-management/benefits-of-a-bank-account
6. https://en.wikipedia.org/wiki/QR_code

7. https://www.investopedia.com/terms/p/payment-gateway.asp
8. https://www.paisabazaar.com/banking/mobile-banking/

OUTCOMES:

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

1. Learn and apply social network ethics. (K3)
2. Understand the browsing culture. (K2)
3. Analyze the networking concepts . (K4)
4. Develop self professionalism. (K3)
5. Gain hands-on experience in various digital identification procedures. (K2)
6. Analyse and apply the different digital payment gateway methods. (K4)

CO- PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	3	2	-	3	2	3	-	2
CO2	-	-	-	-	3	2	-	3	2	3	-	2
CO3	-	-	-	-	3	2	-	-	1	3	-	2
CO4	-	-	-	-	3	2	-	3	3	3	-	2
CO5	-	-	-	-	3	2	-	-	2	3	-	2
CO6	-	-	-	-	3	2	-	-	2	3	-	2

SEMESTER - I

20HSMG101 SDG NO. 4&5	PERSONAL VALUES	L	T	P	C
		2	0	0	0

OBJECTIVES:

- Values through Practical activities

UNIT I SELF CONCEPT **6**

Understanding self Concept – Identify Yourself – Who am I – an individual, engineer, citizen – Attitude – Measuring Behaviour – Change of Behaviour – Personality – Characteristics in personal, professional life.

UNIT II INDIVIDUAL VALUES **6**

Personal Values – Attributes –Courage – Creativity, Honesty, Perfection, Simplicity, Responsibility – Measuring personal values

UNIT III MORAL VALUES **6**

Moral – Understanding right and wrong – Positive thoughts – Respect to others – Doing good to society.

UNIT IV PHYSICAL AND MENTAL WELL-BEING **6**

Health – Physical fitness –Mental vigour – Diet management – Yoga – Meditation – Peaceful life – Happiness in life

UNIT V DECISION MAKING **6**

Goal Setting – Decision making skill – Overcome of Barriers – Success – Mental strength and weakness

TOTAL: 30 PERIODS

Note:

Each topic in all the above units will be supplemented by practice exercises and classroom activities and projects.

REFERENCE BOOKS:

1. Barun K. Mitra, "Personality Development and Soft Skills", Oxford University Press, 2016.
2. B.N.Ghosh, "Managing Soft Skills for Personality Development" McGraw Hill India, 2012.

OUTCOMES:

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

1. Become an individual in knowing the self. (K4)
2. Acquire and express Personal Values, Spiritual values and fitness. (K4)
3. Practice simple physical exercise and breathing techniques. (K2)
4. Practice Yoga asana which will enhance the quality of life. (K1)
5. Practice Meditation and get benefitted. (K1)
6. Understanding moral values and need of physical fitness. (K2)

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	2	3	3	1	1	1
CO2	-	-	-	-	-	2	2	3	3	1	1	1
CO3	-	-	-	-	-	2	2	3	3	1	1	1
CO4	-	-	-	-	-	2	2	3	3	1	1	1
CO5	-	-	-	-	-	2	2	3	3	1	1	1
CO6	-	-	-	-	-	2	2	3	3	1	1	1

SEMESTER - I

20HSTA101 SDG NO. 4	HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1

UNIT I LANGUAGE AND LITERATURE 3

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

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

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

UNIT III FOLK AND MARTIAL ARTS 3

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

UNIT IV THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

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

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

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

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

தமிழர் மரபு

அலகு I மொழி மற்றும் இலக்கியம்: **3**

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை: 3

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

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலொட்டம், தொல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV தமிழர்களின் திறைக் கோட்பாடுகள்: 3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்கொப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: 3

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

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு — மக்களும் பண்பாடும் — கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

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

SEMESTER - II

20BSMA204 SDG NO. 4	DISCRETE STRUCTURES	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To learn the basic concepts of Relations and Functions
- To learn the concepts of Mathematical induction, Permutation and Combination
- To understand the concepts of Logic, Rules of inference and Quantifiers
- To impart the knowledge on Groups, Normal subgroups, Rings and Fields
- To develop Graph Algorithms by using the concepts of Graphs and Trees

UNIT I RELATION AND FUNCTION 12

Binary Relation, Partial Ordering Relation, Equivalence Relation – Sum and Product of functions – Bijective functions – Inverse and composite functions.

UNIT II COMBINATORICS 12

The Principles of Mathematical Induction-The Well-Ordering Principle – Recursive definition – Basic counting techniques – Inclusion and exclusion , Pigeonhole principle – Permutation – Combination.

UNIT III LOGICS AND PROOFS 12

Basic Connectives – Truth Tables – Logical Equivalence: The Laws of Logic, Logical Implication – Rules of Inference – The use of Quantifiers – Proof Techniques: Some Terminology – Proof Methods and Strategies – Forward Proof – Proof by Contradiction – Proof by Contraposition.

UNIT IV ALGEBRAIC STRUCTURES 12

Algebraic Structures with One Binary Operation – Semi Groups, Monoids, Groups, Permutation Groups – Subgroups – Normal subgroups – Algebraic Structures with two Binary Operations - Definition and Examples of Rings and Fields – Boolean Algebra – Identities of Boolean Algebra.

UNIT V GRAPHS AND TREES 12

Graphs and their properties – Degree, Connectivity, Path, Cycle – Sub Graph – Isomorphism – Eulerian and Hamiltonian Walks –Rooted Trees, Trees and Sorting.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications: with Combinatorics and Graph Theory", 7th Edition, Tata McGraw –Hill Education Pvt. Ltd., 2015.
2. J.P. Tremblay and R. Manohar, "Discrete Mathematical Structure with Applications to Computer Science", Tata Mc Graw Hill Education (India) Edition 1997.
3. Narsingh Deo, "Graph theory with applications to Engineering and Computer Science", Prentice Hall Inc., Englewood Cliffs,N.J., 1974.

REFERENCES:

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

ONLINE RESOURCES:

1 https://www.youtube.com/watch?v=h_9WjWENWV8&list=PL3o9D4Dl2FJ9q0_gtFXPh_H4POI5dK0yG

2 https://www.youtube.com/watch?v=xlUFkMKSB3Y&list=PL0862D1A947252D203.

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=PLHXZ9OQGMqxersk8fUxiUMSIx0DBqsKZS

OUTCOMES:

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

1. Classify the relations and functions defined on a set. (K2)
2. Apply counting principle and mathematical induction to solve combinatorial problems. (K3)
3. Construct mathematical arguments using logical connectives, quantifiers and verify the correctness of an argument using symbolic logic, truth tables and proof strategies. (K3)
4. Explain the fundamental concepts of algebraic structures such as groups, rings, fields and Boolean algebra. (K3)
5. Illustrate the concepts of graphs and sorting in trees. (K3)

CO- PO MAPPING :

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

SEMESTER - II

20HSEN201 SDG NO. 4	TECHNICAL ENGLISH - II	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To strengthen the listening skills for comprehending and critically analyzing passages
- To enhance students' ability with multiple strategies and skills for making technical presentations
- To participate in group discussions for developing group attitude
- To develop skills for preparing effective job application
- To write effective technical reports

UNIT I LANGUAGE DEVELOPMENT **9**

Listening – Listening conversations involving two participants – multiple

participants – Speaking – conversation methods in real life occurrences using expressions of different emotions and imperative usages – Reading passages and short stories - Writing – preparation of checklist – extended definition – Language Development – tenses - subject - verb agreement

UNIT II VOCABULARY BUILDING 9

Listening – listening formal and informal conversation and participative exercises – Speaking - creating greetings/wishes/excuses and thanks – Reading – articles/novels-Writing summary of articles and concise writing identifying new words – homonyms, homophones, homographs – one-word substitutions – easily confused words - creating SMS and using emoticons - sharing information in social media. Language Development - reported speeches – regular and irregular verbs - idioms & phrases

UNIT III WRITING TECHNICAL REPORTS 9

Listening – listening conversation – effective use of words and their sound aspects, stress, intonation & pronunciation – Speaking - practicing telephonic conversations – observing and responding. Reading – regular columns of newspapers/magazines - Writing – reports – feasibility, accident, survey and progress - preparation of agenda and minutes – Language Development - using connectives – discourse markers

UNIT IV TECHNICAL WRITING 9

Listening – Model debates & documentaries - Speaking – expressing agreement/disagreement, assertiveness in expressing opinions – Reading biographies/autobiographies – Writing – note-making – formal letters – inviting guests – acceptance/declining letters - Language Development – degrees of comparison - numerical adjectives – embedded sentences

UNIT V GROUP DISCUSSION AND JOB APPLICATION 9

Listening – Listening - classroom lectures – recommending suggestions & solutions – Speaking – participating in group discussion – learning GD strategies – Reading – journal articles - Writing – Job application – cover letter - résumé preparation – Language Development – purpose statement – editing – verbal analogies.

TOTAL: 45 PERIODS

TEXT BOOKS :

1. Board of editors. Fluency in English: A Course book for Engineering and Technology. Orient Blackswan, Hyderabad 2016.
2. Ashraf Rizvi. M, Effective Technical Communication. 2nd ed. McGraw Hill, New Delhi, 2018.

REFERENCES:

1. Bailey, Stephen. Academic Writing: A Practical Guide for Students. Routledge, New York,2011.
2. Raman, Meenakshi and Sharma, Sangeetha. Technical Communication Principles and Practice. Oxford University Press, New Delhi, 2014.
3. Muralikrishnan& Mishra Sunitha, Communication skills for Engineers 2nd ed. Pearson, Tamilnadu, India 2011. P. Kiranmai and Rajeevan, Geetha. Basic Communication Skills, Foundation Books, New Delhi, 2013.
4. Suresh Kumar, E. Engineering English. Orient Blackswan, Hyderabad, 2015
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://freevideolectures.com/course/3250/introduction-to-film-studies/10

ONLINE RESOURCES

1. https://www.ef.com/wwen/english-resources/
2. https://www.smilesforlearning.org/gclid=EAIaIQobChMI49DF9bnd6AIVSY6PCh1d_gV9EAAYASAAEgIBPvD_BwE.

OUTCOMES:

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

1. Define technical terms with the correct use of grammar (K1)
2 Identify new words, phrases, idioms and summarize articles/ write ups effectively (K2)
3 Pronounce words correctly, speak fluently and share opinions and suggestions effectively in conversations, debates and discussions (K3)
4 Construct reports convincingly and write official letters emphatically (K3)
5 Communicate confidently while speaking and writing by employing language strategies (K2)
6 Adapt group behavior, execute their role as a contributing team member and prepare winning job applications (K3)

CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	2	3	1	2
CO2	-	2	-	-	-	-	-	-	2	3	1	1
CO3	-	-	-	1	-	-	-	2	2	3	1	1
CO4	-	-	-	-	-	2	-	3	2	3	2	2
CO5	-	-	-	-	-	-	-	-	2	3	2	2
CO6	-	-	-	-	-	-	-	2	2	3	1	2

SEMESTER - II

20BSPH203 SDG NO. 4	PHYSICS FOR INFORMATION SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the essential principles of physics of conducting materials, super conducting and optical properties of materials
- To educate the basic principles of semi conductor device and electron transport properties
- To become proficient in magnetic materials
- To acquire the basic working of nano electronic devices

UNIT I CONDUCTING MATERIALS **9**

Classical free electron theory-Expression for electrical conductivity-Thermal conductivity expression-Wiedemann-Franzlaw-Success and failures-Electrons in metals-Motion of a particle in a three dimensional box (Quantum Mechanical Approach)-degenerate states-Fermi-Dirac statistics-Density of energy states - Electron in periodic potential - Energy bands in solids - Tight binding approximation-Electron effective mass-Concept of hole.

UNIT II SEMI CONDUCTOR MATERIALS **9**

Intrinsic Semiconductors - Direct and indirect band gap semiconductors - Carrier concentration in intrinsic semi conductors-extrinsic semi conductors-Carrier concentration in N-type & P-type semi conductors-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-Ohmic contacts-Schottky diode.

UNIT III MAGNETIC PROPERTIES OF MATERIALS 9

Magnetic dipole moment-atomic magnetic moments-magnetic permeability and susceptibility-Magnetic material classification:diamagnetism-para magnetism - ferro magnetism - anti ferro magnetism - ferri magnetism -Ferro magnetism: origin and exchange interaction-Domain Theory-M versus H behaviour - Hard and soft magnetic materials - applications - Magnetic principle in computer data storage-Magnetic hard disc-GMRsensor.

UNIT IV SUPER CONDUCTING & OPTICAL PROPERTIES OF MATERIALS9

Super conductivity - Type-I and Type-II superconductors - Properties and applications-Classification of optical materials -Carrier generation and recombination processes - Photo current in a P-N diode - Solar cell - LED - Organic LED-Optical data storage techniques and devices.

UNIT V NANODEVICES 9

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 nano materials-Tunneling: single electron phenomena and single electron transistor - Quantum dot laser -Carbon nano tubes: Properties and applications.

TOTAL: 45PERIODS

TEXT BOOKS:

1. Jasprit Singh, "Semiconductor Devices: Basic Principles", Wiley 2012.
2. Kasap, S.O., "Principles of Electronic Materials and Devices", McGraw-HillEducation, 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 & PoonamTandon., "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:

At the end of the course, the students should able to

1. Understand 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 (K2)
2. Illustrate the various types of semiconductors based on band gap energy and doping, expression for carrier concentration, Fermi energy and their variations (K2)
3. Apply the suitable semiconducting materials for Hall device, Schottky and tunnel diode fabrication and acquire the basic knowledge of magnetic materials and its classification (K3)
4. Gain the knowledge on the types of superconducting and optical materials, properties of superconductors, mechanism of carrier generation and recombination in optical data storage devices (K2)
5. Apply the semiconducting, ferri magnetic and superconducting materials in optical devices, data storage devices and magnetic levitation (K3)
6. Understand the basics of 1D, 2D, 3D quantum structures, single electron transport, carbon nano tubes and its applications (K3)

CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	3	-	-	-	-	-	-	1
CO2	3	3	-	-	3	-	2	-	-	-	-	3
CO3	3	3	-	2	3	-	3	-	-	-	-	2
CO4	3	3	2	2	3	-	3	-	-	-	-	3
CO5	3	3	3	3	3	-	3	-	-	-	-	3
CO6	3	3	2	2	3	-	-	-	-	-	-	1

SEMESTER - II

20BSCY201 SDG NO. 4,17	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the nature and facts about environment
- To find and implement scientific, technological, economic and political solutions to environmental problems
- To study the interrelationship between living organism and environment
- To provide the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management

UNIT I ENVIRONMENT, ECO SYSTEMS AND BIODIVERSITY 10

Definition, scope and importance of environment – need for public awareness– Ecosystem: concept of an ecosystem – structure and functions of an ecosystem – Biotic and abiotic components – Bio geo chemical cycle (C, N & P) –energy flow in the ecosystem – food chains, food webs and ecological pyramids– ecological succession - keystone species. Introduction to bio diversity definition: genetic, species and ecosystem diversity – values of biodiversity –IUCN Red list species classification - endemic, endangered, rare, vulnerable,extinct and exotic species – Biodiversity at global, national and local levels –India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity – man-wildlife conflicts. Conservation of biodiversity: In-situ andex-situ conservation of biodiversity. Field study of Terrestrial (Forest,Grassland, Desert) and Aquatic ecosystem (Pond, Lake, River, Estuary and Marine)

UNIT II ENVIRONMENTAL POLLUTION 9

Definition – causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear pollution – solid waste management: causes, effects and control measures of municipal solid wastes (MSW) – role of an individual inprevention of pollution – Case studies related to environmental pollution. Disaster management: floods, earthquake, cyclone and landslides – nuclear holocaust – Case studies.

UNIT III NATURAL RESOURCES 9

Forest resources: Use and over – exploitation, deforestation – Land resources: land degradation, man induced landslides, soil erosion and desertification –Water resources: Use and over- utilization of surface and ground water – dams-benefits and problems, conflicts over water – Mineral resources: Environmental effects of extracting and using mineral resources – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture – fertilizer – pesticide problems,water logging and salinity. Energy resources: Renewable energy (Solar energy,Wind energy, Tidal energy, Geothermal energy, OTE, Biomass energy) and nonrenewable energy (Coal, Petroleum, Nuclear energy) sources. – role of an individual in conservation of natural resources. Case studies – timber extraction, mining, dams and their effects on forests and tribal people.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 9

Atmospheric Chemistry - Composition and structure of atmosphere. Climate change - greenhouse effect- role of greenhouse gases 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). environmental ethics: Issues and possible solutions – Green chemistry – 12 principles of green chemistry. Urbanisation - Urban problems related to energy - Water conservation: rainwater harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns - case studies. Environment Legislations and Laws : Environment (protection) act – 1986. Air (Prevention and Controlof Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act. Biomedical Waste(Management and Handling rules):1998 and amendments- scheme of labelling of environmentally friendly products (Ecomak) - Issues involved in enforcement of environmental legislation - central and state pollution controlboards, role of non-governmental organization – Public awareness -Environmental Impact Assessment (EIA).

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 8

Population growth, variation among nations – population explosion – family welfare programme – women and child welfare environment and humanhealth – HIV / AIDS – Role of Information Technology in environment and Human health – Case studies – human rights – value education – Sustainable Development – Need for sustainable development – concept – 17

SDG goals – 8 Millennium Development Goals(MDG).

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 andScience', 2nd edition, Pearson Education, 2004.
3. Ravikrishnan A, 'Environmental Science and Engineering', Sri Krishna Hitech Publishing Company Pvt. Ltd, Revised Edition 2020.

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., Hydrabad, 2015.
3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India Pvt. Ltd., Delhi, 2014.
4. Rajagopalan. R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.

OUTCOMES:

Upon successful completion of this course, student should be able to

1. Explain the different components of environment, structure and function of an ecosystem, importance of bio diversity and its conservation. (K1)
2. Aware about problems of environmental pollution, its impact on human and ecosystem, control measures and basic concepts in Disaster Management. (K2)
3. Disseminate the need for the natural resources and its application to meet the modern requirements and the necessity of its conservation. (K2)
4. Illustrate the various aspects of atmospheric chemistry with a focus on climate change and recognize the principles of green chemistry. Describe suitable scientific, technological solutions and Protection Acts to eradicate social and environmental issues. (K2)
5. Recognize the need for population control measures and the environmental based value education concepts to achieve the Sustainable Development Goals. (K2)

CO - PO MAPPING :

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

SEMESTER - II

20ESIT202 SDG NO. 4&9	PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To develop simple Python programs with conditionals and loops
- To define Python functions and to implement lists, tuples, dictionaries and sets
- To perform file operations and understand OO concepts in Python
- To understand NumPy, Pandas and Matplotlib

UNIT I BASICS OF PYTHON PROGRAMMING 9

Introduction to Python – Literals – Variables and Identifiers – Data Types – Input Operation – Comments – Reserved words – Indentation – Operators and Expressions - Conditionals: Boolean values and operators - conditional if - alternative if - chained conditional - Iteration - Illustrative programs: Evaluation of expressions - String Operations - Circulate the values of n variables - Square root (Newton's method) - GCD - Sum an Array of Numbers.

UNIT II STRING, LISTS, TUPLES, DICTIONARIES, SETS 9

Strings: String slices - Immutability - String functions and methods - String module - Lists: List operations - List slices - List methods - List loop - Mutability - Aliasing - Cloning lists - List parameters - Tuples: Tuple assignment - Tuple as return value.

Dictionaries: Operations and Methods - Advanced list processing - List comprehension - Sets: Creating Sets – Operations and methods – Set comprehension - Illustrative programs: Linear search - Binary search - Selection sort - Insertion sort - Merge sort.

UNIT III FUNCTIONS, MODULES, PACKAGES **9**

Functions - definition and use - Flow of execution - Parameters and arguments - Fruitful functions: Return values - Parameters - Local and global scope - Function composition - Recursion - Modules – from import statement – Name of Module – Making your own modules - Packages - Packages in Python – Standard Library Modules – Globals(), Locals() and Reload(); Illustrative programs: Fibonacci series using functions - Arithmetic operations using module - Area of different shapes using packages.

UNIT IV FILES, EXCEPTIONS, CLASSES AND OBJECTS **9**

Files and exception: Text files - Reading and writing files - Format operator - Command line arguments - Errors and exceptions - Handling exceptions - Classes and Objects: Defining classes - Creating Objects – Data abstraction – Class constructor – Class variables and Object variables – Public and Private data members – Private Methods; Illustrative programs: Word count - Copy file - Creating user defined exception - Creating student class and object.

UNIT V NUMPY, PANDAS, MATPLOTLIB **9**

Introduction - Basics of NumPy - N-dimensional Array in NumPy - Methods and Properties - Basics of SciPy - Broadcasting in NumPy Array Operations - Array Indexing in NumPy, Pandas - Introduction - Series - DataFrame - Matplotlib - Basics - Figures and Axes - Method subplot() - Axis container Illustrative Programs: Multiplying a Matrix by a Vector, Solving Linear System of Equations - Using Pandas to Open CSV files - Creating a Single plot.

TOTAL: 45 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.
7. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus", Wiley India Edition, 2013.
8. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.

WEB REFERENCES:

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

OUTCOMES:

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

1. Understand the syntax and semantics, string operations of python programming language (K2)
2. Develop python programs using control low statements.(K3)
3. Construct various Data structures to develop python programs. (K3)
4. Illustrate the concepts of Functions, Modules and Packages in Python.(K3)
5. Understand the concepts of ObjectOriented Programming, files and Exception handling.(K2)
6. Examine various problem solving concepts in python to develop real time applications.(K4)

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	1	1	0	0	1	0	1	2	2
CO2	3	3	3	3	3	1	0	0	0	0	0	1	2	2
CO3	3	3	3	3	3	2	1	0	0	0	0	1	2	2
CO4	3	3	3	3	3	2	1	0	0	0	0	1	2	2
CO5	3	3	3	3	3	2	2	1	0	2	0	2	3	3
CO6	3	3	3	3	3	3	3	2	3	2	3	2	3	3

SEMESTER - II

20CBPC201 SDG NO. 4 & 9	DATA STRUCTURES & ALGORITHMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the basic terminologies of algorithm and data organization
- Understand the concepts of ADTs
- Learn linear data structures–lists, stacks, and queues
- Understand sorting, searching and hashing algorithms
- Learn dynamic data structures-Tree and Graph

UNIT I BASIC TERMINOLOGIES AND INTRODUCTION TO ALGORITHM7

Algorithm Specification - Recursion - Performance Analysis - Asymptotic Notation - The Big-O - Omega and Theta Notation - Programming Style - Refinement of Coding-Time-SpaceTrade Off- Testing-Data Abstraction.

UNIT II LINEAR DATA STRUCTURE 11

Array-Stack–Operations-Evaluating Arithmetic Expressions-Conversion of Infix to Postfix Expression-Queue–Circular Queue–DeQueue-Operations-Linked_List and its Types - Various Representations - Applications of Linear Data Structures.

UNIT III NON-LINEAR DATA STRUCTURE–TREES & GRAPHS 11

Trees–TreeTraversals-Binary Tree-Threaded Binary Tree-Binary Search Tree-B&B+Tree-AVL Tree-Splay Tree-Graph-Directed-Undirected-Basic

Terminologies and Representations- Graph Search and Traversal Algorithms-Operations & Applications of Non-Linear Data Structures.

UNIT IV SEARCHING AND SORTING ON VARIOUS DATA STRUCTURES 11

Sequential Search-Binary Search-Breadth First Search-Depth First Search Insertion Sort - Selection Sort - Shell Sort - Divide and Conquer Sort - Merge Sort-Quick Sort-Heapsort-Introduction to Hashing.

UNIT V FILES 5

File Organisation - Sequential - Direct - Indexed Sequential - Hashed and Various Types of Accessing Schemes.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. E. Horowitz, S. Sahni, S.A -Freed, "Fundamentals of Data Structures", Universities Press, Second Edition, 2008.
2. A.V. Aho, J.E. Hopperoft, J.D. Ullman, "Data Structures and Algorithms", Pearson Education, 1983.

REFERENCES:

1. The Art of Computer Programming: Volume1: Fundamental Algorithms, Donald E. Knuth.
2. Introduction to Algorithms, Thomas, H.Cormen, Charles E.Leiserson, Ronald L. Rivest, Clifford Stein, The MIT Press.
3. Open Data Structures: AnIntroduction (Open Paths to Enriched Learning), 31st Edition, Pat Morin, UBC Press.

WEB RESOURCES:

1. https://swayam.gov.in/nd2_cec19_cs04/preview
2. https://nptel.ac.in/courses/106102064/

ONLINE RESOURCES:

1. https://www.codechef.com/certification/data-structures-and-algorithms/prepare
2. https://www.coursera.org/specializations/data-structures-algorithms

OUTCOMES:

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

1. Implement abstract data types for linear data structures. (K3)
2. Implement abstract data types for non-linear data structure (K3)

3. Apply the different linear and non-linear data structures to problem solutions (K3)
4. Implement the various sorting algorithms (K3)
5. Implement the various searching algorithms (K3)
6. Implement files and graph data structures for various applications (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	2	1	1	1	0	2	2	3	3	3	2
CO2	2	2	1	2	1	1	1	0	2	2	3	3	3	2
CO3	3	3	2	3	3	1	1	1	2	2	3	3	3	2
CO4	2	2	1	2	3	2	1	0	1	1	2	1	3	2
CO5	2	2	1	2	3	2	1	0	1	1	2	1	3	2
CO6	2	2	1	2	1	1	1	0	2	2	3	3	3	2

SEMESTER - II

20ESPL201 SDG NO. 4	PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- Develop Python programs with conditionals, loops and functions
- Represent compound data using Python lists, tuples, dictionaries
- Read and write data from/to files in Python
- Implement NumPy, Pandas, Matplotlib libraries

LIST OF EXPERIMENTS :

1 Compute the GCD of two numbers
2 Find the maximum and minimum of a list of numbers
3 Linear search and Binary search
4 Selection sort, Insertion sort
5 Merge sort, Quick Sort
6 First n prime numbers
7 Multiply matrices
8 Programs that take command line arguments (word count)
9 Find the most frequent words in a text read from a file
10 Exception Handling – License Process

11 Classes and Objects – Student class
12 Solving Linear System of Equations
13 Using Pandas to Open csv files
14 Creating a Single plot
15 Creating Scatter plot, Histogram

TOTAL: 45 PERIODS

LAB REQUIREMENTS

Python 3

OUTCOMES

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

1. Implement simple programs for describing the syntax, semantics and control flow statements. [K3]
2. Examine the core data structures like String, lists, dictionaries, tuples and sets in Python to store, process and sort the data. [K2]
3. Articulate the concepts of functions, modules and packages in Python. [K2]
4. Illustrate the applications of python libraries. [K3]
5. Create files and perform read and write operations in it. [K3]
6. Handle exceptions and create classes and objects for any real time applications. [K3]

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	1	2	1	2	-	-	-	1	-	3	3	-	1
CO2	1	2	3	3	3	2	1	1	1	1	1	3	1	2
CO3	-	1	3	3	2	1	-	-	-	-	1	3	-	1
CO4	1	2	3	3	2	-	-	-	-	-	1	3	1	2
CO5	-	-	3	3	2	-	-	1	-	-	2	3	-	-
CO6	-	-	3	3	2	-	-	1	-	-	2	3	-	-

SEMESTER - II

20CBPL202 SDG NO. 4	DATA STRUCTURES & ALGORITHMS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- Design and implement linear and non-linear data structures
- Develop & implement binary search trees with all operations
- Write functions to implement graph traversal algorithms
- Familiarize in sorting and searching algorithm
- Appropriately use the linear/non-linear data structure operations for a given problem

LIST OF EXPERIMENTS

1. Towers of Hanoi using user defined stacks.
2. Reading, writing, and addition of polynomials.
3. Line editors with line count, word counts howing on the screen.
4. Trees with all operations.
5. All graph algorithms.
6. Saving/retrieving non-linear data structure in/from a file

TOTAL: 45 PERIODS

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

Equipments:

Standalone desktops with C compiler 30Nos OR Server with C compiler supporting 30 terminals or more.

OUTCOMES

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

1. Write functions to implement linear and non-linear data structure operations (K4)
2. Write programs to implement binary search trees with all operations (K4)
3. Write functions to implement graph traversal algorithms (K4)
4. Familiarize in sorting algorithm (K1)
5. Familiarize in searching algorithm (K1)
6. Appropriately use the linear / non-linear data structure operations for a given problem (K1)

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	-	1	2	-	1	1	-	2
CO2	2	2	2	-	2	2	3	1	2	2	-	2
CO3	1	1	1	1	-	1	1	-	1	2	-	1
CO4	2	2	2	2	1	1	1	-	1	1	1	1
CO5	2	2	1	-	-	1	1	-	-	-	1	-
CO6	1	1	1	1	1	1	1	1	1	1	1	1

SEMESTER - II

20ESGE201 SDG NO. 4,9,12	ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	3	1.5

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. Stair case 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 equipments – 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 HWR and FWR.

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 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.

Machine assembly practice:

1. Study of centrifugal pump.
2. Study of air conditioner.

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 : 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

1. 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 Digital Live-wire detector	 2 Nos 2 Nos

2. Electronics

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

3. 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 Demolition Hammer Circular Saw Planer Hand Drilling Machine	 2 Nos 2 Nos 2 Nos 2 Nos 2 Nos

	Jigsaw	2 Nos

4. Mechanical

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

OUTCOMES:

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

1. Elaborate on the components, gates, soldering practices. Calculate electrical parameters such as voltage, current, resistance and power. (K1)
2. Design and implement Rectifier and Timer circuits (K2)
3. Measure the electrical energy by single phase and three phase energy meters. (K2)
4. Prepare the carpentry and plumbing joints. (K2)
5. Perform different types of welding joints and sheet metal works (K2)
6. Perform different machining operations in lathe and drilling. (K2)

CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	1	-	-	1	1	1	1
CO2	3	2	1	1	2	1	-	-	1	1	1	1
CO3	2	2	1	1	1	1	-	-	1	1	1	1
CO4	1	1	1	-	-	2	-	-	1	1	1	2
CO5	2	1	1	-	-	1	1	1	1	1	1	2
CO6	2	1	1	-	-	1	-	1	1	1	1	2

SEMESTER - II

20TPHS201 SDG NO. 4&5	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	0

OBJECTIVES:

- To understand the nuances in resume building
- To explore various virtual meeting tools
- To gain knowledge about online certification courses
- To develop knowledge in Google Suite products
- To enhance presentation skills

UNIT I RESUME BUILDING **6**

Your Strength, Projects, Internship, Paper Presentation, uploading your coding in github, Introduction to HackerRank, HackerEarth virtual online assessment (Auto Proctored) (Practicals - Construct a resume, Register for a online Mock Assessment / Contest)

UNIT II VIRTUAL MEETINGS **6**

Basic Etiquette of virtual meeting – Introduction to Skype - Zoom - Webex - Google Meet - Gotowebinar - Jio meet – Screen Share - Jamboard - Feedback polling - Chatbox

(Practicals - Accept and Register for a mock class to attend - How to host a meeting).

UNIT III ONLINE LEARNING **6**

Online Certification - Coursera – Udemy – Edx – Cisco – Online Practice Platforms - SkillRack – Myslate - FACEprep - BYTS - aptimithra - Contest Registrations - TCS Campus Commune - HackwithInfy, InfyTQ - Virtusa NurualHack - Mindtree Osmosis – Online assessment - AMCAT-PGPA.

(Practicals - Campus Commune Registration , Coursera registration - Mock Registration (KAAR Technologies as sample).

UNIT IV GOOGLE SUITE **8**

Define google suite - Benefits of google suite - Google Search - Sheet - Docs - Forms - Calender - Drive - Slide - Translate - Duo - Earch - Maps - Hangouts- Sites - Books - Blogger

(Practicals – Create google sheets and share - Create google Forms and share, Create Google Slide and share , Google drive creation and share (Knowledge of Rights), Create poll and share.

UNIT V PRESENTATION SKILLS **4**

Email Writing – Group Discussion - Power Point Presentation

(Practicals- Create a self SWOT Analysis report. A PowerPoint Slide Preparation)

TOTAL : 30 PERIODS

WEB REFERENCES :

Unit I: Resume Building:

1. https://zety.com/blog/resume-tips
2. https://resumegenius.com/blog/resume-help/how-to-write-a-resume
3. https://www.hackerearth.com/recruit/
4. https://www.hackerrank.com/about-us

Unit – II:Virtual Meetings

1. https://www.claphamschool.org/our-community/blog/online-learning-etiquette-guide-14-principles-to-guide-students
2. https://online.hbs.edu/blog/post/virtual-interview-tips?c1=GAW_SE_NW&source=IN_GEN_DSA&cr2=search__-__nw__-__in__-__dsa__-__general&kw=dsa__-__general& cr5=459341920955&cr7=c&gclid=Cj0KCQjw8fr7BRDSARIsAK0Qqr4dRRbboL3kltrwDsr7hm8oIHtN5dfjD3NIFZULuzNwEXxhjpNFQ2caApn5EALw_wcB
3. https://hygger.io/blog/top-10-best-group-meeting-apps-business/
4. https://www.zdnet.com/article/best-video-conferencing-software-and-services-for-business/

Unit – III:Online Learning

1. https://www.coursera.org/browse
2. https://support.udemy.com/hc/en-us/articles/229603868-Certificate-of-Completion
3. https://www.edx.org/course/how-to-learn-online
4. https://www.cisco.com/c/en/us/training-events/training-certifications/certifications.html
5. https://campuscommune.tcs.com/en-in/intro
6. https://www.freshersnow.com/tcs-campus-commune-registration/
7. https://www.infosys.com/careers/hackwithinfy.html
8. https://www.mindtree.com/blog/osmosis-2013-my-experiences
9. https://www.myamcat.com/knowing-amcat
10. https://www.admitkard.com/blog/2020/02/06/amcat/

Unit IV: Google Suite

1. https://www.inmotionhosting.com/blog/what-is-g-suite-and-why-should-i-consider-using-it/
2. https://en.wikipedia.org/wiki/G_Suite
3. https://blog.hubspot.com/marketing/google-suite
4. https://kinsta.com/blog/g-suite/

Unit V: Presentation Skills

1. https://www.mindtools.com/CommSkll/EmailCommunication.htm
2. https://www.grammarly.com/blog/email-writing-tips/
3. https://business.tutsplus.com/articles/how-to-write-a-formal-email--cms-29793
4. https://www.softwaretestinghelp.com/how-to-crack-the-gd/
5. https://www.mbauniverse.com/group-discussion/tips
6. https://slidemodel.com/23-powerpoint-presentation-tips-creating-engaging-interactive-presentations/
7. https://business.tutsplus.com/articles/37-effective-powerpoint-presentation-tips--cms-25421
8 https://blog.prezi.com/9-tips-on-how-to-make-a-presentation-a-success/
9. http://www.garrreynolds.com/preso-tips/design/

OUTCOMES:

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

1. Construct a suitable resume and registration procedure for online mock assessments. (K1)
2. Handle various virtual meeting tools. (K3)
3. Acquire exposure about online certification courses. (K4)
4. Get involved and work in a collaborative manner. (K2)
5. Gain knowledge in various presentation methodologies. (K1)
6. Apply knowledge to practice Google suite features and SWOT analysis. (K3)

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	3	2	-	3	2	3	-	2
CO2	-	-	-	-	3	2	-	3	2	3	-	2
CO3	-	-	-	-	3	2	-	-	1	3	-	2
CO4	-	-	-	-	3	2	-	3	3	3	-	2
CO5	-	-	-	-	3	2	-	-	2	3	-	2
CO6	-	-	-	-	3	2	-	-	2	3	-	2

SEMESTER - II

20HSMG201 SDG NO. 4 & 5	INTERPERSONAL VALUES	L	T	P	C
		2	0	0	0

OBJECTIVES:

- Values through Practical activities

UNIT I INTERPERSONAL VALUES **6**

Interpersonal Relationships and Values – Importance and Barriers – Building and maintain relationships – Mutual understanding – Respect to others.

UNIT II EFFECTIVE COMMUNICATION **6**

Communication skills –Importance and Barriers - Impressive formation and management – Public speaking

UNIT III GROUP DYNAMICS **6**

Group formation –Teamwork – Identify others attitude and behaviour – Formation of relationship – Personal and professional.

UNIT IV MUTUAL RELATIONSHIP **6**

Building mutual understanding and cooperation – Enhancing decision making skills – Problem solving skills – Comparative Appraisal – Interpersonal needs.

UNIT V POSITIVE ATTITUDE **6**

Fostering trust and cooperation – Developing and maintain positive attitude – Improving socialization – Development of security and comfort.

TOTAL: 30 PERIODS

Note: Each topic in all the above units will be supplemented by practice exercises and classroom activities and projects.

REFERENCE BOOKS:

1. Barun K. Mitra, "Personality Development and Soft Skills", Oxford University Press, 2016.
2. B.N.Ghosh, "Managing Soft Skills for Personality Development", McGraw Hill India, 2012.

OUTCOMES:

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

1. Develop a healthy relationship & harmony with others. (K1)
2. Practice respecting every human being. (K3)
3. Practice to eradicate negative temperaments. (K3)
4. Acquire Respect, Honesty, Empathy, Forgiveness and Equality. (K4)
5. Manage the cognitive abilities of an Individual. (K5)
6. Understanding the importance of public speaking and teamwork. (K2)

CO – PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	2	3	3	1	1	1
CO2	-	-	-	-	-	2	2	3	3	1	1	1
CO3	-	-	-	-	-	2	2	3	3	1	1	1
CO4	-	-	-	-	-	2	2	3	3	1	1	1
CO5	-	-	-	-	-	2	2	3	3	1	1	1
CO6	-	-	-	-	-	2	2	3	3	1	1	1

SEMESTER - II

20HSTA201 SDG NO. 4	TAMILS AND TECHNOLOGY	L	T	P	C
		1	0	0	1

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3

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

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3

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

UNIT III MANUFACTURING TECHNOLOGY 3

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

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

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

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

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

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2 கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3 கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

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

தமிழர் மரபு

அலகு I நெசவு மற்றும் பானைத் தொழில்நுட்பம்: 3

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

அலகு II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: 3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க கொலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் ___ சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் கொலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

அலகு III உற்பத்தித் தொழில் நுட்பம்: 3

கப்பல் கட்டும் கலை -உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணொடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: 3

அணை, ஏரி, குளங்கள், மதகு -சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் ___ பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.

அலகு V அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: 3

அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூ லகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

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

SEMESTER - III

20BSMA302 SDG NO. 4	PROBABILITY & STATISTICAL MODELING	L	T	P	C
		3	1	0	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.

UNIT I PROBABILITY AND RANDOM VARIABLES 12

Probability – Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Erlang and Normal distributions.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Joint moment generating functions and its properties-Multinomial distribution –Bivariate normal distribution – Central limit theorem (for independent and identically distributed random variables).

UNIT III LINEAR STATISTICAL MODELS AND TESTING OF HYPOTHESIS 12

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, Procedures of testing. Analysis of Variance (one-way, two-way with as well as without interaction).

UNIT 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.

UNIT V ESTIMATION AND TIME SERIES ANALYSIS 12

Point estimation, criteria for good estimates (un-biasedness, consistency), Methods of estimation including maximum likelihood estimation. Basics of Time Series: Stationary, ARIMA Models: Identification, Estimation and Forecasting.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Probability and Statistics for Engineers (4th Edition), I. R. Miller, J. E. Freund and R. Johnson, 2016.
2. Introduction to Probability Models, S. M. Ross, Academic Press, N.Y, 2009.
3. Fundamentals of Statistics (Vol. I and Vol. II), A. Goon, M. Gupta and B. Dasgupta, 2013.
4. The Analysis of Time Series: An Introduction, Chris Chatfield, 2003.

REFERENCES:

1. A first course in Probability, S. M. Ross, Prentice Hall, 2013.
2. Introduction to the Theory of Statistics, A. M. Mood, F. A. Graybill and D.C. Boes, 2017.
3. Introduction to Linear Regression Analysis, D. C. Montgomery and E. Peck, 2006.
4. Applied Regression Analysis, N. Draper and H. Smith, 1998.
5. Fundamentals of Mathematical Statistics, S. C. Gupta and V. K. Kapoor, 2014.

WEB REFERENCES:

1. https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/
2. https://www.stat.berkeley.edu/~aldous/134/gravner.pdf

ONLINE RESOURCES:

1. https://www.nptel.ac.in/courses/110107113/
2. https://nptel.ac.in/courses/103106123/

OUTCOMES:

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

1. Apply standard discrete and continuous probability distributions in solving real life problems. (K3)
2. Apply the concepts of two dimensional random variables, central limit theorem and multivariate distributions in the real life problems. (K3)
3. Apply the methods of Simple, Multiple - Regression, Correlation, Design of experiments and hypothesis testing to infer the relation among the given data. (K3)
4. Apply the appropriate non parametric hypothesis testing procedures based on inferences. (K3)
5. Analyze the various models of time series analysis for forecasting and methods of estimation in statistical analysis. (K3)

CO – PO MAPPING:

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

SEMESTER - III

20AIPC302 SDG NO. 4	FUNDAMENTALS OF MACHINE LEARNING TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Explain the different types of Machine learning techniques
- Understand the Predictive, Descriptive and Prescriptive Analytics
- Apply different types of classification models in Supervised Machine learning
- Apply the different regression modelling and Optimization in Supervised learning
- Apply the basic clustering algorithm models

UNIT I INTRODUCTION TO MACHINE LEARNING 9

Introduction to Machine Learning – Types of Machine learning – Supervised – Un-supervised – Reinforcement Learning types – Applications of Machine learning techniques with Case study– Banking and Finance – Healthcare – Insurance – Issues in Machine learning

UNIT II PREDICTIVE AND DESCRIPTIVE LEARNING MODELS 9

Basic Types of data in Machine Learning – Exploring structure Data – Numerical data – Categorical data – Data Quality and Remediation – Data Preprocessing – Descriptive models – predictive models – prescriptive models – Applications of descriptive, predictive and prescriptive models - Training the models - Evaluating the performance of the model – Improving the performance of the model

UNIT III CLASSIFICATION ALGORITHM 9

Introduction to Feature Engineering – Feature construction – Feature extraction – Feature subset selection – Classification learning models and steps - Classification Algorithms – KNN – Decision Tree – Random Forest Model – Support Vector Machine

UNIT IV REGRESSION MODELLING 9

Introduction regression modelling – Mathematical model for Linear regression – Simple Linear regression – Multiple Linear Regression – Improving Accuracy of Linear regression model - Polynomial Regression - Logistic regression – Maximum likelihood Estimation - Stepwise regression – Ridge regression – Lasso Regression – Elastic Net regression modelling

UNIT V CLUSTERING ALGORITHM AND OTHER TYPES OF LEARNING 9

Introduction to Clustering – Different types of clustering techniques – Partitioning methods – K – Medoids: Object based technique – Hierarchical Clustering – Density based methods – Pattern Using Association Rules – Association Rule – Apriori algorithm for association rule learning – build the apriori principle rules – Other types of learning – Representation learning – Active Learning – Instance Based Learning - Association Rules Learning – Ensemble Learning

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014
2. Tom M Mitchell, "Machine Learning", First Edition, McGraw Hill Education, 2013
3. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, "Machine Learning", First Edition, Pearson, 2018
4. Thomas P. Trappenberg, "Fundamentals of Machine Learning", Oxford University Press, 2020

REFERENCES :

1. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.
2. Jason Bell, "Machine learning – Hands on for Developers and Technical Professionals", First Edition, Wiley, 2014
3. Ethem Alpaydin, "Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)", Third Edition, MIT Press, 2014.

WEB REFERENCES

1. http://digimat.in/nptel/courses/video/106106202/L01.html
2. http://digimat.in/nptel/courses/video/106106139/L01.html

ONLINE REFERENCES

1. http://digimat.in/nptel/courses/video/106106213/L01.html
2. http://digimat.in/nptel/courses/video/106106198/L01.html

OUTCOMES:

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

1. Explain the types of Machine Learning with example application. (K2)
2. Differentiate between descriptive, predictive and prescriptive models with case study. (K4)
3. Apply the suitable classification algorithm for a given problem. (K3).
4. Apply an appropriate regression modelling technique and improve the performance of the technique for a given problem. (K3)
5. Apply suitable clustering algorithm model for a given problem. (K3)
6. Compare different types of Machine Learning models with suitable use case. (K2)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	-	-	-	-	-	-	-	1	1	1
CO2	3	3	3	2	-	-	-	-	-	-	-	1	1	1
CO3	3	3	3	2	-	-	-	-	-	-	-	1	1	1
CO4	3	3	3	2	-	-	-	-	-	-	-	1	1	1
CO5	3	3	3	2	-	-	-	-	-	-	-	1	1	1
CO6	3	3	3	2	-	-	-	-	-	-	-	1	1	1

SEMESTER - III

20AIPC401 SDG NO. 4	FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the 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.

UNIT I INTRODUCTION **9**

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems – Search Strategies- Uninformed- Heuristics- Informed

UNIT II PROBLEM SOLVING METHODS **9**

Local Search Algorithms and Optimization Problems - Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing – Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games

UNIT III REPRESENTATION OF KNOWLEDGE **9**

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information

UNIT IV PLANNING **9**

Planning- Planning problems, Simple planning agent, Planning languages, Blocks world ,Goal stack planning, Mean Ends Analysis, Non-linear Planning, Conditional planning, Reactive planning, Implementation of block world problem

UNIT V APPLICATIONS **9**

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Robot – Hardware – Perception – Planning – Moving

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2009
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, 2008
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://books.google.co.in/books?id=uSvYmki2yg0C&printsec=frontcover&dq=Supervised+Learning&hl=en&sa=X&ved=0ahUKEwigkNa1xN3oAhWawjgGHe8hAzoQ6AEIKDAA#v=onepage&q=Supervised%20Learning&f=false

OUTCOMES:

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

1. Formulate a problem and build intelligent agents. (K1)
2. Apply appropriate searching techniques to solve a real-world problem. (K2)
3. Analyse the problem and infer new knowledge using suitable knowledge representation schemes. (K3)
4. Develop planning and apply learning algorithms on real world problems. (K3)
5. Design an expert system and implement natural language processing techniques. (K3)
6. Implement advance techniques in Artificial Intelligence. (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	2	1	1	-	1	-	-	1	3	3
CO2	2	3	2	3	2	1	1	-	1	-	-	1	3	3
CO3	2	3	2	3	2	1	1	-	1	-	-	1	3	2
CO4	2	3	2	3	3	1	1	-	2	-	-	1	2	2
CO5	2	3	2	3	3	1	1	-	2	-	-	1	2	3
CO6	2	3	2	3	3	1	1	-	2	-	-	1	2	2

SEMESTER - III

20CSPC301 SDG NO. 4 & 9	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand Object Oriented Programming concepts and principles of
- Packages, Inheritance and Interfaces
- To define Exceptions and use I/O streams
- To develop a Java application with threads and generic classes
- To design and build simple Graphical User Interfaces

UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 10

Object Oriented Programming – Abstraction – Objects and Classes –Encapsulation– Inheritance – Polymorphism– OOP in Java – Characteristics of Java – The Java Environment – Java Source File – Compilation – Fundamental Programming Structures in Java – Defining Classes in Java – Constructors - Methods - Access Specifiers – Static Members - Comments - Data Types- Variables - Operators- Control Flow- Arrays- Packages – Javadoc Comments.

UNIT II INHERITANCE AND INTERFACES 9

Inheritance – Super Classes– Sub Classes –Protected Members – Constructors in Sub Classes– The Object Class – Abstract Classes and Methods – Final Methods and Classes – Interfaces – Defining an Interface – Implementing Interface - Differences between Classes and Interfaces and Extending Interfaces – Object Cloning -Inner Classes -Array Lists -Strings.

UNIT III EXCEPTION HANDLING AND I/O 9

Exceptions – Exception Hierarchy – Throwing and Catching Exceptions – Built-in Exceptions-Creating own Exceptions - Stack Trace Elements - Input / Output Basics – Streams – Byte Streams and Character Streams – Reading and Writing Console – Reading and Writing Files.

UNIT IV MULTI-THREADING AND GENERIC PROGRAMMING 8

Differences between Multi-Threading and Multitasking - Thread Life Cycle - Creating Threads - Synchronizing Threads - Inter-Thread Communication - Daemon Threads - Thread Groups - Java Concurrency Packages – Generic Programming – Generic Classes – Generic Methods – Bounded Types – Restrictions and Limitations.

UNIT V LAMBDAS STREAMS AND REACTIVE PROGRAMMING 9

Lambda Expressions – Library Enhancements to Support Lambdas – No Parameter-Single Parameter - Multiple Parameters – With or Without Return Keyword-Comparator– Filter Collection Data-Streams-Generating Streams-Java Stream Interface Methods – For each-Map-Filter-Limit-Sorted – Parallel Processing - Reactive Programming– ReactiveX– ReactiveX Classes– Creating Operator– Reactive Subjects.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Herbert Schildt, "Java - The Complete Reference", 8 Edition, McGrawHill Education, 2011.
2. E.Balagursamy- "Programming with Java", 6 Edition, McGrawHill Education, 2019.

REFERENCES:

1. Paul Deitel, Harvey Deitel, "Java SE 8 for Programmers", 3 Edition, Pearson, 2015.
2. Steven Holzner, "Java 2 Blackbook", Dream Tech Press, 2011.
3. Timothy Budd, "Understanding Object-Oriented Programming with Java", Updated Edition, Pearson Education, 2000.

4. Kathy Sierra, Bert Bates, Trisha Gee, "Head First Java", 3rd Edition, O'Reilly, 2022.
5. Joshua Bloch, " Effective Java", Third Edition, Addison Wesley, 2018.

WEB REFERENCES:

1. https://www.w3schools.com/java/java_oop.asp
2. https://www.edureka.co/blog/object-oriented-programming/
3. https://www.ntu.edu.sg/home/ehchua/programming/java/J3a_OOPBasics.html

ONLINE RESOURCES :

1. https://www.ntu.edu.sg/home/ehchua/programming/java/J3a_OOPBasics.html
2. https://introcs.cs.princeton.edu/java/lectures/

OUTCOMES:

Upon completion of the course, students should be able to

1. Comprehend Object Oriented Programming Concepts in Java. (K2)
2. Illustrate the purpose of packages, Java documents and Analyze the various types of Inheritance. (K4)
3. Apply the Object Oriented Programming Concepts to develop the reusable Applications. (K3)
4. Illustrate the java applications using Java Exceptions and I/O Streams. (K4)
5. Understand the concept of Multithreading and Generic Classes in Java.(K2)
6. Design and implement Lambda expressions, streams and reactive programming. (K6)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	2	-	2	-	-	-	-	-	2	3	2
CO2	3	1	3	2	-	2	-	-	2	-	-	2	3	2
CO3	3	1	3	2	-	2	-	-	-	-	-	2	3	3
CO4	3	1	3	2	-	2	-	-	-	-	-	2	3	2
CO5	3	1	3	2	3	2	-	-	-	-	-	2	3	2
CO6	3	1	3	2	3	2	-	-	1	-	-	2	3	2

SEMESTER - III

20CSPC402 SDG NO. 4	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To design a database using ER diagrams, convert them to Relational Databases and to write SQL Queries
- To understand the fundamental concepts of Transaction Processing, Concurrency Control techniques and Recovery procedures
- To understand the Internal Storage structures and about the Query Processing Techniques
- To have an introductory knowledge about the Object Databases, XML Databases and NoSQL Databases

UNIT I DATABASE DESIGN 7

Purpose of Database System – Views of Data –Database System Architecture-Data Models– Entity Relationship Model – ER Diagrams – Enhanced ER Model.

UNIT II RELATIONAL DATABASES 11

Introduction to Relational Databases – Relational Model-ER-to-Relational Mapping– Keys –Relational Algebra – SQL Fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL-Functional Dependencies – Non-loss Decomposition – First – Second - Third Normal Forms - Dependency Preservation – Boyce/CoddNormal Form – Multi Valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

UNIT III TRANSACTIONS 9

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.

UNIT IV IMPLEMENTATION TECHNIQUES 9

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 – Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics - Cost Estimation.

UNIT V ADVANCED TOPICS **9**

Distributed Databases – Architecture - Data Storage - Transaction Processing – Object Based Databases - Object Database Concepts – Object Relational Features - ODMG Object Model – ODL - OQL – XML Databases - XML Hierarchical Model – DTD - XML Schema –Xquery.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, Tata McGraw Hill, 2020.
2. RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2016.

REFERENCES:

1. C.J.Date, A.Kannan, S.Swamynathan,"An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, "Database Management Systems", Fourth Edition, McGraw-Hill Education, 2015.
3. G.K.Gupta,"Database Management Systems", Tata McGraw Hill, 2011.

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. http://learnsql.com
5. https://www.w3schools.com/sql/default.asp
6. https://www.khanacademy.org/computing/computer-programming/sql

OUTCOMES:

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

1. Discuss the concepts of database to apply the Relational, ER model for design and SQL for implementation of the database. (K2)
2. Recognize and identify the use of normalization and functional dependencies to refine the database system. (K1)
3. Demonstrate various SQL queries for the Transaction Processing & Locking using concept of Concurrency control. (K2)
4. Build the query processing techniques for the optimization of SQL queries. (K3)

5. Implement the indexing and hashing techniques for the organisation of database records. (K3)
6. Illustrate how the advanced databases differ from the traditional databases. (K2)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	2	1	0	0	0	0	0	0	2	2
CO2	2	2	2	2	1	1	0	0	0	0	0	0	2	2
CO3	2	1	2	1	2	1	0	0	0	0	0	0	2	2
CO4	2	2	2	2	1	1	0	0	0	0	0	0	2	2
CO5	2	2	2	2	1	1	0	0	0	0	0	0	2	2
CO6	2	2	2	1	2	1	0	0	0	0	0	0	2	2

SEMESTER - III

20AIPL301 SDG NO. 9	PROBABILITY AND STATISTICAL MODELLING LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To understand data definitions and data manipulation commands
- To learn the R Programming
- To understand functions, procedures and procedural extensions of databases
- To be familiar with the use of a front-end tool
- To understand design and implementation of typical database applications

LIST OF EXPERIMENTS:

1. Introduction to R: basic commands, graphics, indexing data, loading data.
2. Implementation of Bayes' theorem.
3. Implementation of Binomial, Poisson theorem.
4. Implementation of Erlang, Normal distribution.

5. Verification of two-dimensional random variables.
6. Implementation of Regression model.
7. Implementation of Co-relation model.
8. Implementation of Non-parametric inference.
9. Verification of estimation and time series analysis.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, students should be able to

1. Install and use R for simple programming tasks. (K3)
2. Extend the functionality of R by using add-on packages. (K2)
3. Extract data from files and other sources and perform various data manipulation tasks on them. Code statistical functions in R. (K4)
4. Use R Graphics and Tables to visualize results of various statistical operations on data. (K3)
5. Apply the knowledge of R gained to data Analytics for real life applications. (K3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	3	-	-	-	3	-	-	-	-	2	1
CO2	-	3	-	-	3	3	-	-	3	-	3	3	3	2
CO3	3	-	2	-	3	-	-	2	3	-	3	-	3	2
CO4	-	3	-	3	-	-	3	3	3	-	-	3	2	1
CO5	-	3	-	2	-	2	-	3	-	3	2	-	2	1
CO6	-	3	-	3	-	-	3	3	3	-	-	3	2	1

SEMESTER - III

20AMPL301 SDG NO. 4	DATA SCIENCE AND MACHINE LEARNING LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- Introduce students to the fundamental concepts of machine learning and data analysis
- Develop students' skills in using popular machine learning and data analysis tools and libraries
- Provide hands-on experience in implementing various machine learning and data analysis techniques
- Help students understand the practical applications of machine learning and data analysis in various domains

LIST OF EXPERIMENTS:

1. Python basics and Numpy.
2. Data Analysis with Pandas
3. Linear regression on a real-world dataset.
4. Multiple linear regression on a real-world dataset
5. Polynomial regression on a real-world dataset
6. Ridge and Lasso regularization on a real-world dataset
7. Elasticnet Regression on a real-world dataset
8. Logistic regression on a real-world dataset
9. Decision tree classification on a real-world dataset
10. Random forest classification on a real-world dataset
11. Support vector machine (SVM) classification on a real-world dataset
12. K-means clustering on a real-world dataset
13. Hierarchical clustering on a real-world dataset
14. Building a Q-learning algorithm for a simple game
15. Building a Deep Q-learning algorithm for a simple game

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, students should be able to

1. Demonstrate an understanding of the fundamental concepts of machine learning and data analysis. (K2)
2. Use popular machine learning and data analysis tools and libraries like Numpy, Pandas, Scikit-learn, and Keras. (K3)

3. Building predictive and classification models. (K3)
4. Implement various machine learning and data analysis techniques like regression, classification, clustering, and neural networks. (K3)
5. Apply machine learning and data analysis techniques to real-world datasets and interpret experimental results. (K3)
6. Analyze the performance of machine learning and data analysis models and select appropriate techniques for different tasks. (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	2	1	1	-	1	-	-	1	3	3
CO2	2	3	2	3	2	1	1	-	1	-	-	1	3	3
CO3	2	3	2	3	2	1	1	-	1	-	-	1	3	2
CO4	2	3	2	3	3	1	1	-	2	-	-	1	2	2
CO5	2	3	2	3	3	1	1	-	2	-	-	1	2	3
CO6	2	3	2	3	3	1	1	-	2	-	-	1	2	2

SEMESTER - III

20CSPL402 SDG NO. 9	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To learn the use of Data Definition, Data Manipulation Commands, Nested and Join queries
- To understand Functions, Procedures and Procedural extensions of databases
- To be familiar with the use of a Front End tool
- To understand design and implementation of typical Database applications

LIST OF EXPERIMENTS:

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements.
2. Database Querying – Simple queries, Nested queries, Sub queries and Joins.

3. Implementation of Views, Sequences and Synonyms.
4. Database Programming: Implicit and Explicit Cursors.
5. Procedures and Functions.
6. Triggers.
7. Exception Handling.
8. Database Design using ER Modeling, Normalization and Implementation for any application.
9. Database Connectivity with Front End Tools.
10. Case Study using Real Life Database applications.

TOTAL: 45 PERIODS

LAB REQUIREMENTS

SOFTWARE

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

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

OUTCOMES:

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

1. Use typical data definitions and manipulation commands. (K1)
2. Design applications to test Nested and Join Queries. (K3)
3. Implement simple applications that use Views. (K3)
4. Critically analyze the use of Tables, Views, Functions and Procedures. (K4)
5. Make use of ER modeling and normalization to design and implement database. (K3)
6. Implement real life applications that require a Front-end Tool as a Team. (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	2	1	0	0	0	0	0	0	2	2
CO2	2	2	2	1	2	1	0	0	0	0	0	0	2	2
CO3	2	2	2	1	2	1	0	0	0	0	0	0	2	2
CO4	2	2	2	1	2	1	0	0	0	0	0	0	2	2
CO5	2	2	2	2	1	1	0	0	0	0	0	0	2	2
CO6	2	2	2	1	2	1	0	0	0	0	0	0	2	2

SEMESTER - III

20AMTE301 SDG NO. 4,11,15	LIVE-IN-LAB - I	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To understand the engineering aspects of design with reference to simple products
- To foster innovation in design of products
- To develop design that add value to products and solve technical problems.
- To create awareness among the students of the characteristics of several domain areas where IT can be effectively used

COURSE PLAN:

Study: Take minimum three simple products, processes or techniques in the area of specialization, study, analyze and present them. The analysis shall be focused on functionality, construction, quality, reliability, safety, maintenance, handling, sustainability, cost etc. whichever are applicable. Each student in the group has to present individually; choosing different products, processes or techniques.

Design: The project team shall identify an innovative product, process or technology and proceed with detailed design. At the end, the team has to document it properly and present and defend it. The design is expected to concentrate on functionality; design for strength is not expected.

Note: *The one hour/week allotted for tutorial shall be used for discussions and presentations. The project team (not exceeding four) can be students from different branches, if the design problem is multidisciplinary.*

EVALUATION:

1. First evaluation (Immediately after first internal examination) : 20 marks

2. Second evaluation (Immediately after second internal examination): 20 marks

3. Final evaluation (Last week of the semester) :

60 marks

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

OUTCOMES:

Upon completion of the course, students should be able to

1. List the problems and conduct literature survey to identify the gap and come up with an application oriented research problem in the specific domain. (K1)
2. Understand the project characteristics and explore necessary tools and components needed at various stages of the project (K2)
3. Design and validate the proposed system using simulation. (K3)
4. Develop the Prototype of the proposed system by adapting Industrial safety standards and best financial management practices (K5)
5. Analyze the obtained results and prepare a technical report. (K4)
6. Evaluate the project and go for journals and patents publication. (K5)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	3	2	2	3	3	3
CO2	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO3	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO4	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO5	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO6	2	2	2	1	2	1	1	1	3	2	3	3	3	2

SEMESTER - III

20AMTP301 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	1	0

APTITUDE & COGNITIVE SKILLS – PHASE 1

OBJECTIVES:

- To educate and enrich the students on quantitative ability, reasoning ability, and verbal ability.

UNIT I QUANTITATIVE ABILITY – I **6**

Problems on Trains - Time and Distance - Height and Distance - Time and Work

UNIT II QUANTITATIVE ABILITY – II **6**

Problems on Ages - Alligation or Mixture - Chain Rule - Simple Interest - Simple Equation - Theory of Equation.

UNIT III REASONING ABILITY – I **6**

Analytical Reasoning - Pipes and Cistern - Logical Problems - Logical Games - Logical Deduction - Data Sufficiency - Arithmetic Reasoning

UNIT IV VERBAL ABILITY – I **6**

Idioms & Phrases - Synonyms - Antonyms - Classification

UNIT V CREATIVITY ABILITY – I **6**

Venn Diagrams -Cube and Cuboids - Dice - Cubes and Dice - Figure Matrix.

TOTAL: 30 PERIODS

REFERENCES:

1. R. S. Agarwal , "Quantitative Aptitude for Competitive Exams" .
2. Sarvesh Verma, Quantum CAT.
3. R. S. Agarwal , "A Modern Approach to Logical Reasoning".
4. Arun sharma , "Verbal Ability and Reading Comprehension".

PROBLEM SOLVING USING C PROGRAMMING - PHASE 2

OBJECTIVES:

- To provide exposure to problem-solving through programming.
- To train the student to the basic concepts of the C-programming language.
- To provide exposure to problem-solving through programming
- To give the student hands-on experience with the concepts

UNIT I INTRODUCTION TO PRINCIPLES OF PROGRAMMING **6**

Introduction to Programming - Programing Domain: Artiicial Intelligence Systems Programming - Assembly Level Languages - Problem solving using Algorithms and Flowcharts.

UNIT II INTRODUCTION TO C PROGRAMMING **6**

Features of C and its Basic Structure, Simple C programs, Constants, Integer Constants, Real Constants, Character Constants, String Constants Floating point Numbers, The type cast Operator, Interactive Programming. Operators Expressions and Control statement, The goto statement, The if statement, The if-else statement, Nesting of if statements, The conditional expression, The break statement and continue statement.

UNIT III OPERATORS, EXPRESSIONS AND CONTROL STATEMENTS 6

Arithmetic Operators - Unary Operators - Relational and Logical Operators - The Conditional Operator - Library Functions - Bitwise Operators - The Increment and Decrement Operators - The Size of Operator - Precedence of operators - The goto statement - The if statement - The if-else statement - Nesting of if statements - The conditional expression - The switch statement - The while loop - The do…while loop - The for loop - The nesting of for loops - The break statement and continue statement

UNIT IV INTRODUCTION TO PRINTED CIRCUIT BOARD & PCB DESIGNING TOOLS 6

Fundamental of electronic components- Basic electronic circuits- Basics of printed circuit board designing: Layout planning-general rules and parameters- ground conductor considerations- thermal issues- check and inspection of artwork-Design rules for Digital circuit PCBs-Analog circuit PCBs-high frequency and fast pulse applications- Brief Introduction of various simulators.

UNIT V IMPLEMENTATION OF PCB DESIGN 6

Building simple schematics – Fabrication of DC Regulated Power Supply – Artwork & Printing of Simple PCB – Etching & Drilling of PCB – Wiring & Fitting Shop – Testing of Regulated Power supply Fabricated.

TOTAL: 30 PERIODS

TEXT BOOKS:

1. Printed circuit board design, fabrication assembly and testing By R. S. Khandpur, Tata McGraw Hill 2006.

REFERENCES:

1. Balagurusamy, “Programming in ANSI C”, Tata McGraw-Hill Education, 2008
2. Stephen G. Kochan, “Programming in C”, 3rd Edition, Sam’s Publishing, 2004
3. Printed circuit Board Design and technology, Walter C. Bosshart,1983.
4. Printed Circuits Handbook, Sixth Edition, by Clyde F. Coombs, Jr, Happy T. Holden, Publisher: McGraw-Hill Education Year: 2016.
5. Complete PCB Design Using OrCAD Capture and PCB Editor, Kraig Mitzner Bob Doe Alexander Akulin Anton Suponin Dirk Müller, 2nd Edition 2009.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/108/102/108102045
2. https://www.coursera.org/courses?query=embedded%20systems

WEB REFERENCES:

1. https://www.tutorialspoint.com/embedded_systems/index.htm

OUTCOMES:

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

1. Analyze their quantitative ability. (K4)
2. Understand the ability of arithmetic reasoning along with creative thinking and problem solving skills. (K2)
3. Create their verbal ability through vocabulary building and grammar. (K6)
4. Evaluate the situations to analyse the computational methods in order to identify and abstract the programming task involved. (K5)
5. Analyze tasks in which the numerical techniques are applicable in order to apply them to write, edit, compile, debug, correct, recompile and run programs. (K4)
6. Analyze and Design applications using Arrays, Strings, Pointers, Structures and Unions. (K4)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO2	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO3	-	-	-	-	3	2	-	-	1	3	-	2	-	-
CO4	-	-	-	-	3	2	-	3	3	3	-	2	2	2
CO5	-	-	-	-	3	2	-	-	2	3	-	2	2	2
CO6	-	-	-	-	3	2	-	-	2	3	-	2	2	2

SEMESTER - IV

20BSMA404 SDG NO. 4	LINEAR ALGEBRA AND ITS APPLICATIONS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To learn about solving system of linear equations using matrices
- To learn about vector spaces, subspaces, bases 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.

UNIT I SOLUTION OF SYSTEM OF LINEAR EQUATIONS 12

Vectors and linear combinations – rank of a matrix – Gaussian elimination – LU Decomposition – Solving Systems of Linear Equations using the tools of Matrices.

UNIT II VECTOR SPACES 12

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

UNIT III LINEAR TRANSFORMATIONS 12

Introduction-Linear Transformations-Range and Null Space-Dimension Theorem-Matrix representation of a Linear Transformation-Eigen Values and Eigen Vectors-Positive definite matrices-Diagonalizability

UNIT IV INNER PRODUCT SPACES 12

Introduction-Inner Product Spaces-orthogonality – projections- Gram Schmidt Orthogonalization Process-QR decomposition-Lease Square Approximation

UNIT V APPLICATIONS OF LINEAR ALGEBRA 12

Singular value decomposition and Principal component analysis – Introduction to their applications in data Science.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Higher Engineering Mathematics, B.S. Grewal, 1965
2. Linear Algebra, Stephen H. Friedberg, Arnold J. Insel and Lawrence E. Spence,2018

REFERENCES:

1. Advanced Engineering Mathematics, 7th Edition, Peter V. O'Neil,2011
2. Advanced Engineering Mathematics, 2nd Edition, Michael. D. Greenberg,2002
3. Introduction to Linear Algebra, 5th Edition, Gilbert Strang, 2016
4. Applied Mathematics (Vol. I & II), by P. N. Wartikar & J. N. Wartikar,2008

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-i
2. https://cosmolearning.org/courses/1806-linear-algebra/video-lectures/
3. https://towardsdatascience.com/understanding-singular-value-decomposition-and-its-application-in-data-science-388a54be95d
4. https://towardsdatascience.com/principal-component-analysis-intro-61f236064b38

OUTCOMES:

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

1. Determine the rank, linear combination of row/column vectors of the matrix and apply LU decomposition and Gauss elimination methods to solve the system of linear equations. (K3)
2. Determine the bases, dimension of vector spaces and subspaces. (K3)
3. Determine the range, null space of the linear transformation and diagonalize the matrix of the linear transformation. (K3)
4. Construct an orthonormal basis using Gram-Schmidt Orthogonalization process and use it for QR decomposition of a matrix and compute the minimal solution using Least square approximation. (K3)
5. Apply singular value decomposition and principal component analysis in analyzing data. (K3)
6. Apply Singular Value Decomposition and Principal Component Analysis in analyzing data. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	-	-	-	-	-	-	1
CO2	3	3	2	2	1	-	-	-	-	-	-	1
CO3	3	3	2	2	1	-	-	-	-	-	-	1
CO4	3	3	2	2	1	-	-	-	-	-	-	1
CO5	3	3	2	2	1	-	-	-	-	-	-	1
CO6	3	3	2	2	1	-	-	-	-	-	-	1

SEMESTER - IV

20ITPC401 SDG NO. 4	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand and apply the algorithm analysis techniques
- To critically analyze the efficiency of alternative algorithmic solutions for the same problem
- To understand different algorithm design techniques
- To understand the limitations of Algorithmic power

UNIT I INTRODUCTION 10

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties - Analysis Framework – Empirical analysis - Mathematical analysis for Recursive and Non-recursive algorithms – Visualization.

UNIT II BRUTE FORCE AND DIVIDE-AND-CONQUER 9

Brute Force – Computing an – String Matching - Closest-Pair and Convex-Hull Problems - Exhaustive Search - Travelling Salesman Problem - Knapsack Problem - Assignment Problem. Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort – Heap Sort - Multiplication of Large Integers – Closest-Pair and Convex - Hull Problems.

UNIT III DYNAMIC PROGRAMMING AND GREEDY TECHNIQUES 9

Dynamic programming – Principle of optimality - Coin Changing Problem - Computing a Binomial Coefficient – Floyd's Algorithm – Multi Stage Graph - Optimal Binary Search Trees – Knapsack Problem and Memory functions - Greedy Technique – Container Loading Problem - Prim's Algorithm and Kruskal's Algorithm – 0/1 Knapsack Problem - Optimal Merge pattern - Huffman Trees.

UNIT IV ITERATIVE IMPROVEMENT 8

The Simplex Method - The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs - Stable Marriage problem.

UNIT V COPING WITH THE LIMITATIONS OF ALGORITHM POWER 9

Lower - Bound Arguments - P, NP, NP - Complete and NP-Hard Problems- Backtracking – n-Queen Problem - Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – LIFO Search and FIFO Search - Assignment Problem – Knapsack Problem – Travelling Salesman Problem - Approximation Algorithms for NP-Hard Problems – Travelling Salesman Problem – Knapsack Problem.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Computer Algorithms/ C++", Second Edition, Universities Press, 2007.

REFERENCES:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.
2. Alfred V.Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
3. Harsh Bhasin, "Algorithms Design and Analysis", Oxford university press, 2016.
4. S. Sridhar, "Design and Analysis of Algorithms", Oxford university press, 2014.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106101060
2. https://www.cse.iitm.ac.in/course_details.php?arg=OTI
3. https://swayam.gov.in/nd1_noc19_cs47/previ

ONLINE RESOURCES:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-design-and-analysis-of-algorithms-spring-2015/
2. http://www.learnalgorithms.in/
3. https://courses.cs.vt.edu/ csonline/Algorithms/Lessons/
4. http://openclassroom.stanford.edu/MainFolder/Course/Page.php?course=IntroToAlgorithms.

OUTCOMES:

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

1. Review the fundamentals of algorithmic problem solving and analyzing efficiency of algorithms [K2]
2. Apply mathematical formulation, complexity analysis and methodologies to solve recurrence relations for algorithms [K3]
3. Compare the time complexities of various algorithms [K3]
4. Critically analyze the different algorithm design techniques for a given problem [K3]
5. Illustrate NP class problems and formulate solutions using standard approach [K2]
6. Articulate solutions for real life problems using algorithm design principles [K3]

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	0	0	0	0	0	0	0	0	0
CO2	3	3	1	0	0	0	0	0	0	0	0	0
CO3	2	3	0	1	0	0	0	0	0	0	0	0
CO4	2	3	0	2	0	0	0	0	0	0	0	0
CO5	1	2	0	1	0	0	0	0	0	0	0	0
CO6	1	2	1	2	0	0	0	0	0	0	0	0

SEMESTER - IV

20CSPC401 SDG NO. 9	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic concepts and functions of operating systems.
- To understand Processes and Threads
- To analyze Scheduling algorithms.
- To understand the concept of Deadlocks.
- To analyze various memory management schemes.
- To understand I/O management and File systems.
- To be familiar with the basics of Linux system and Mobile OS like iOS and Android.

UNIT I OPERATING SYSTEM OVERVIEW 7

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multi core Organization. Operating system overview-objectives and functions, Evolution of Operating System - Computer System Organization Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

UNIT II PROCESS MANAGEMENT 11

Processes - Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; CPU Scheduling - Scheduling criteria, Scheduling algorithms, Multiple- processor scheduling, Real time scheduling; Threads- Overview, Multithreading models, Threading issues; Process Synchronization - The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock – System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT III STORAGE MANAGEMENT 9

Main Memory – Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, 32 and 64-bit architecture Examples; Virtual Memory – Background, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

UNIT IV FILE SYSTEMS AND I/O SYSTEMS 9

Mass Storage system – Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space management; File-System Interface - File concept, Access methods, Directory Structure, Directory organization, File system mounting, File Sharing and Protection; File System Implementation- File System Structure, Directory implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem, Streams, Performance.

UNIT V CASE STUDY 9

Linux System - Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Inter-process Communication; Mobile OS - iOS and Android - Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2012.

REFERENCES :

1. Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems – A Spiral Approach", Tata McGraw Hill Edition, 2010.
2. Achyut S.Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.
3. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Pearson Education, 2004.
4. Gary Nutt, "Operating Systems", Third Edition, Pearson Education, 2004.
5. Harvey M. Deitel, "Operating Systems", Third Edition, Pearson Education, 2004.
6. Daniel P Bovet and Marco Cesati, "Understanding the Linux kernel", 3rd edition, O'Reilly, 2005.
7. Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", Fourth Edition, Payload media, 2011.

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

ONLINE REFERENCES

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

OUTCOMES:

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

1. Understand the basic concepts and functions of the operating system. (K2)
2. Analyze various scheduling algorithms. (K4)
3. Understand deadlock, prevention and avoidance algorithms. (K2)
4. Compare and contrast various memory management schemes. (K4)
5. Understand the functionality of file systems (K2)
6. Understand the performance of administrative tasks on Linux servers. (K2)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	1	-	1	1	-	-	-	1	2	2
CO2	3	3	3	2	2	-	1	1	-	-	-	1	2	2
CO3	3	3	2	2	2	-	1	1	-	-	-	1	2	2
CO4	2	2	3	2	2	-	1	1	-	-	-	1	2	2
CO5	3	3	3	2	2	-	1	1	-	-	-	1	2	2
CO6	3	3	2	2	2	-	1	1	-	-	-	1	2	2

SEMESTER - IV

20AMPC401 SDG NO. 4 & 9	NATURE INSPIRED COMPUTING TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Understand the basics of Natural systems
- To appreciate the concepts of Natural systems and its applications
- To understand new Basic Natural systems functions(operations)
- To understand the fundamentals of nature inspired techniques which influence computing
- To understand an Integration of Hardware and software in Natural applications.
- To Understand practical implementation of Natural design considerations.

UNIT I INTRODUCTION 9

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.

UNIT II COMPUTING INSPIRED BY NATURE 9

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

UNIT III SWARM INTELLIGENCE 9

Introduction - Ant Colonies, Ant Foraging Behavior, Ant Colony Optimization, SACO and scope of ACO algorithms, Ant Colony Algorithm (ACA), Swarm Robotics, Foraging for food, Social Adaptation of Knowledge , Particle Swarm Optimization (PSO)

UNIT IV IMMUNO COMPUTING 9

Introduction- Immune System, 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

UNIT V COMPUTING WITH NEW NATURAL MATERIALS 9

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

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, 2007

REFERENCES:

1. Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.
2. Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.
3. Marco Dorrigo, Thomas Stutzle," Ant Colony Optimization", PHI,2005

WEB REFERENCES:

1. https://nptel.ac.in/courses/112103301
2. https://www.coursera.org/learn/modeling-simulation-natural-processes
3. https://www.mun.ca/computerscience/undergraduates/courses/comp-3201-introduction-to-nature-inspired-computi/

ONLINE RESOURCES:

1. https://searchworks.stanford.edu/view/13573432
2. https://kamenpenkov.files.wordpress.com/2016/01/zomaya-2006.pdf

OUTCOMES:

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

1. Illustrate the basic concepts of Swarm Intelligence processes. (K2)
2. Make use of the principle of Immuno computing techniques. (K3)
3. Translate skills for planning, estimating, and resourcing for Natural design considerations. (K3)
4. Identify the scope changes of nature inspired techniques which influence computing. (K3)
5. Identify optimization techniques as a means to provide functionality and value to apply context in specific case studies. (K3)
6. Understand the needs and familiarize the DNA Computing. (K2)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	1	1	1	2	1	1	2	1	2
CO2	3	3	3	3	3	1	2	2	3	2	1	2	1	2
CO3	3	3	3	3	3	1	1	1	1	2	1	2	1	2
CO4	3	3	3	2	3	1	2	2	2	2	1	2	2	2
CO5	3	3	3	3	3	1	2	2	3	3	2	2	2	2
CO6	3	3	-	-	2	2	-	-	-	-	1	1	2	2

SEMESTER - IV

20AIPC502 SDG NO. 4 & 9	DEEP LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamental techniques and principles of Neural Networks
- Identify and apply appropriate deep learning architectures for analyzing the data for a variety of problems.
- To analyze deep learning concepts with Convolutional Neural Network case studies
- To Implement different deep learning algorithms
- To study of an advanced deep learning technique

UNIT I INTRODUCTION TO DEEP LEARNING & NEURAL NETWORKS 9

Historical context and motivation for deep learning - Fundamentals of Neural Networks - Comparison of Biological and Artificial Neurons - Perceptron –Model of Artificial Neuron – Feedforward neural networks - Deep networks - Regularizing a deep network, Model Exploration - Hyperparameter tuning.

UNIT II DEEP LEARNING ARCHITECTURES 9

Machine Learning and Deep Learning - Representation Learning - Width and Depth of Neural Networks - Activation Functions: RELU – LRELU – ERELU - Unsupervised Training of Neural Networks - Restricted Boltzmann Machines - Auto Encoders - Deep Learning Applications.

UNIT III CONVOLUTIONAL NEURAL NETWORK 9

Introduction to convolution neural networks: stacking, striding and pooling - Applications like image, and text classification - Architectural Overview - Motivation, Layers, Filters, Parameter sharing, Regularization, Popular CNN Architectures: ResNet - AlexNet – Applications.

UNIT IV SEQUENCE MODELING: RECURRENT NETS 9

Unfolding computational graphs - Recurrent Neural Networks (RNNs), Bidirectional RNNs, Encoder -Decoder sequence to sequence architectures - Deep Recurrent Networks.

UNIT V ADVANCED DEEP LEARNING TECHNIQUES 9

Deep Belief Networks – Deep Boltzman Machine – Deep Associative Memory networks – Generative Neural Networks – Deep fake Technology –Case Study on designing deep learning solutions for identifying fake fingerprints, fake images and videos.

TOTAL: 45 HOURS

TEXT BOOKS:

1. Simon Haykin, "Neural Networks, A Comprehensive Foundation", 2nd Edition, Addison Wesley Longman, 2001.
2. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
3 Jeff Heaton, Deep Learning and Neural Networks, Heaton Research Inc, 2015.
4 Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.

REFERENCES:

1. Cosma Rohilla Shalizi, "Advanced Data Analysis from an Elementary Point of View", 2015.
2. Deng & Yu, "Deep Learning: Methods and Applications", Now Publishers, 2013.
3. Michael Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015.

WEB REFERENCES:

1. www.nptel.ac.in/courses/106/106/106106184/
2. www.nptel.ac.in/courses/106/106/106106201/
3. www.nptel.ac.in/courses/106/105/106105215/

4 www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-s191- introductionto-deep-learning-january-iap-2020/ 5.
5. www.kaggle.com/learn/intro-to- deep-learning

OUTCOMES:

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

1. Demonstrate the basic concepts, fundamental learning techniques and layers. (K2)
2. Analyze and Evaluate, in the context of a case study, the advantages and disadvantages of deep learning neural network architectures and other approaches. (K3)
3. Design convolutional networks for handwriting and object classification from images or video. (K4)
4. Design recurrent neural networks for sequence modeling. (K4)
5. Apply and evaluate deep learning on real data sets. (K3)
6. Build, train and apply fully connected deep neural networks. (K4)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	2	-	-	-	-	-	-	1	1	2
CO2	3	3	2	2	2	-	-	-	-	-	-	2	3	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	1
CO4	3	3	2	3	3	-	-	-	2	-	2	3	3	2
CO5	3	3	2	3	3	2	2	-	2	-	2	3	2	2
CO6	3	3	3	3	3	2	2	-	2	2	2	3	3	3

SEMESTER - IV

20CSPW401 SDG NO. 4 & 9	COMPUTER NETWORKS WITH LAB	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To understand the protocol layering and physical level communication
- To understand the various components required to build different networks and analyze the performance of a network
- To learn the functions of network layer and the various routing protocols
- To familiarize the functions and protocols of the Transport layer

UNIT I INTRODUCTION AND PHYSICAL LAYER 9

Networks – Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

UNIT II DATA LINK LAYER & MEDIA ACCESS 9

Introduction – Data Link Layer - Addressing – DLC Services – Data-Link Layer Protocols – HDLC – PPP - Media Access Control - Wired LANs: Ethernet - Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices.

UNIT III NETWORK LAYER 9

Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets - Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.

UNIT IV TRANSPORT LAYER 9

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram protocol – Transmission Control Protocol – SCTP.

UNIT V APPLICATION LAYER 9

WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP.

LIST OF EXPERIMENTS: 15

1. Simple client server program.
2. Socket program for echo/ping commands.
3. Implementing Link state routing algorithm.
4. Implementing distance vector routing algorithm.
5. Study of Network Simulator (NS2 or NS3) and Simulation of Congestion Control Algorithms using NS.
6. Study of TCP/UDP performance using Simulation tool.
7. Simulation of error correction code (like CRC).
8. Traffic Analysis using Wireshark.

TOTAL: 60 PERIODS

LAB REQUIREMENTS:

1. C/C++/JAVA/Equivalent compiler
2. Network Simulator like NS2/OPNET/Wireshark

TEXT BOOKS:

1. Behrouz A. Forouzan, “Data communications and networking with TCP/IP protocol suite", Sixth Edition, McGraw Hill, cop. 2022.
2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.

REFERENCES:

1. William Stallings, “Data and Computer Communications”, Tenth Edition, Pearson Education, 2014.
2. Nader F. Mir, "Computer and Communication Networks", Second Edition Prentice Hall, 2014.
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. Andrew S. Tanenbaum, David J. Wetherall,"Computer Networks ", 5th edition, Pearson Education,2011

WEB REFERENCES:

1. https://swayam.gov.in/nd2_cec19_cs07/preview
2. https://nptel.ac.in/courses/106105081/
3. https://www.isi.edu/nsnam/ns/

ONLINE RESOURCES:

1. https://ptgmedia.pearsoncmg.com/images/9780789749048/samplepages/0789749041.pdf
2. https://www.cse.iitb.ac.in/~sri/cs348/cs378-lab00-overview.pdf
3. https://freevideolectures.com/course/2276/computer-networks
4. https://www.youtube.com/watch?v=g8iY36onLeM&list=PLWPirh4EWFpHJrW1D9UB24wsbM3zx7QMx

OUTCOMES:

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

1. Understand the basic layers and its functions in computer networks. (K2)
2. Demonstrate the performance of a network. (K2)
3. Explain the basics of how data lows from one node to another. (K2)
4. Understand IEEE standards, analyze and design routing algorithms. (K2)
5. Describe the working of various transport and application layer protocols. (K2)
6. Apply the protocols for various functions in the network. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	3	2	2	-	2	1	-	1	3	2
CO2	3	3	2	-	-	-	1	-	-	-	-	-	2	1
CO3	3	3	3	-	1	-	1	-	-	1	-	1	3	1
CO4	3	3	3	-	-	-	1	-		1	-	-	2	2
CO5	3	3	3	-	1	-	2	-	-	1	-	1	3	2
CO6	3	3	3	-	1	-	1	-	-	1	-	-	3	2

SEMESTER - IV

20AIPL401 SDG NO. 4	DAA AND AI LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To learn Design and Analysis Algorithm
- To learn Prolog Program.
- To Implement in prolog and its working environment
- To Implement N-Queen problem and puzzle problem using Prolog
- To Analyze the problem using BFS and DFS algorithm

LIST OF EXPERIMENTS:

1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
2. Using Open MPI, implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
3. Implement Binary tree traversal techniques using recursion and without recursion. Identify the best method, Justify your answer.
4. Print all the nodes reachable from a given starting node in a digraph using BFS method. Check whether a given graph is connected or not using DFS method.

5. Write and implement an algorithm determining articulation points and the biconnected components in the given graph.
6. Implement an algorithm to find the minimum cost spanning tree using i) Prim's algorithm ii) Kruskal's Algorithm.
7. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm. Study of Prolog
8. Write simple fact for the statements using prolog
9. Write predicates one convert's centigrade temperature to Fahrenheit, other checks if a temperature is below freezing.
10. Write a program to solve 4-Queen problem.
11. Write a program to solve 8-puzzle problem.
12. Write a program to solve any problem using Breadth First Search.
13. Write a program to solve any problem Depth First Search
14. Write a program to solve Travelling salesman Problem

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Implement Design and Analysis Algorithm. (K3)
2. Implement in prolog and its working environment. (K3)
3. Implement N-Queen problem and puzzle problem using Prolog.(K5)
4. Analyze the problem using BFS and DFS algorithm. (K3)
5. Implement water jug and missionaries and cannibal problem using prolog. (K4)
6. Implement water jug and missionaries and cannibal problem using prolog. (K5)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	3	2	2	-	2	1	-	1	3	2
CO2	3	3	2	-	-	-	1	-	-	-	-	-	2	1
CO3	3	3	3	-	1	-	1	-	-	1	-	1	3	1
CO4	3	3	3	-	-	-	1	-		1	-	-	2	2
CO5	3	3	3	-	1	-	2	-	-	1	-	1	3	2
CO6	3	3	3	-	1	-	1	-	-	1	-	-	3	2

SEMESTER - IV

20AIPL501 SDG NO. 4 & 9	DEEP LEARNING LABORATORY	L	T	P	C
		0	0	3	3

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 the practical knowledge in handling and analyzing real world applications

List of Experiments :

1. Basic image processing operations : Histogram equalization, thresholding, edge detection, data augmentation, morphological operations
2. Build a neural network
3. Build a deep learning model to classify a cat and dog using CNN
4. Build a deep learning model to classify a cat and dog using RNN
5. Build a deep learning model to predict stock prices using RNN
6. Train a Deep learning model to classify a given image using pre trained model
7. Object detection using Convolution Neural Network
8. Recommendation system from sales data using Deep Learning
9. Perform Sentiment Analysis in network graph using RNN
10. Image generation using GAN
11. Image Captioning with LSTMs
12. Build a deep learning model to classify digits in MNIST dataset
13. Build a deep learning model to generate smiles in SMILES dataset

OUTCOMES:

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

1. Understand the role of neural networks. (K2)
2. Analyze and Evaluate, in the context of a case study, the advantages and disadvantages of deep learning neural network architectures and other approaches. (K3)
3. Understand the role of deep learning in machine learning applications and get familiar with the use of TensorFlow/Keras in deep learning applications. (K2)

4. Apply various optimization techniques. (K2)
5. Apply various concepts related with Deep Learning to solve Problems. (K3)
6. Analyze different deep learning models in Image related projects. (K4)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	2	-	-	-	-	-	-	1	1	2
CO2	2	2	2	2	2	-	-	-	-	-	-	2	3	2
CO3	2	2	3	3	2	-	-	-	-	-	-	2	2	1
CO4	3	3	2	2	3	-	-	-	-	-	2	3	3	2
CO5	2	3	2	2	3	-	-	-	-	-	2	3	2	2
CO6	3	3	3	3	3	-	-	-	-	-	2	3	3	3

SEMESTER - IV

20AMTE401 SDG NO. 4, 11, 15	LIVE-IN-LAB-II	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide opportunities for the students, expose to Industrial environment and real time work
- To offer students a glimpse into real world problems and challenges that need IT based solutions
- To improve the team building, communication and management skills of the students
- To introduce students to the vast array of literature available of the various research challenges in the field of CSE

COURSE METHODOLOGY:

1. This initiative is designed to inculcate ethical principles of research and to get involve in life-long learning process for the students.
2. The course must involve engineering design with realistic constraints. It must also include appropriate elements of the following: Engineering standards, design analysis, modeling, simulation, experimentation, prototyping, fabrication, correlation of data, and software development.

3. Project can be individual work or a group project, with maximum of 3 students. In case of group project, the individual project report of each student should specify the individual's contribution to the group project.
4. On completion of the project, the student shall submit a detailed project report. 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 (Immediately after first internal examination) : 20 marks.
2. Second evaluation (Immediately after second internal examination): 30marks
3. Final evaluation (Last week of the semester) : 50marks

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

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Conduct literature survey to identify the gap and an application oriented research problem in the specific domain(K4)
2. Design and validate the proposed system using simulation(K6)
3. Prototype the proposed system(K5)
4. Analyze the obtained results and prepare a technical report(K4)
5. Publish the work in journals and apply for the patents. (K3)
6. Prepare for industrial environment and real time work(K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	3	2	2	3	3	3
CO2	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO3	2	2	3	1	2	1	1	1	3	2	3	3	3	2
CO4	3	3	2	1	2	1	1	1	3	2	3	3	3	2
CO5	2	3	2	1	2	1	1	1	3	2	3	3	3	2
CO6	2	2	2	2	3	2	2	2	2	2	3	3	3	3

SEMESTER - IV

20AMTP401 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

OBJECTIVES:

- Improve their quantitative ability.
- Improve their reasoning ability.
- Enhance their verbal ability through vocabulary building and grammar
- Equip with creative thinking and problem solving skills

UNIT I QUANTITATIVE ABILITY – III **6**

Compound Interest - Profit and Loss- Partnership - Percentage- Set Theory

UNIT II QUANTITATIVE ABILITY – IV **6**

True Discount-Ratio and Proportion - Simplification - Problems On H.C.F and L.C.M

UNIT III REASONING ABILITY – II **6**

Course of Action - Cause and Effect - Statement and Conclusion - Statement and Argument - Data Sufficiency (DS) - Statement and Assumption - Making Assumptions

UNIT IV VERBALABILITY – II **6**

Change of Voice - Change of Speech - Letter and Symbol Series - Essential Part Verbal Reasoning - Analyzing Arguments

UNIT V CREATIVITY ABILITY – II **6**

Seating Arrangement - Direction Sense Test - Character Puzzles - Missing Letters Puzzles - Mirror &Water Images.

TOTAL: 30 PERIODS

ADVANCED C PROGRAMMING - PHASE 2

COURSE OBJECTIVE:

- To improve C programming skills with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To understand procedural programming methods using Dynamic memory Allocation.

UNIT I INTRODUCTION TO RECURSION **6**

Introduction to Recursion, Types of Recursion - Head Recursion , Tail Recursion, Tree Recursion, Indirect Recursion and Nested Recursion . Recursion vs Looping - Analysis on efficiency of looping and recursion, Working of recursive code in main memory. Recurrence Relation , Different types of recurrence relation. Deriving time complexity and space complexity using recurrence relation.

UNIT II GROWTH FUNCTIONS AND RECURSION **6**

Polynomial Equations, Compare growth functions - order growth functions, omega growth functions, theta growth functions - Constant time, Linear time, Logarithmic time, Quadratic time and exponential time. Problems on Recursions - Factorial Number, Sum of first N Natural Numbers, Nth Fibonacci Number, Exponent Function, Taylor Series, Tower of Hanoi.

UNIT III STORAGE CLASSES, THE PREPROCESSOR AND DYNAMIC MEMORY ALLOCATION **6**

Storage Classes and Visibility, Automatic or local variables, Global variables, Static variables, External variables, File Inclusion, Macro Definition and Substitution, Macros with Arguments, Nesting of Macros, Conditional Compilation, Dynamic Memory Allocation, Allocating Memory with malloc, Allocating Memory with calloc, Freeing Memory, Reallocating Memory Blocks, Pointer Safety, The Concept of linked list, Inserting a node by using Recursive Programs, Sorting and Reversing a Linked List, Deleting the Specified Node in a Singly Linked List.

UNIT IV ORACLE BASICS **6**

Java Fundamental-Java Programming- Artificial Intelligence and Machine Learning in Java.

UNIT V KAGGLE **6**

Introduction to Kaggle- Projects on Kaggle Data Set

TEXT BOOKS:

1. Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.
2. Herbert Schildt, "Java The complete reference", 8th Edition, McGraw Hill Education, 2011. 5. Cay S. Horstmann, Gary cornell, "Core Java Volume –I Fundamentals", 9th Edition, Prentice Hall, 2013.

REFERENCES:

1. R. G. Dromey, "How to Solve It By Computer", Pearson, 1982 2. A.R. Bradley, "Programming for Engineers", Springer, 2011
2. Kernighan and Ritchie, "The C Programming Language", (2nd ed.) Prentice Hall, 1988.
3. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015. 5. Steven Holzner, "Java 2 Black book", Dreamtech press, 2011.

OUTCOMES :

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

1. Analyze their quantitative ability. (K4)
2. Understand the ability of arithmetic reasoning along with creative thinking and problem solving skills. (K2)
3. Create their verbal ability through vocabulary building and grammar. (K6)
4. Evaluate code organization and functional hierarchical decomposition with complex data types.
5. Understand C programming skills to apply advanced structured and procedural programming. (K2)
6. Apply Various File and Bit Manipulation algorithms in Problem Solving. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO2	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO3	-	-	-	-	3	2	-	-	1	3	-	2	-	-
CO4	-	-	-	-	3	2	-	3	3	3	-	2	2	2
CO5	-	-	-	-	3	2	-	-	2	3	-	2	2	2
CO6	-	-	-	-	3	2	-	-	2	3	-	2	2	2

SEMESTER - IV

20MGMC401 SDG NO. 4	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

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 l To Know about Constitutional remedies

UNIT I INTRODUCTION **6**

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties

UNIT II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT **6**

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India.

UNIT III STRUCTURE AND FUNCTION OF STATE GOVERNMENT **6**

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

UNIT IV CONSTITUTION FUNCTIONS **6**

Indian Federal System – Centre – State Relations – President's Rule – Constitutional Amendments – Constitutional Functionaries.

UNIT V CONSTITUTIONAL REMEDIES **6**

Enforcement of fundamental rights - Power of parliament to modify the rights the conferred by this part in their application to forces.

TOTAL: 30 PERIODS

TEXTBOOKS:

1. Durga Das Basu, "Introduction to the Constitution of India ", Prentice Hall of India, New Delhi.

2. R.C. Agarwal, (1997) "Indian Political System", S. Chand and Company, New Delhi.
3. M.V. Pyle (2019) , "An Introduction to The Constitution of India, 5/e", Vikas Publishing, New Delhi.
4. P.M. Bakshi, (2018) , "Constitution of India", Universal Law Publishing, New Delhi.
5. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 11th Reprint, 2010.

REFERENCES:

1. Sharma, Brij Kishore, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi.
2. U.R.Gahai, "Indian Political System", New Academic Publishing House, Jalandhar.

OUTCOMES:

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

1. Explain the Constitution and Fundamental rights of citizens (K2)
2. Discuss the structure, hierarchy and functions of Central Government (K2)
3. Explain the functions of Supreme Court and Judiciary Systems in the state (K2)
4. Discuss the structure, hierarchy and functions of State Government (K2)
5. Recall the Centre-State relationship, constitutional amendments and functionaries (K1)
6. Discuss the remedies and rights available to India Citizens (K2)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	1	-	-	-	-	-
CO2	-	-	-	-	-	1	1	-	-	-	-	-
CO3	-	-	-	-	-	1	1	-	-	-	-	-
CO4	-	-	-	-	-	1	1	-	-	-	-	-
CO5	-	-	-	-	-	2	1	3	-	-	-	-
CO6	-	-	-	--	-	2	1	2	3	-	-	-

SEMESTER - V

20AMPW501 SDG NO. 4 & 9	DATA VISUALIZATION TECHNIQUES WITH LAB	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To provide students with an understanding of the basics of data and visualization, including the visualization process and the types and structures of data.
- To introduce students to various visualization techniques for spatial, geospatial, and multivariate data, and to give them practical experience creating visualizations.
- To explore interaction concepts and techniques for visualizations, including text and document visualization and animation.
- To expose students to current research directions in visualization and to encourage critical thinking about the design and evaluation of visualizations.

UNIT I INTRODUCTION AND DATA FOUNDATION 9

Basics - Relationship between Visualization and Other Fields -The Visualization Process - Pseudo code Conventions - The Scatter plot. Data Foundation - Types of Data - Structure within and between Records - Data Pre-processing - Data Sets

UNIT II FOUNDATIONS FOR VISUALIZATION 9

Visualization stages - Semiology of Graphical Symbols - The Eight Visual Variables - Historical Perspective - Taxonomies - Experimental Semiotics based on Perception Gibson‘s Affordance theory – A Model of Perceptual Processing.

UNIT III VISUALIZATION TECHNIQUES 9

Spatial Data: One-Dimensional Data - Two-Dimensional Data – Three-Dimensional Data - Dynamic Data - Combining Techniques. Geospatial Data: Visualizing Spatial Data - Visualization of Point Data -Visualization of Line Data - Visualization of Area Data

UNIT IV ADVANCED VISUALIZATION TECHNIQUES 9

Issues in Geospatial Data Visualization Multivariate Data: Point-Based Techniques - LineBased Techniques - Region-Based Techniques - Combinations of Techniques – Trees Displaying Hierarchical Structures – Graphics and Networks- Displaying Arbitrary Graphs/Networks.

UNIT V RESEARCH DIRECTIONS IN VIRTUALIZATIONS 9

Steps in designing Visualizations – Problems in designing effective Visualizations- Issues of Data. Issues of Cognition, Perception, and Reasoning. Issues of System Design Evaluation, Hardware and Applications.

List of Experiments:

1. A/B Testing: Compare two different visualization formats to see which is more effective in conveying a message.
2. Heat Mapping: Create a heat map to show the distribution of data values over a geographic area.
3. Interactive Visualization: Create an interactive visualization that allows users to explore data on their own.
4. Comparative Visualization: Compare data from multiple sources or over time periods to identify trends and patterns.
5. Multivariate Analysis: Analyze multiple variables to determine correlations and interdependencies.
6. Geographic Visualization: Show how data is distributed across different regions or countries.
7. Social Media Analytics: Analyze social media data to identify trends and insights.
8. Machine Learning Visualization: Visualize machine learning algorithms to better understand how they work.
9. Data Mining: Use data mining techniques to uncover patterns and insights in large data sets.
10. Natural Language Processing: Use natural language processing to analyze text data and visualize the results.

TOTAL: 60 PERIODS

REFERENCES:

1. Matthew Ward, Georges Grinstein and Daniel Keim, "Interactive Data Visualization Foundations, Techniques, Applications", 2010.
2. Colin Ware, "Information Visualization Perception for Design", 2nd edition, Margon Kaufmann Publishers, 2004.
3. Robert Spence "Information visualization – Design for interaction", Pearson Education, 2 nd Edition, 2007.
4. Alexandru C. Telea, "Data Visualization: Principles and Practice," A. K. Peters Ltd, 2008.

OUTCOMES:

1. Understand different types and structures of data and pre-processing steps to prepare data for visualization.

2. Apply various visualization techniques for spatial, geospatial, and multivariate data.
3. Utilize interaction concepts and techniques to create engaging and informative visualizations.
4. Evaluate and critique research in visualization.
5. Design and evaluate visualizations using best practices and current trends in the field.
6. Apply the knowledge and skills gained from the course in various disciplines such as data science, computer science, and design.

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	2	1	3	1	2	1	2	3	3
CO2	3	3	3	3	3	3	3	2	3	2	3	3	3	3
CO3	2	2	3	2	2	2	2	2	2	2	3	3	3	2
CO4	2	3	2	2	2	3	3	3	3	2	3	3	3	2
CO5	2	3	2	2	3	2	3	3	3	2	3	3	3	2
CO6	2	2	2	3	3	2	2	2	2	2	3	3	3	3

SEMESTER - V

20AMPC501 SDG NO. 4 & 9	COMPUTER VISION AND IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of computer vision, including image processing, feature extraction, object recognition,
- To know the various deep learning techniques used for computer vision.
- To learn the use of popular computer vision libraries and frameworks such as OpenCV and Pillow
- To implement the real-world applications based projects by applying computer vision techniques.

UNIT I Introduction to computer vision and image processing 9

Overview of computer vision and its applications, Image processing techniques, Image representation and manipulation, Popular computer vision and image processing libraries: OpenCV and Pillow.

UNIT II Feature Extraction and Matching 9

Feature detection and description, Keypoint matching and correspondence, Applications of feature extraction and matching.

UNIT III Image segmentation and clustering 9

What is Segmentation, Semantic Segmentation, Instance Segmentation, Segmentation Algorithms, Clustering for image analysis and classification, Applications of image segmentation and clustering.

UNIT IV Object recognition and detection 9

What is Object Detection, Object recognition algorithms, Object detection using sliding windows and region-based methods, Convolutional neural networks for object detection, Tools for object detection: Roboflow, and Landing AI

UNIT V Advanced topics in computer vision 9

Tracking and motion analysis, 3D computer vision, and Applications of computer vision in robotics and autonomous vehicles.

TOTAL: 45 PERIODS

TEXT BOOK:

1. "Computer Vision: Algorithms and Applications" by Richard Szeliski

OUTCOMES:

1. Understand the fundamentals of computer vision and how it is used in practical applications.
2. Apply various computer vision techniques for image processing, feature extraction, and object recognition.
3. Learn the applications of image segmentation and clustering techniques
4. Design and implement computer vision models using deep learning techniques.
5. Use popular computer vision libraries and frameworks such as OpenCV and TensorFlow.
6. Apply computer vision techniques to real-world problems such as robotics and autonomous vehicles

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	3	2	2	2	3	2	2	3	3	3
CO2	3	3	3	2	2	3	2	2	3	3	3	3	3	3
CO3	3	2	3	3	3	1	1	1	3	2	3	3	2	2
CO4	3	3	2	3	2	1	1	1	3	2	3	3	3	3
CO5	2	3	2	3	2	1	1	1	3	2	3	3	3	3
CO6	2	3	2	3	3	2	2	2	2	2	3	3	3	3

SEMESTER - V

20AIPC503 SDG NO. 9 & 11	NATURAL LANGUAGE PROCESSING AND CHATBOT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamentals of natural language processing
- To understand the use of words and representations in NLP
- To describe the role of semantics of sentences and pragmatics
- To apply the NLP techniques to machine translation
- To acquire knowledge on chatbots and its terminologies

UNIT I INTRODUCTION TO NLP **9**

Overview and advantages of NLP - NLP Libraries - Language Modeling: Unigram Language Model - Bigram – Trigram - N-gram - Advanced smoothing for language modeling - Empirical Comparison of Smoothing Techniques - Applications of Language Modeling.

UNIT II ANALYSIS OF WORD FORMS **9**

Bag of words - Word Classes - skip-gram - Continuous Bag-of-Words, Embedding representations for words Lexical Semantics - Word Sense Disambiguation - Knowledge Based and Supervised Word Sense Dis - ambiguation.

UNIT III SEMANTIC ANALYSIS **9**

Context free Grammars for English - Parsing with Context free Grammar - Features and uniication - Lexicalized and Probabilistic Parsing -Language and Complexity - Semantics: Representing meaning – Semantic analysis - Lexical semantics - Word sense disambiguation and Information retrieval.

UNIT IV MACHINE TRANSLATION 9

Need of MT - Problems of Machine Translation - MT Approaches - Direct Machine Translations - Rule-Based Machine Translation - Knowledge Based MT System - Statistical Machine Translation (SMT) - Parameter learning in SMT (IBM models) using EM) - Encoder-decoder architecture - Neural Machine Translation.

UNIT V OVERVIEW OF CHATBOT 9

Fundamentals of Conversational Systems – NLU - DM – NLG. Chatbot framework & Architecture - Conversational Flow & Design - Introduction to popular chatbot frameworks – Google Dialog low, Microsoft Bot Framework, Amazon Lex, RASA Channels: Facebook Messenger, Google Home, Alexa, WhatsApp, Custom Apps.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Speech and Language Processing: AnIntroduction to Natural Language Processing, Computational Linguistics and Speech Recognition Jurafsky, David, and James H. Martin, PEARSON
2. Foundations of Statistical Natural Language Processing, Manning, Christopher D., and Hinrich Schutze, Cambridge, MA: MIT Press
3. Natural Language Understanding, James Allen. The Benjamin/ Cummings Publishing Company Inc.
4. Natural Language Processing with Python – Analysing Text with the Natural Language Toolkit Steven Bird, Ewan Klein, and Edward Loper.

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-languageprocessing-with-deep-learning
2. https://freevideolectures.com/course/4050/nptel-applied-naturallanguage-processing
3. https://freevideolectures.com/course/2272/artiicial-intelligence/39

OUTCOMES:

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

1. Explain the concept of NLP Libraries and language modeling. (K2)
2. To design an innovative application using NLP components. (K6)
3. Exemplify the analysis of word forms. (K2)
4. Explain the semantics for language processing. (K2)
5. Summarize the approaches for machine translation and applications of NLP. (K2)
6. Interpret Chatbot framework & Architecture - Conversational Flow & Design. (K2)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	1	2	2	-	-	1	-	2	2	1	2
CO2	3	3	-	1	2	3	-	-	1	-	2	2	1	2
CO3	3	2	-	1	2	1	-	-	1	-	2	2	-	3
CO4	3	2	-	1	2	1	-	-	1	-	2	2	1	-
CO5	3	3	-	1	2	1	-	-	1	-	2	2	-	2
CO6	3	2	-	1	2	2	-	-	1	-	2	2	2	2

SEMESTER - V

20AMPC502 SDG NO. 4 & 9	IOT AND EDGE COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic concepts of IoT and Edge computing
- To get knowledge about the various services provided by IoT.
- To familiarize themselves with various communication protocols and networking.
- To know the implementation of IoT with different tools.
- To understand the various applications in IoT using DHT sensor, Pi camera.

UNIT I INTRODUCTION TO IOT AND EDGE COMPUTING 9

IoT and Edge Computing Definition and Use Cases, Introduction to Edge Computing Scenarios - Edge computing purpose and definition, Edge

computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M.

UNIT II ARCHITECTURES OF IOT SYSTEMS 9

IoT Architecture and Core IoT Modules-A connected ecosystem, IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with the examples-Example use case and deployment, Case study – Telemedicine palliative care, Requirements, Implementation, Use case retrospective.

UNIT III INTERFACING MICROCOMPUTERS 9

RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout and Pinouts, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi, Connecting Raspberry Pi via SSH, Remote access tools, Interfacing DHT Sensor with Pi, Pi as Webserver, Pi Camera, Image & Video Processing using Pi.

UNIT IV TELECOMMUNICATION AND CLOUD COMPUTING 9

Telecommunication Protocols: LoRa, LoRaWAN, XBEE, ZIGBEE, Edge to Cloud Protocols, MQTT, MQTT publish-subscribe, MQTT architecture details, ThingSpeak, Adafruit, IFTTT Platform. GCP and Firebase.

UNIT V APPLICATIONS AND ADVANCEMENTS 9

Edge computing with Nvidia Boards and Raspberry Pi, Industrial and Commercial IoT and Edge Computing solutions, IoT and Edge Security, Physical and hardware security, Shell security, Cryptography, Software-Defined Perimeter, Blockchains and cryptocurrencies in IoT, Government regulations and intervention, Digital twin of devices-applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. IoT and Edge Computing for Architects - Second Edition, by Perry Lea, Publisher: Packt Publishing, 2020, ISBN: 9781839214806
2. Edge Computing and Computational Intelligence Paradigms for the IoT, Editors: G. Nagarajan, R. I. Minu, 2019, Publisher IGI Global.

REFERENCES:

1. Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama, wiley publication, 2019, ISBN: 9781119524984.

2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand and David Boyle, "From Machine-to-Machine to the Internet of Things Introduction to a New Age of Intelligence", Academic Press, 2014

OUTCOMES:

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

1. Learn the main concepts, key technologies, strength and limitations of Edge computing techniques.
2. Understand the IoT architecture, and its comparison with M2M and SCADA infrastructure models of IoT.
3. Explore the case studies related to telemedicine palliative care
4. Analyze the networking and how the sensors are communicated in IoT
5. Analyze and design different communication protocols and cloud protocols for IoT implementation.
6. Understand the different network security processes involved in Cryptography, Block chain etc.,.

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	3	2	2	3	3	3
CO2	3	2	3	2	3	3	2	2	3	3	3	3	3	3
CO3	2	2	3	1	2	1	1	1	3	2	3	3	3	2
CO4	3	2	2	1	2	1	1	1	3	2	3	3	3	2
CO5	3	2	2	1	2	1	1	1	3	2	3	3	3	2
CO6	3	2	2	2	3	2	2	2	2	2	3	3	3	3

SEMESTER - V

20AMPL501 SDG NO. 4 & 9	COMPUTER VISION & IMAGE PROCESSING LAB	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To provide hands-on experience in computer vision techniques for analyzing images and videos. Students will learn the basics of image processing and analysis, feature extraction, object detection, and tracking. They will gain practical experience in implementing these techniques using popular computer vision libraries and tools

LIST OF EXPERIMENTS:

1. Image Processing Techniques: Implementing basic image processing techniques such as image filtering, edge detection, and thresholding using OpenCV.
2. Feature Extraction: Implementing feature extraction techniques such as Harris corner detector, SIFT, and SURF using OpenCV
3. Object Detection: Implementing object detection techniques such as Haar cascades and YOLO using OpenCV, TensorFlow/Pytorch.
4. Object Tracking: Implementing object tracking techniques such as KCF and MOSSE using OpenCV.
5. Segmentation: Implementing image segmentation using semantic and instance segmentation.
6. Facial Recognition: Implementing facial recognition using Eigenfaces, Fisherfaces, or LBPH using OpenCV.
7. Optical Flow: Implementing optical flow algorithms such as Lucas-Kanade and Horn-Schunck using OpenCV.
8. Stereo Vision: Implementing stereo vision algorithms such as SGBM and BM using OpenCV.
9. Tools for Computer Vision: Implementing end-to-end computer vision projects using Roboflow and Landing AI

OUTCOMES:

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

1. Understand the image processing concepts using OpenCV (K1)
2. Implement object detection using various platforms (K3)
3. Illustrate the segmentation methods (K2)
4. Develop applications using face recognition (K3)
5. Implement stereo vision algorithm using OpenCV (K3)
6. Implement computer vision real time projects (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	2	-	-	2	-	-	-	1	3	2
CO2	3	2	2	2	2	-	-	2	-	-	-	3	3	2
CO3	2	2	3	1	3	-	-	-	-	-	-	3	3	1
CO4	3	3	3	1	3	-	-	-	2	-	2	3	3	2
CO5	3	3	3	1	3	2	2	-	2	-	2	2	3	2
CO6	3	3	3	2	3	2	2	-	2	2	2	3	3	3

SEMESTER - V

20AIPL502 SDG NO. 4 & 9	NLP & CHATBOT LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To implement NLP concepts
- To implement text classification and summarization
- To understand Sentiment Analysis
- To learn spam detection model

LIST OF EXPERIMENTS:

1. Implementation of resume screening with python
2. Development of Sentiment Analysis with python
3. Develop Keyword extraction with python
4. Development of NLP for other languages
5. Implement NLP for whatsapp chat
6. Chatbot Implementation
7. Implement of next word prediction model

LIST OF EQUIPMENT: Standalone desktops with Python

OUTCOMES:

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

1. Implement NLP concepts using python (K2)
2. Create NLP applications for other languages (K2)
3. Illustrate detection models (K3)
4. Develop applications using sentiment analysis (K3)
5. Implement whatsapp chat analysis (K3)
6. Implement predition model (K2)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	2	-	-	2	-	-	-	1	3	2
CO2	3	2	2	2	2	-	-	2	-	-	-	3	3	2
CO3	2	2	3	1	3	-	-	-	-	-	-	3	3	1
CO4	3	3	3	1	3	-	-	-	2	-	2	3	3	2
CO5	3	3	3	1	3	2	2	-	2	-	2	2	3	2
CO6	3	3	3	2	3	2	2	-	2	2	2	3	3	3

SEMESTER - V

20AIPL503 SDG NO. 4 & 9	IOT LABORATORY	L	T	P	C
		0	0	3	1.5

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 the practical knowledge in handling and analyzing real world applications

LAB REQUIREMENTS:

1. Introduction to Raspberry-Pi 3 and Arduino
2. Write an arduino program to demonstrate user defined functions
3. To interface LED/buzzer with arduino/raspberry pi and write a program to turn on LED for 1 sec after every 2 seconds
4. Interfacing Raspberry-pi with the smart phone for enabling home automation.
5. Home security System using Raspberry-pi and PIR Sensor.
6. Remote Data Logging with Raspberry-pi using socket programming.
7. Design of a temperature dependent auto-cooling system using Raspberry-pi.
8. LED Control and Pi-Camera interfacing with Raspberry-pi.
9. Introduction to Arduino microcontroller and its programming.
10. Interfacing of the sensors and actuators with Arduino.
11. Real Time Projects Based on IoT

EQUIPMENTS:

HARDWARE:

1. Arduino basic kit or Raspberry Pi starter kit

SOFTWARE:

1. Raspbian OS
2. Arduino IDE
3. Cloud Apps:AWS

OUTCOMES:

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

1. Understand the concept of Internet of Things (K2)
2. Implement interfacing of various sensors with Arduino/Raspberry Pi (K4)
3. Demonstrate the ability to transmit data wirelessly between different devices (K4)
4. Show an ability to upload/download sensor data on cloud and serve (K2)
5. Apply various concepts related with Deep Learning to solve Problems. (K4)
6. Examine various SQL queries from MySQL database. (K2)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	-	-	-	3	3	2
CO2	3	3	3	3	3	2	-	-	3	3	1	3	3	2
CO3	3	3	3	3	3	2	-	-	3	3	1	3	3	2
CO4	3	3	3	3	3	2	-	-	3	3	1	3	3	2
CO5	3	3	3	3	3	2	-	-	3	3	1	3	3	2
CO6	3	3	3	3	3	2	-	-	3	3	1	3	3	2

SEMESTER - V

20AMTE501 SDG NO. 4, 11 & 15	LIVE-IN-LAB–III	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide opportunities for the students, expose to Industrial environment and real time work
- To give access to NASSCOM research and intelligence that tracks industry trends, growth opportunities and best practices, access to a repository of industry presentations, blogs, discussions and articles
- To impart detailed knowledge in the field of Artificial Intelligence and data science and other related technology
- To automate repetitive and redundant tasks and eliminates the human intervention using UiPath a Robotic Process Automation tool
- To enable hands-on experience in the AI BASED domain

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.
2. To engage students in AI&ML beyond their robust academic curriculum that sparks curiosity and imagination while teaching critical knowledge and skills.
3. The project work must involve engineering design with realistic constraints. It must also include appropriate elements of the following: Engineering standards, design analysis, modeling, simulation, experimentation, prototyping, fabrication, correlation of data, and software development.
4. This practice will engage beyond the curriculum using industry- relevant technologies that help students get ready for the next step in their education or careers. It helps the learners expand knowledge; develop skills, and their innovativeness.
5. The initiative is designed to provide students with foundational knowledge and skills in areas of AI&ML that are universally in high demand across computing jobs
6. Project can be individual work or a group project, with a maximum of 3 students. In case of group project, the individual project report of each student should specify the individual's contribution to the group project
7. On completion of the project, the student shall submit a detailed project report. 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 (Immediately after first internal examination) : 20 marks
2. Second evaluation (Immediately after second internal examination): 30 marks
3. Final evaluation Last week of the semester) : 50 marks

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

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Conduct literature survey to identify the gap and an application oriented research problem in the specific domain (K1)
2. Identify the problem based on the conducted literature survey
3. Facilitate change through thought leadership, research, market intelligence and membership engagement. (K2)
4. Prototype the proposed system (K3)
5. Plan and execute the technology on an enterprise-wide basis, integrate operations, applications and data, build internal capabilities to adapt and scale, and more importantly, create business value and competitive advantages. (K3)
6. Enhance trade in software and services, encourage and promote the advancement of research through publications in journals and apply for patents. (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	3	2	2	3	3	3
CO2	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO3	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO4	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO5	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO6	2	2	2	1	2	1	1	1	3	2	3	3	3	2

SEMESTER - V

20AMTP501 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

ANALYTICAL & CRITICAL THINKING SKILLS – PHASE 1

OBJECTIVES:

- Enhance their quantitative ability.
- Enhance their reasoning ability
- Enhance their verbal ability.
- Equip with creative thinking and problem solving skills

UNIT I QUANTITATIVE ABILITY – V **10**

Square Root And Cube Root,Logarithm,Volume and Surface Area, Permutation and Combination

UNIT II QUANTITATIVE ABILITY – V **10**

Probability, Averages, Area, Odd Man Out, Crypt Arithmetic, Flowcharts

UNIT III REASONING ABILITY – III **8**

Data Interpretation Table Charts, Data Interpretation Bar Charts, Blood Relationship, Puzzles

UNIT IV VERBAL ABILITY – III **10**

Spellings, Selecting Words, Spotting Errors, Ordering of Words, Logical Sequence of Words

UNIT V CREATIVITY ABILITY – III **7**

Logical Puzzles, Playing Cards Puzzles, Clock Puzzles, Number Puzzles, Sudoku

TOTAL : 45 PERIODS

REFERENCES:

1. Quantitative Aptitude for Competitive Exams by R. S. Agarwal
2. Quantum CAT by Sarvesh Verma
3. A Modern Approach to Logical Reasoning by R. S. Agarwal
4. Verbal Ability and Reading Comprehension by Arun Sharma

DOMAIN SPECIFIC TRAINING -WEB TECHNOLOGIES - PHASE 2

OBJECTIVES:

- Understand different Internet Technologies
- Be exposed to Java specific Web services architecture
- Create Dynamic Web Pages using different Scripting
- Build tools that assist in automating data transfer over the Internet.

UNIT I WEBSITES BASICS, HTML 5, CSS 3, WEB 2.0 7

Web 2.0:Basics-RIA Rich Internet Applications – Collaborations tools – Understanding websites and web servers: Understanding Internet – Difference between websites and web server- Internet technologies Overview –Understanding the difference between internet and intranet; HTML and CSS: HTML 5.0 , XHTML, CSS 3-HTML5 – Tables – Lists – Image – HTML5 control elements –Semantic elements – Drag and Drop – Audio – Video controls – CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images –Colors – Shadows – Text – Transformations – Transitions – Animations.

UNIT II CLIENT SIDE AND SERVER SIDE PROGRAMMING 6

Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects,-Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript. Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server;- DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example

TOTAL: 13 PERIODS

OUTCOMES:

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

1. Construct a basic website using HTML and Cascading Style Sheets.(K2)
2. Build dynamic web pages with validation using JavaScript objects and by applying different event handling mechanisms. (K3)
3. Develop server side programs using Servlets and JSP.(K2)
4. Understand the cookies concepts using Java Servlet architecture (K1)
5. Concatenate the images and videos using inheritance concept (K2)
6. Implement the database connectivity with real time examples (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	3	-	-	-	-	-	3	3	3	3	3
CO2	1	-	2	3	-	-	-	-	-	3	3	2	3	3
CO3	1	-	2	3	-	-	-	-	1	3	3	2	3	3
CO4	1	-	1	2	2	-	-	-	-	3	3	2	2	3
CO5	1	-	-	3	-	2	-	-	-	3	3	2	2	3
CO6	2	-	1	3	2	1	-	-	-	3	3	3	3	3

SEMESTER - VI

20AIPC601 SDG NO. 4 & 9	ROBOTICS PROCESS AUTOMATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic concepts of robots
- To learn about different automation system components
- To analyze diverse sensors and actuators with real time case studies
- To execute various kinematics of robot
- To implement future robotic applications

UNIT I BASIC CONCEPTS 10

Significant Perspective of Robots - Components of a Robot System -Types of Robots - Robot Performance - Automation principles and strategies - Scope of automation - Development of Robot Applications - Mathematical modeling of the robot. INTRODUCTION TO ROBOTIC PROCESS AUTOMATION: Scope and techniques of automation, Robotic process automation - What can RPA do?, Benefits of RPA, Components of RPA, RPA platforms, The future of automation.

RPA BASICS: History of Automation - What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Workloads which can be automated – RPA Advanced Concepts - Standardization of processes - RPA Development methodologies - Difference from SDLC - Robotic control low architecture - RPA business case - RPA Team - Process Design Document/Solution Design Document - Industries best suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem.

UNIT II RPA TOOL AND AUTOMATION SYSTEM COMPONENTS 10

INTRODUCTION AND BASICS: Introduction to RPA Tool - The User Interface - Variables - Managing Variables - Naming Best Practices - The Variables Panel - Generic Value Variables - Text Variables - True or False Variables – Number Variables - Array Variables - Date and Time Variables - Data Table Variables - Managing Arguments - Naming Best Practices - The Arguments Panel – Using Arguments - About Imported Namespaces - Importing New Namespaces- Control Flow - Control Flow Introduction - If Else Statements - Loops - Advanced Control Flow - Sequences - Flowcharts - About Control Flow - Control Flow Activities - The Assign Activity - The Delay Activity - The Do While Activity - The If Activity - The Switch Activity - The While Activity - The For Each Activity - The Break Activity - Data Manipulation - Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data Handling Equipment -

Automated Assembly Systems - Types of Automated Assembly Systems - Vision Systems - Process - Grippers and Tool Changers - Tooling and Assembly Automation Components - System Controls - Automated Storage/Retrieval Systems - Safety and Guarding

UNIT III ADVANCED AUTOMATION CONCEPTS & TECHNIQUES 10

Recording Introduction - Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix Automation - Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval - Advanced Citrix Automation challenges - Best Practices - Using tab for Images - Starting Apps - Excel Data Tables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel - Extracting Data from PDF - Extracting a single piece of data - Anchors - Using anchors in PDF

UNIT IV WORKING WITH ROBOTIC SENSORS AND ACTUATORS, KINEMATICS 9

Sensor Characteristics, Velocity, Acceleration Sensors - Force and Pressure Sensors - Torque Sensors – Ultrasonic Sensor - Visible Light and Infrared Sensors - Touch and Tactile Sensors - Proximity Sensors - Range Finders – other sensors Characteristics of Actuating Systems - Comparison of Actuating Systems - Case Study: Working with ultrasonic distance sensors –Working with the IR proximity. ROBOT KINEMATICS -Inverse Kinematics - Inverse orientation – Inverse locations – Singularities – Jacobian - Trajectory Planning: Joint interpolation - Task space interpolation - Executing user specified tasks.

UNIT V APPLICATIONS OF ROBOT 7

Industrial applications of robots – Medical – Household – Entertainment – Space – Underwater - Defense - Disaster management - Applications, Micro and Nanorobots, Robotics and Automation for Industry 4.0 – Future Applications.

TOTAL: 45 PERIODS

TEXTBOOK:

1. Alok Mani Tripathi, “Learning Robotic Process Automation”, Packt Publishing, 2018.
2. Mehta, B. R., Reddy, Y. Jaganmohan, “Industrial process automation systems: design and implementation”, Wiley, Elsevier, 2015.
3. Deb.S.R and Sankha Deb, "Robotics Technology and Flexible Automation", Tata McGraw Hill Publishing Company Limited, 2010.

4. Frank Casale , Rebecca Dilla, Heidi Jaynes , Lauren Livingston, "Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation,1st Edition 2015.

REFERENCES:

1. David Jefferis, "Artificial Intelligence: Robotics and Machine Evolution", Crabtree Publishing Company, 1992.
2. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
3. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant", Independently Published, 1st Edition 2018.
4. Srikanth Merianda,"Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation", Consulting Opportunity Holdings LLC, 1st Edition 2018.
5. Lim Mei Ying, "Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots and automate business processes", Packt Publishing, 1st Edition 2018.
6. B.K.Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers,Chennai, 1998.
7. S.Ghoshal, " Embedded Systems & Robotics" – Projects using the 8051 Microcontroller", Cengage Learning, 2009.

WEB REFERENCES:

1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.academy.uipath.comMike Wilson, "Implementation of Robot Systems: An introduction to robotics, automation, and successful systems integration in manufacturing", Butterworth- Heinemann, 1st edition, 2014.

WEB REFERENCES:

1. https://nptel.ac.in/courses/107106090

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/112105249

OUTCOMES:

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

1. Understand the basic concepts of Robotics, RPA and the ability to differentiate it from other types of automation (K2)
2. Summarize the Risks and Challenges towards the implementation of RPA and Relate different types of Automated Assembly Systems (K3)

3. Discover basic Knowledge about Robotic Sensors & Actuators (K2)
4. Interpret the principle behind robotic drive system, end effectors, sensor, machine vision robot kinematics and programming. (K3)
5. Implement robotics related projects for real time applications (K3)
6. Understand the applications & Future Scope of Robotics in various fields (K2)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	2	2	2	3	2	3	2	3	-	-	2
CO2	3	2	-	3	3	3	2	3	2	2	3	-	-	2
CO3	2	2	-	2	2	3	3	2	3	3	3	1	1	2
CO4	3	2	-	2	3	3	2	2	2	3	2	-	3	2
CO5	3	3	-	3	2	2	2	2	3	3	2	3	2	2
CO6	3	2	-	3	3	2	2	1	2	3	3	1	2	3

SEMESTER - VI

20AIPC403 SDG NO. 4	ADVANCED MACHINE LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce students to the advanced concepts and techniques of Machine Learning.
- To have a thorough understanding of the Graphical Model Representation
- To study the various Modelling
- To understand the importance of Uncertainty Estimation

UNIT I GRAPHICAL MODEL REPRESENTATION 9

Directed Graphical Model-Overview, representation of probability distribution and conditional independence statements. Undirected Graphical Model- potentials, conditional independence and graph separability, factorization- Constructing undirected models from distributions- Relationship between directed and undirected models- Common undirected

graphical models: Factor models, Ising and Potts model, Gibbs distribution, log-linear models, CRFs- Feature-based potentials for flexible deployment in many applications- applications in vision and text mining.

UNIT II INFERENCE IN GRAPHICAL MODELS 9

Overview- Variable elimination- Junction trees and sum product message passing. Graphical model parameters- Learning conditional graphical models (CRFs), conditional likelihood training- Learning with partially observed data

UNIT III HIGH DIMENSIONAL OBJECTS AND SAMPLING 9

Generative models for text- Variational Autoencoders- Generative Adversarial Networks- Forward sampling- Importance sampling- MCMC sampling

UNIT IV UNCERTAINITY ESTIMATION 9

Bayesian Neural Networks: Uncertainties in Parameters Estimated with Neural Networks- Meta-Learning- Counterfactual reasoning, Causality. Neural models for density estimation- Masked Autoregressive Flow for Density Estimation- MADE: Masked Autoencoder for Distribution Estimation- Masked Autoregressive Flow for Density Estimation- Density estimation using real NVP- Few-shot Autoregressive Density Estimation: Towards Learning to Learn Distributions- TensorFlow Distributions

UNIT V MODELLING 9

Gaussian Process- Time series forecasting: encoder-decoder approach as in Deep AR- Correlated time series- High-dimensional multivariate forecasting with low-rank Gaussian Copula Processes.

TOTAL: 45 PERIODS

TEXT BOOKS :

1. The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Trevor Hastie, Robert Tibshirani, and Jerome Friedman, Publisher-Springer (Unit-I, II, III)
2. Understanding Machine Learning, Shai Shalev-Shwartz and Shai Ben-David, Cambridge University Press (Unit-IV, V)

REFERENCES:

1. Machine Learning: A Probabilistic Perspective (Adaptive Computation and Machine Learning series) , Kevin P. Murphy, The MIT Press.
2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems , Aurélien Géron, O'Reilly Media.

WEB REFERENCES:

1. http://digimat.in/nptel/courses/video/106102220/L01.html

ONLINE RESOURCES:

1. http://digimat.in/nptel/courses/video/106106140/L01.html
2. http://digimat.in/nptel/courses/video/106106226/L01.html

OUTCOMES:

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

1. Distinguish between different graphical models. (K4)
2. Suggest apt inference for different graphical models. (K2)
3. Design high dimensional objects. (K5)
4. Design systems that use the appropriate graph models of machine learning. (K5)
5. Modify existing machine learning algorithms based on Uncertainty Estimation. (K3)
6. Apply concept of advanced machine learning for real time applications. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	1	1	1
CO2	3	3	2	2	-	-	-	-	-	-	-	1	1	1
CO3	3	3	2	2	-	-	-	-	-	-	-	1	1	1
CO4	3	3	2	2	-	-	-	-	-	-	-	1	1	1
CO5	3	3	2	2	-	-	-	-	-	-	-	1	1	1
CO6	3	3	2	2	-	-	-	-	-	-	-	1	1	1

SEMESTER - VI

20AIPW602 SDG NO. 9	BIG DATA ANALYTICS WITH LAB	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To learn big data and hadoop platform
- To provide an overview of No SQL databases
- To understand HDFS concepts and interfacing with HDFS
- To examine data processing operators and compare with traditional databases
- To gain knowledge on various visualization techniques

UNIT I INTRODUCTION TO BIG DATA AND HADOOP 9

Analytics – Descriptive Analytics – Diagnostic Analytics – Predictive Analytics – Prescriptive Analytics –Types of Digital Data - Introduction to Big Data - Big Data Analytics - History of Hadoop - Apache Hadoop -Analyzing Data with Unix tools -Analyzing Data with Hadoop - Hadoop Streaming - Hadoop Echo System - IBM Big Data Strategy.

UNIT II BIG DATA PATTERNS & NOSQL 9

No SQL databases: Mongo DB: Introduction – Features – Data types – Mongo DB Query language – CRUD operations – Arrays – Functions: Count – Sort – Limit – Skip – Aggregate – Map Reduce. Cursors – Indexes – Mongo Import – Mongo Export. Cassandra: Introduction – Features – Data types – CQLSH – Key spaces – CRUD operations – Collections – Counter – TTL – Alter commands – Import and Export – Querying System tables.

UNIT III BIG DATA STORAGE AND ANALYSIS 9

Design of HDFS- HDFS Concepts - Command Line Interface – Hadoop File system interfaces – Data low - Hadoop I/O: Compression, Serialization, Avro - File-Based Data structures, Mapreduce Model with example – Hadoop YARN – Hadoop Schedulers.

UNIT IV HADOOP ECO SYSTEM 9

Introduction to PIG, Execution Modes of PigComparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators - Hive : Hive Shell, Hive Services, Hive Metastore - Comparison with Traditional Databases, HiveQLBig SQL : Introduction

UNIT V CASE STUDY AND DATA VISUALISATION 9

Data Visualisation – Frameworks & Libraries – Types - Line Chart – Scatter Plot - Bar Chart - Box Plot - Pie Chart - Dot Chart - Map Chart - Gauge Chart – Radar Chart - Matrix Chart - Spatial Graph - Distribution Plot - Violin Plot - Count Plot – Case Study: Installation of Hive along with practice examples - Implement of Matrix Multiplication with Hadoop Map Reduce.

LIST OF EXPERIMENTS

1. Downloading and installing Hadoop; Understanding different Hadoop
2. modes. Startup scripts, Configuration files.
3. Hadoop Implementation of file management tasks, such as Adding files and directories, Retrieving files and Deleting files
4. Implement of Matrix Multiplication with Hadoop Map Reduce
5. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
6. Implementation of K-means clustering using Map Reduce
7. Installation of Hive along with practice examples.
8. Installation of HBase, Installing thrift along with Practice examples
9. Practice importing and exporting data from various data bases.

TOTAL : 60 PERIODS

TEXT BOOK:

1. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley Publication, 2015.
2. Arshdeep Bahga, Vijay Madisettai, “Big Data Science & Analytics”, Vpt Publisher, 2016
3. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013.
4. Tom White, “Hadoop: The Definitive Guide”, O’Reilly, 4th Edition, 2015.
5. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications”, Wiley, 2014.

REFERENCES:

1. Jure Leskovec, Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
2. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.
3. “Data Science and Big Data Analytics”, EMC2 Education Services, 2013.
4. Seema Acharya, SubhashiniChellappan, “Big Data and Analytics”, Wiley Publications, First Edition, 2015

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

OUTCOMES:

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

1. Understand the Technologies for Handling Big Data and Hadoop Ecosystem (K1)
2. Identify the Analytical Approaches and Tools to analyze the data (K2)
3. Acquire clear understanding of Hadoop YARN and NoSQL Data Management (K2)
4. Analyze Info sphere Big Insights Big Data Recommendations. (K3)
5. Develop Big Data Solutions using Hadoop Eco System (K2)
6. Analyze the distribution of numerical data (K2)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	1	1	1
CO2	3	3	2	2	-	-	-	-	-	-	-	1	1	1
CO3	3	3	2	2	-	-	-	-	-	-	-	1	1	1
CO4	3	3	2	2	-	-	-	-	-	-	-	1	1	1
CO5	3	3	2	2	-	-	-	-	-	-	-	1	1	1
CO6	3	3	2	2	-	-	-	-	-	-	-	1	1	1

SEMESTER - VI

20AIPL601 SDG NO. 4 & 8	ROBOTICS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To understand different types of robots
- To understand the concept of RPA
- To implement web scraping, data mitigation process.
- To learn the email query processing and customer support emails.

- To develop credit card applications.
- To automate the process in excel and pdf.

LIST OF EXPERIMENTS:

1. Study of robots based on configuration and application.
2. Forward Kinematic Study – Articulated Robot
3. Study on Robotics application
4. Web Scraping
5. Data Migration & Entry
6. Email Query Processing
7. Customer Support Emails
8. Scheduling systems
9. Credit card applications
10. Moving Files from one Source Folder to Destination Folder
11. Excel Automation
12. PDF Automation

EQUIPMENTS:

1. ROBOT ANALYZER SOFTWARE 10 USERS FREEWARE
2. PYTHON
3. DOF ROBOT
4. DOF ROBOT
5. DOF ROBOT
6. MOBILE BOTS
7. SENSOR MODULE

OUTCOMES:

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

1. Understand the different types of robot, movement, kinematics and applications. (K1)
2. Learn to Implement RPA (K3)
3. Develop web scraping, data mitigation and entry process (K2)
4. Create the query processing in email and customer support emails (K3)
5. Develop credit card applications. (K3)
6. Implement the automation process in excel and pdf (K2)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	1	1	1
CO2	3	3	2	2	-	-	-	-	-	-	-	1	1	1
CO3	3	3	2	2	-	-	-	-	-	-	-	1	1	1
CO4	3	3	2	2	-	-	-	-	-	-	-	1	1	1
CO5	3	3	2	2	-	-	-	-	-	-	-	1	1	1
CO6	3	3	2	2	-	-	-	-	-	-	-	1	1	1

SEMESTER - VI

20AIPL403 SDG NO. 4	ADVANCED MACHINE LEARNING LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To develop advance knowledge in Machine Learning.
- To expose the various algorithms In Machine Learning
- To extend the skill to use Advance Machine Learning Algorithms
- To Analyze the real time data sets
- To analyze Model-Based Algorithms
- To analyze and visualize data

LIST OF EXPERIMENTS :

1. Write a program to implement the naıv̈e Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
2. Assuming a set of documents that need to be classified, use the naıv̈e Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
3. Write a program to construct model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
4. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Mean's algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

5. Write a program to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
6. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
7. Implement Support Vector Machine Algorithm for advanced classification of data.
8. Write a program to implement CNN algorithm.
9. Implement Deep Q Network for the analysis of data.
10. Write a program to implement Reinforcement Learning and Model-Based Reinforcement Learning.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Describe Advance Machine Learning Algorithms. (K1)
2. Analyze and Construct the Data Visualization. (K4)
3. Configure the Programming Environment. (K2)
4. Analyze real time data set. (K4)
5. Implement Advanced Machine Learning Algorithms for data analysis. (K3)
6. Implement advanced machine learning concepts for real time applications. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	2	1	1	-	1	-	-	1	3	3
CO2	2	3	2	3	2	1	1	-	1	-	-	1	3	3
CO3	2	3	2	3	2	1	1	-	1	-	-	1	3	2
CO4	2	3	2	3	3	1	1	-	2	-	-	1	2	2
CO5	2	3	2	3	3	1	1	-	2	-	-	1	2	3
CO6	2	3	2	3	3	1	1	-	2	-	-	1	2	3

SEMESTER - VI

20HSPL501 SDG NO. 4, 8	COMMUNICATION AND SOFT SKILLS LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To develop effective communication and presentation skills
- To enhance the employability and career skills of the learners
- To enable the learners for preparing job application and e-portfolio
- To make the learners use soft skills efficiently
- To develop their confidence and help them in attending interviews successfully

UNIT I LISTENING AND SPEAKING SKILLS 6

Conversational skills participate in formal and informal talks – general, – group discussion – time management – group dynamics – GD strategies - making effective presentations - listening/watching interviews conversations, documentaries - listening to lectures, discussions from social media – improving articulation.

UNIT II ADVANCED READING AND WRITING SKILLS 6

Reading different genres of texts - writing job applications – cover letter – résumé – emails – memos - writing abstracts – summaries – interpreting visual texts - e-portfolio.

UNIT III SKILLS FOR COMPETITIVE EXAMS 6

Reading passages for competitive exams – language focus exercise – building vocabulary tasks - FAQs related to competitive exams – current affairs - improving global reading skills – elaborating ideas – summarizing – understanding arguments – identifying opinion/attitude and making inferences - critical reading.

UNIT IV SOFT SKILLS 6

Motivation – emotional intelligence – managing changes – stress management – leadership straits – team work – career planning – intercultural communication – creative and critical thinking

UNIT V INTERVIEW SKILLS 6

Different types of interview – personal interview – panel interview – telephone/online interview - interview etiquette - answering questions – offering information – mock interviews – FAQs related to job interviews

TOTAL: 30 PERIODS

REFERENCES:

1. Business English Certificate Materials, Cambridge University Press.
2. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge, 2011.
3. International English Language Testing System Practice Tests, Cambridge University Press.
4. Personality Development (CD-ROM), Times Multimedia, Mumbai.

WEB REFERENCES:

1. https://nptel.ac.in/courses/109/107/109107121/
2. https://swayam.gov.in/nd1_noc19_hs33/preview
3. https://ict.iitk.ac.in/courses/enhancing-soft-skills-and-personality/

ONLINE RESOURCES:

1. https://www.britishcoucil.my/english/courses-adults/learning-tips/importance-of-soft-skills
2. https://www.skillsoft.com/content-solutions/business-skills-training/soft-skills-training/

OUTCOMES:

Upon completion of the course learners should be able to

1. Demonstrate a better understanding of the communication process by articulating effectively(K2)
2. Exhibit soft skills & technical skills and construct e-portfolio effectively(K3)
3. Apply critical thinking abilities and perform well in group discussions(K2)
4. Adapt the skills towards grooming as a professional continuously(K2)
5. Identify different types of personal interview skills through mock interviews and practices(K2)
6. Execute the employability and career skills in their chosen profession(K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	1	2	3	1	1
CO2	-	-	-	-	-	-	-	2	3	3	2	1
CO3	-	-	-	-	-	-	-	2	3	2	-	1
CO4	-	-	-	-	-	-	-	1	1	3	2	2
CO5	-	-	-	-	-	2	-	1	2	3	-	1
CO6	-	-	-	-	-	-	-	1	1	3	2	2

SEMESTER - VI

20AMPJ601 SDG NO. 4,11,15	INNOVATIVE DESIGN PROJECT	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To understand the engineering aspects of design with reference to simple products
- To foster innovation in design of products
- To develop design that add value to products and solve technical problems

COURSE PLAN

Study: Take minimum three simple products, processes or techniques in the area of specialization, study, analyze and present them. The analysis shall be focused on functionality, construction, quality, reliability, safety, maintenance, handling, sustainability, cost etc. whichever are applicable. Each student in the group has to present individually; choosing different products, processes or techniques.

Design: The project team shall identify an innovative product, process or technology and proceed with detailed design. At the end, the team has to document it properly and present and defend it. The design is expected to concentrate on functionality; design for strength is not expected.

Note: *The one hour/week allotted for tutorial shall be used for discussions and presentations. The project team (not exceeding four) can be students from different branches, if the design problem is multidisciplinary.*

TOTAL: 45 PERIODS

EVALUATION

1. First evaluation (Immediately after first internal examination) : 20 marks
2. Second evaluation (Immediately after second internal examination) : 20 marks
3. Final evaluation (Last week of the semester) : 60 marks

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

OUTCOMES:

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

1. Understand techniques involved in the simple developed products
2. Analyze their quality in terms of reliability, maintenance etc.,
3. Enhance the leadership and individual skills through assignment
4. Think innovatively on the development of components, products, processes or technologies in the engineering field
5. Analyze the problem requirements and arrive workable design solutions
6. Document the findings attained from the projects

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2	3	-	-	1	2	3	1	1
CO2	2	3	3	2	1	-	-	2	3	3	2	1
CO3	-	-	-	-	1	-	-	2	3	2	-	1
CO4	1	1	3	3	3	-	-	1	1	3	2	2
CO5	1	2	3	3	3	2	-	1	2	3	-	1
CO6	-	-	-	-	2	-	-	1	1	3	2	2

SEMESTER - VI

20AMTP601 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

PROBLEM SOLVING SKILLS – PHASE 1

OBJECTIVES:

- Improve their quantitative ability.
- Improve their reasoning ability.
- Enhance their verbal ability through vocabulary building and grammar
- Equip with creative thinking and problem solving skills

UNIT I QUANTITATIVE ABILITY – III **6**

Compound Interest - Profit and Loss - Partnership - Percentage - Set Theory

UNIT II QUANTITATIVE ABILITY – IV **6**

True Discount - Ratio and Proportion - Simplification - Problems on H.C.F and L.C.M

UNIT III REASONING ABILITY – II **6**

Course of Action - Cause and Effect - Statement and Conclusion - Statement and Argument - Data Sufficiency (DS) - Statement and Assumption - Making Assumptions.

UNIT IV VERBAL ABILITY – II **6**

Change of Voice - Change of Speech - Letter and Symbol Series - Essential Part - Verbal Reasoning - Analyzing Arguments.

UNIT V CREATIVITY ABILITY – II **6**

Seating Arrangement - Direction Sense Test - Character Puzzles - Missing Letters Puzzles - Mirror &Water Images.

TOTAL : 30 PERIODS

REFERENCES:

1. R. S. Agarwal, "Quantitative Aptitude for Competitive Exams"
2. Sarvesh Verma, "Quantum CAT"
3. R. S. Agarwal, "A Modern Approach to Logical Reasoning"
4. Arun sharma, "Verbal Ability and Reading Comprehension"

ADVANCED C PROGRAMMING AND MATLAB AND SIMULINK PROGRAMMING - PHASE 2

COURSE OBJECTIVE:

- To improve C programming skills with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To understand procedural programming methods using MATLAB & SIMULINK.

UNIT I INTRODUCTION TO RECURSION AND GROWTH FUNCTIONS 6

Introduction to Recursion - Recurrence Relation - Deriving time complexity and space complexity using recurrence relation Polynomial Equations - Compare growth functions - Nth Fibonacci Number - Exponent Function - Taylor Series - Tower of Hanoi.

UNIT II STORAGE CLASSES, THE PREPROCESSOR AND DYNAMIC MEMORY ALLOCATION 6

Storage Classes and Visibility - Automatic or local variables - Global variables - Macro Definition and Substitution - Conditional Compilation - Dynamic Memory Allocation - Allocating Memory with malloc and callo Allocating Memory with calloc - Freeing Memory - The Concept of linked list - Inserting a node by using Recursive Programs - Deleting the Specified Node in a Singly Linked List.

UNIT III FILE MANAGEMENT AND BIT MANIPULATION 6

Defining and Opening a file - Closing Files - Input/output Operations on Files - Predefined Streams - Error Handling during I/O Operations - Random Access to Files - Command Line Arguments - The hexadecimal number system - C bitwise operators - How to generate all the possible subsets of a set - Tricks with Bits - Applications of bit operations.

UNIT IV BASICS OF PROGRAMMING IN MATLAB 6

Variables - array - matrices - programming structure- Script files- Functions - Debugging programs - Loops, branches and control flow - Relational and logical operations - 2D and 3D graphics - Multiple plots, Plot properties- Numerical analysis: Non-linear equations and optimization - Differential equations.

UNIT V SIMULINK AND MATLAB OPTIMIZATION TOOLBOX 6

Introduction SIMULINK models - blocks - Systems and sub-systems - Simulating Dynamic System - Solving a model - Solvers - MATLAB SIMULINK for signal processing - Solving linear and quadratic optimization problems.

TOTAL : 30 PERIODS

REFERENCES:

1. R. G. Dromey, "How to Solve It By Computer", Pearson, 1982
2. A.R. Bradley, "Programming for Engineers", Springer, 2011
3. Kernighan and Ritchie, "The C Programming Language", (2nd ed.) Prentice Hall, 1988
4. Amos Gilat, "Matlab, An Introduction With Applications", Wiley Publication, 4th edition
5. Brian R. Hunt, Jonathan Rosenberg, and Ronald L Lipsman, "A Guide to MATLAB", Cambridge University press.

REFERENCES

1. Agam Kumar Tyagi, "Matlab and Simulink for Engineering" Oxford Higher Education
2. Rudra Pratap "Getting Started with MATLAB"Oxford Higher Education
3. Stephen J Chapman, "MATLAB Programming for Engineers", 6E, CENGAGE

ONLINE RESOURCES

1. https://matlabacademy.mathworks.com/
2. https://www.tutorialspoint.com/matlab/index.htm
3. https://medium.com/quick-code/top-tutorials-to-learn-matlab-for-beginners-d19549ecb7b7
4. https://nptel.ac.in/courses/103/106/103106118/

WEB RESOURCES

1. https://www.mathworks.com/academia/books.html
2. https://in.mathworks.com/support/learn-with-matlab-tutorials.html

COURSE OUTCOMES :

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

1. Analyze their quantitative ability. (K4)
2. Understand the ability of arithmetic reasoning along with creative thinking and problem solving skills. (K2)
3. Create their verbal ability through vocabulary building and grammar. (K6)

4. Evaluate code organization and functional hierarchical decomposition with complex data types. (K5)
5. Understand to improve C programming skills to apply advance structured and procedural programming. (K2)
6. Apply the Matlab Simulink and optimization toolbox for signal processing applications. (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO2	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO3	-	-	-	-	3	2	-	-	1	3	-	2	-	-
CO4	-	-	-	-	3	2	-	3	3	3	-	2	2	2
CO5	-	-	-	-	3	2	-	-	2	3	-	2	2	2
CO6	-	-	-	-	3	2	-	-	2	3	-	2	2	2

SEMESTER - VII

20AIPC701 SDG NO. 4 & 9	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concept of Cloud Computing
- To appreciate the Evolution of Cloud from the existing technologies
- To have knowledge on the various issues in Cloud Computing
- To appreciate the Emergence of Cloud as the next generation computing paradigm

UNIT I INTRODUCTION 9

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud –On-demand Provisioning.

UNIT II CLOUD ENABLING TECHNOLOGIES 10

Service Oriented Architecture – REST – Web Services – Publish-Subscribe Model – Micro services – Micro services Architecture -Basics of Virtualization– Types of Virtualization – Implementation Levels of Virtualization– Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.

UNIT III CLOUD ARCHITECTURE,SERVICES AND STORAGE 8

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - laaS –PaaS – SaaS – Architectural Design Challenges – Cloud Storage –Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

UNITIV RESOURCE MANAGEMENT AND SECURITY IN CLOUD 10

Inter Cloud Resource Management – Resource Provisioning andResource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges –Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.

UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS 8

Hadoop – Map Reduce – Virtual Box - Google App Engine –Programming Environment for Google App Engine – OpenStack –Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017.

REFERENCES:

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", TataMcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing- A Practical Approach", Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", O'Reilly,2009.

ONLINE RESOURCES:

1. https://eniac2017.files.wordpress.com/2017/03/distributed-and-cloud-computing.pdf.
2. https://www.vmware.com/topics/glossary/content/distributed-cloud.html

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc20_cs20/preview
2. https://nptel.ac.in/courses/106/105/106105167/
2. https://freevideolectures.com/course/4639/nptel-cloud-computing
3. https://www.udemy.com/course/learn-cloud-computing-from- scratch/

OUTCOMES:

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

1. Identify the main concepts, key technologies, strengths and limitations of cloud computing. (K3)
2. Explain the key and enabling technologies that help in the development of the cloud.(K2)
3. Understand and use the architecture of compute and storage cloud,service and delivery models.(K2)
4. Explain the core issues of cloud computing such as resource management and security.(K2)
5. Discover and use current cloud technologies. (K3)
6. Identify the appropriate technologies, algorithms and approaches for implementation and use of cloud. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	-	-	-	-	-	-	-	-
CO2	2	3	2	1	-	-	-	-	-	-	-	-
CO3	3	2	2	1	3	-	-	-	-	-	-	-
CO4	3	3	3	2	3	3	2	2	1	1	2	2
CO5	3	3	2	2	2	-	-	-	-	1	-	2
CO6	3	3	3	3	1	3	1	3	-	-	2	2

SEMESTER - VII

20HSMG601 SDG NO. 4	PRINCIPLES OF ENGINEERING MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Enable the students to study the evolution of Management
- Study the functions and principles of management
- Learn the application of the principles in an organization.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Management – Science or Art – Manager Vs Entrepreneur – types of managers – Engineers as Managers. Evolution of Management – Scientific, human relations, system and contingency approaches – Types of Business organization – Sole proprietorship, partnership, company-public and private sector enterprises – Organization culture and Environment – Current issues and future trends in Management; Industry 4.0 – Engineering management in modern business.

UNIT II PLANNING 9

Planning, Technology Planning - Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – MBO – process - Principles and functions of engineering management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING **9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmenta lization – delegation of authority – centralization and decentralization – Job Design – Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

UNIT IV DIRECTING and CONTROLLING **9**

Foundations of individual and group behaviour – Motivation – theories and techniques–Leadership – Level 5 leadership - theories – Leadership as a determinant of Engineering management - Communication – process and barriers – effective communication – Communication and IT - System and process of controlling – budgetary and non-budgetary control techniques.

UNIT V INNOVATION AND TECHNOLOGY MANAGEMENT **9**

Innovation management of Product and Services, Role of R & D in Entrepre neurship, Breakthrough Innovation, Disruptive Innovation – Modern approaches in Engineering management – Green management, Lean management, Managing diversity. IPR – Principles of Ethics for Engineering Managers.

TOTAL: 45 PERIODS

TEXTBOOK:

1. Tripathy PC and Reddy PN, Principles of Management, Tata McGraw Hill, 1999.

REFERENCES:

1. Stephen P. Robbins and Mary Coulter, Management, Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert Management, Pearson Education, 6th Edition, 2004.
3. Stephen A. Robbins and David A. Decenzo and Mary Coulter, Fundamentals of Management Pearson Education, 7th Edition, 2011.
4. Robert Kreitner and MamataMohapatra, Management, Biztantra, 2008.
5. Harold Koontz and Heinz Weihrich Essentials of management Tata McGraw Hill,1998.

WEB RESOURCES:

1. https://www.managementstudyguide.com/organizationmanagement htm
2. https://nptel.ac.in/courses/110/105/110105034/
3. https://courses.lumenlearning.com/boundless-management/chapter/principles-of-management/

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/110/105/110105033/

OUTCOMES:

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

1. Understand the evolution and basic concepts of engineering management. (K2)
2. Demonstrate the planning concepts for effective decision making process. (K2)
3. Describe the basic concepts of organization and its function. (K2)
4. Describe the ability to direct, leadership and communicate effectively. (K2)
5. Apply the concepts of innovation and technology management.(K3)
6. Apply the modern approaches in Engineering management and know the Intellectual property rights (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	1	2	3	3	2	1	1	1	-	1
CO2	3	2	-	2	1	3	-	1	1	1	1	1	-	1
CO3	3	1	-	1	1	1	1	-	1	1	1	1	-	1
CO4	3	2	-	1	1	1	-	-	1	1	1	1	-	1
CO5	3	1	-	1	-	-	1	-	1	1	1	1	-	1
CO6	3	-	-	1	3	2	2	-	-	-	1	1	-	1

SEMESTER - VII

20AMPC701 SDG NO. 4	GENERATIVE DEEP LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand how variational autoencoders can change facial expressions in photos
- Build practical GAN examples from scratch, including CycleGAN for style transfer and MuseGAN for music generation.
- Create recurrent generative models for text generation and learn how to improve the models using attention
- Understand how generative models can help agents to accomplish tasks within a reinforcement learning setting
- Explore the architecture of the Transformer (BERT, GPT-2) and image generation models such as ProGAN and StyleGAN

UNIT I INTRODUCTION TO GENERATIVE DEEP LEARNING 7

Generative Modeling – Framework of GM – Probabilistic Generative Models – Challenges of GM – Representation Learning.

UNIT II AUTO ENCONDERS AND GENERATIVE ADVERSARIAL NETWORKS 11

Autoencoders – Variational Autoencoders – VAE Applications - Generative Adversarial Networks (GANs) – GAN Challenges – Wasserstein GAN – WGAN Gradient Penalty.

UNIT III PAINTING AND WRITING 11

CycleGAN – CyleGAN Modeling - Neural Style Transfer - Long Short-Term Memory Networks – Generating New Texts – RNN Extensions – Architecture of Question-and-Answer Generator

UNIT IV COMPOSING AND PLAYING 11

- Composing Foundations – Music Generating RNN – Musical Organ – MuseGAN Generator – MuseGAN Analysis – Reinforcement Learning and OpenAI Gym – World Model Architecture- VAE Training - MDN-RNN Training – Controller Training – In-Dream Training.

UNIT V ADVANCES IN GENERATIVE MODELING 5

Positional Encoding – Multihead Attention - BERT – GPT-2 - Musenet – ProGAN – BigGAN – StyleGAN – AI Art – AI music.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. David Foster, "Generative Deep Learning Teaching Machines to Paint, Write, Compose, and Play", O'Reilly Media, 2019.
2. Jakub M. Tomczak "Deep Generative Modeling" Springer Cham, 2022.

REFERENCES:

1. Josh Kalin, "Generative Adversarial Networks Cookbook: Over 100 Recipes to Build Generative Models Using Python, TensorFlow, and Keras" Packt Publishing, 2018.
2. Jakub Langr and Vladimir Bok, "GANs in Action: Deep Learning with Generative Adversarial Networks", Manning, 2019.
3. Joseph Babcock and Raghav Bali, "Generative AI with Python and TensorFlow 2: Harness the Power of Generative Models to Create Images, Text, and Music Raghav Bali", Packt Publishing, 2021.

WEB REFERENCES:

1. https://keras.io/examples/generative/
2. https://courses.cs.washington.edu/courses/cse599i/20au/

ONLINE RESOURCES:

1. https://in.coursera.org/specializations/generative-adversarial-networks-gans
2. https://developers.google.com/machine-learning/gan

OUTCOMES:

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

1. Understand generative modeling, framework, types and challenges. (K2)
2. Understand autoencoders and generative adversarial networks (K2)
3. Implementing generative modeling for painting and writing (K3)
4. Implementing generative modeling for composing (K3)
5. Implementing generative modeling for playing (K3)
6. Implementing advanced generative models (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	2	1	1	1	0	2	2	3	3	3	2
CO2	2	2	1	2	1	1	1	0	2	2	3	3	3	2
CO3	3	3	2	3	3	1	1	1	2	2	3	3	3	2
CO4	2	2	1	2	3	2	1	0	1	1	2	1	3	2
CO5	2	2	1	2	3	2	1	0	1	1	2	1	3	2
CO6	2	2	1	2	1	1	1	0	2	2	3	3	3	2

SEMESTER - VII

20AIPL701 SDG NO. 4	CLOUD COMPUTING LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To develop Web Applications in Cloud
- To learn the design and development process involved in creating a Cloud Based Application
- To understand the installation of Cloud Simulation tools and Cloud Setup tools
- To learn to implement and use Parallel programming using Hadoop

LIST OF EXPERIMENTS :

1. Install VirtualBox/VMware Workstation with different flavors of Linux or Windows OS on top of Windows 7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute simple programs.
3. Install GoogleAppEngine.Create hello world app and other simple web applications usingPython/Java.
4. Use GAME launcher to launch theWeb Applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present inCloudSim.
6. Find a procedure to transfer the files from one Virtual Machine to another Virtual Machine.
7. Find a procedure to launch Virtual Machine using try stack (Online Openstack Demo Version)
8. Install Hadoop single node cluster and run simple applications like word count.

LAB REQUIREMENTS:

Softwares

1. Virtual box
2. VMwareWorkstation
3. Openstack,Hadoop
4. Cloudsim
5. GAE launcher

OUTCOMES :

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

1. Discuss various virtualization tools such as Virtual Box, VMware to create virtual Environment. (K2)
2. Design and Implement applications on the Cloud.(K3)
3. Illustrate web applications in a PaaS environment. (K3)
4. Understand how to simulate a cloud environment to implement new schedulers. (K2)
5. Demonstrate and use a Generic Cloud environment that can be used as a private cloud. (K3)
6. Manipulate large data sets in a parallel environment. (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	3	1	1	-	-	-	2	2	3	2
CO2	3	3	3	2	3	1	1	-	-	-	2	2	2	2
CO3	3	3	3	3	3	-	-	-	-	-	2	2	3	2
CO4	2	2	3	2	3	-	-	-	-	-	2	2	3	2
CO5	3	3	3	3	2	1	1	-	-	-	3	3	3	2
CO6	3	3	3	3	2	1	1	-	-	-	2	2	3	2

SEMESTER - VII

20AMPJ701 SDG NO. 4, 6,7,8, 9,11, 12,13, 17	PROJECT PHASE - I	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification
- To review the literatures till the successful solution of the same.
- To train the students face reviews and viva voce examination.

GUIDELINES TO BE FOLLOWED:

The students may be grouped into 3 to 4 and work under a project supervisor and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor (faculty member). The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department. The Project Work Phase-I will have the following Sequence:

I. Problem Identification

1. A statement of system / process specifications proposed to be developed (Block Diagram / Concept tree)
2. List of possible solutions including alternatives and constraints
3. Cost benefit analysis
4. Time Line of activities

II. A report highlighting the design finalization [based on functional requirements and standards (if any)]

III. A presentation including the following:

1. Implementation Phase (Hardware / Software / both)
2. Testing and Validation of the developed system
3. Learning in the Project

IV. Consolidated report preparation

TOTAL: 60 PERIODS

OUTCOMES:

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

1. Conduct literature surveys to identify the gap and an application oriented research problem in the specific domain. (K2)

2. Define and formulate solutions to complex engineering problems. (K5)
3. Use the design standards with consideration of real world constraints in particular the environmental responsibilities of professional engineers and matters related to economic, legislation, lifespan, ethical, social etc. (K3)
4. Demonstrate effective communication skills through presentation and defence of the engineering project. (K3)
5. Demonstrate leadership skills, ability to work independently and in a team through project design, presentation and defence of project findings. (K5)
6. Write a project report based on the findings.

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	3	2	2	3	3	3
CO2	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO3	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO4	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO5	-	-	-	-	1	1	-	1	3	3	1	3	1	1
CO6	-	-	-	-	2	1	-	1	3	3	1	3	1	1

SEMESTER - VII

20AMTP701 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

APTITUDE REFRESHER & APTITUDE COMPANY SPECIFIC TRAINING – PHASE 1

OBJECTIVES:

- Enhance their quantitative ability.
- Enhance their reasoning ability
- Enhance their verbal ability.

UNIT I PRODUCT COMPANY SPECIFIC TRAINING - I 10

Product Specific Training for Amazon, Microsoft, IBM, ThoughtWorks, Juspay, Paypal, Mu Sigma, Zoho Corporation, VM Ware, Directi, Oracle, Wells Fargo, Goldman Sachs, Chargebee, Coda Global, Temenos, Freshworks, Adobe Systems.

UNIT II PRODUCT COMPANY SPECIFIC TRAINING – II 10

Product Specific Training for Ernst and Young, BA Continuum, Standard Chartered, AON Hewitt, Soliton Technologies, Payoda Technologies, Infoview Technologies, Athena Health Technology.

UNIT III SERVICE COMPANY SPECIFIC TRAINING - I 10

TCS, Wipro, TechMahindra, InfoView, RobertBosch, , NTT Data, Verizon, Payoda Technologies.

UNIT IV SERVICE COMPANY SPECIFIC TRAINING - II 10

CTS, Accenture, MindTree, MPhasis, Odessa Technologies, Vuram Technologies, Hewlett Packard, HCL.

UNIT V SERVICE COMPANY SPECIFIC TRAINING - III 5

Capgemini, Infosys, IBM, UGAM Solutions, Skava Systems, L&T Infotech, Bahwan Cybertech, Dhyan Infotech.

TOTAL: 45 PERIODS

REFERENCES

1. Quantitative Aptitude for Competitive Exams by R. S. Agarwal
2. Quantum CAT by Sarvesh Verma
3. A Modern Approach to Logical Reasoning by R. S. Agarwal
4. Verbal Ability and Reading Comprehension by Arun Sharma

HIGH END TECHNICAL & TECHNICAL COMPANY SPECIFIC TRAINING AND TENSOR FLOW - PHASE II

COURSE OBJECTIVE:

Analyse simple algorithms and data structures.

Design of computer algorithms

Understand the basic and advanced concept of machine learning and deep learning

UNIT I SERVICE COMPANY SPECIFIC TRAINING – I 9

TCS – Technical MCQ and Coding; Wipro – Automata Programming; TechMahindra, InfoView, RobertBosch, , NTT Data, Verizon, Payoda Technologies.

UNIT II SERVICE COMPANY SPECIFIC TRAINING – II 9

CTS – Code Debugging & Coding Section; Accenture – Pseudo code, Network Fundamentals, Basics of Computers; MindTree – Automata Coding & Technical MCQ, MPhasis – Automata Coding; Odessa Technologies, Vuram Technologies, Hewlett Packard, HCL

UNIT III SERVICE COMPANY SPECIFIC TRAINING – III 9

Capgemini – Pseudo Code & Coding, Infosys – Pseudo Code; IBM – Coding; UGAM Solutions, Skava Systems, L&T Infotech, Bahwan Cybertech, Dhyan Infotech.

UNIT IV BASICS OF TENSOR FLOW 9

Tensors- Create a Tensor - Tensor Operations - The nn.Module -A word about Layers - Datasets and DataLoaders - Understanding Custom Datasets - Understanding Custom DataLoaders

UNIT V TRAINING A NEURAL NETWORK 9

Training a Neural Network - Loss functions - Custom Loss Function - Optimizers - Using GPU/Multiple GPUs

TOTAL : 45 PERIODS

ONLINE RESOURCES

1. https://www.tensorflow.org/guide/basics
2. https://www.javatpoint.com/tensorflow-introduction

OUTCOMES:

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

1. Demonstrate familiarity with major algorithms and data structures. (K2)
2. Apply important algorithmic design paradigms and methods of analysis.(K3)
3. Understand the coding concepts used in service companies like Infosys, IBM, L&T infotech etc., (K1)
4. Synthesize efficient algorithms in common engineering design situations. (K4)
5. Train and run the deep neural networks. (K3)
6. Understand the Optimization processes using GPUs (K1)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO2	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO3	-	-	-	-	3	2	-	-	1	3	-	2	-	-
CO4	-	-	-	-	3	2	-	3	3	3	-	2	2	2
CO5	-	-	-	-	3	2	-	-	2	3	-	2	2	2
CO6	-	-	-	-	3	2	-	-	2	3	-	2	2	2

SEMESTER - VIII

20AMPJ801 SDG NO. 4,6,7, 8, 9, 11,12,13,17	PROJECT PHASE-II	L	T	P	C
		0	0	8	4

OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students face reviews and viva voce examination

GUIDELINES TO BE FOLLOWED:

- The students may be grouped into 3 to 4 and work under a project supervisor and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor (faculty member).
- The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department.
- A project report is required at the end of the semester.
- The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.
- The Project Work Phase-II will have the following Sequence:

I. Problem Identification

1. A statement of system / process specifications proposed to be developed (Block Diagram / Concept tree)
2. List of possible solutions including alternatives and constraints
3. Cost benefit analysis
4. Time Line of activities

II. A report highlighting the design finalization [based on functional requirements and standards (if any)]

III. A presentation including the following

1. Implementation Phase (Hardware / Software / both)
2. Testing and Validation of the developed system
3. Learning in the Project

IV. Consolidated report preparation

TOTAL: 120 PERIODS

OUTCOMES:

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

1. Conduct literature surveys to identify the gap and an application oriented research problem in the specific domain. (K2)
2. Define and formulate solutions to complex engineering problems. (K5)
3. Use the design standards with consideration of real world constraints in particular the environmental responsibilities of professional engineers and matters related to economic, legislation, lifespan, ethical, social etc. (K3)
4. Demonstrate effective communication skills through presentation and defence of the engineering project. (K3)
5. Demonstrate leadership skills, ability to work independently and in a team through project design, presentation and defence of project findings. (K5)
6. Write a project report based on the findings.

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	3	2	2	3	3	3
CO2	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO3	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO4	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO5	-	-	-	-	1	1	-	1	3	3	1	3	1	1
CO6	-	-	-	-	2	1	-	1	3	3	1	3	1	1

PROFESSIONAL ELECTIVES – I

20AMEL501 SDG NO. 4 & 9	ETHICS AND POLICY ISSUES IN AI COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Study the morality and ethics in AI.
- Learn about the Ethical initiatives in the field of artificial intelligence.
- Study about AI standards and Regulations.
- Study about social and ethical issues of Robot Ethics.
- Study about AI and Ethics- challenges and opportunities.

UNIT I INTRODUCTION 9

Definition of morality and ethics in AI-Impact on society-Impact on human psychology-Impact on the legal system-Impact on the environment and the planet-Impact on trust

UNIT II ETHICAL INITIATIVES IN AI 9

International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles, Warfare and weaponization.

UNIT III AI STANDARDS AND REGULATION 9

Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems-Data Privacy Process- Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems.

UNIT IV ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS 9

Robot-Robo ethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles-Ethics and Professional Responsibility- Robo ethics Taxonomy.

UNIT V AI AND ETHICS- CHALLENGES AND OPPORTUNITIES 9

Challenges - Opportunities- ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine-decision-making role in industries-National and International Strategies on AI.

TOTAL: 45 PERIODS

TEXTBOOK:

1. Y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield," The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020
2. Patrick Lin, Keith Abney, George A Bekey," Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014.

REFERENCES:

1. Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017.
2. Mark Coeckelbergh," AI Ethics", The MIT Press Essential Knowledge series, April 2020

WEB REFERENCES:

1. https://sci-hub.mksa.top/10.1007/978-3-540-30301-5_65
2. https://www.scu.edu/ethics/all-about-ethics/artificial-intelligence-and-ethics-sixteenchallenges-and-opportunities/
3. https://www.weforum.org/agenda/2016/10/top-10-ethical-issues-in-artificial-intelligence/
4. https://sci-hub.mksa.top/10.1159/000492428

OUTCOMES:

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

1. Learn about morality and ethics in AI. (K2)
2. Acquire the knowledge of real time application ethics, issues and its challenges. (K3)
3. Understand the ethical harms and ethical initiatives in AI. (K2)
4. Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems. (K3)
5. Understand the concepts of Robo ethics and Morality with professional responsibilities. (K3)
6. Learn about the societal issues in AI with National and International Strategies on AI. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	1	1	1	-	3	-	1	-	2	2
CO2	2	1	1	1	2	1	1	-	3	-	1	-	2	3
CO3	1	1	1	1	2	2	3	-	3	-	1	-	2	3
CO4	1	-	-	-	1	1	1	-	3	-	1	-	1	2
CO5	1	-	-	-	1	3	3	3	3	-	1	-	2	3
CO6	1	1	1	1	1	2	-	-	3	-	-	-	2	3

PROFESSIONAL ELECTIVES – I

20AMEL502 SDG NO. 4 & 9	EVOLUTION OF AI LANGUAGES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Enhance machine comprehension of human language.
- Advance machine-generated, human-like textual output.
- Deepen understanding of linguistic context and nuances.
- Broaden integration across communication modes.

UNIT I INTRODUCTION TO ARTIFICIAL INTELLIGENCE LANGUAGES9

Overview of artificial intelligence (AI) and its significance - Introduction to AI programming languages and their evolution - Historical perspective: early AI languages such as Lisp, Prolog, and Smalltalk - Comparison of different AI programming paradigms (e.g., symbolic AI vs. connectionist AI) - Case studies of early AI applications and their language requirements

UNIT II TRADITIONAL AI LANGUAGES AND PARADIGMS 9

In-depth study of traditional AI languages like Lisp and Prolog - Understanding the features and characteristics of these languages - Hands-on programming exercises in Lisp and Prolog - Exploring AI algorithms and techniques implemented using traditional AI languages - Analyzing the strengths and limitations of traditional AI languages in modern AI applications

UNIT III EVOLUTION OF AI LANGUAGES: FROM RULE-BASED TO DATA-DRIVEN 9

Transition from rule-based AI languages to data-driven approaches - Introduction to modern AI languages such as Python, R, and Julia - Overview of libraries and frameworks for AI development in modern languages - Case studies showcasing the application of modern AI languages in machine learning, deep learning, and natural language processing - Hands-on projects demonstrating the use of modern AI languages for solving real-world AI problems

UNIT IV ADVANCED TOPICS IN AI LANGUAGE DEVELOPMENT 9

Exploration of advanced concepts and techniques in AI language development - Study of domain-specific languages (DSLs) for AI applications - Introduction to probabilistic programming languages and their use in AI modeling - Overview of quantum programming languages and their potential impact on AI - Discussion on the future directions and trends in AI language research and development

UNIT V ETHICAL AND SOCIETAL IMPLICATIONS OF AI LANGUAGES 9

Examination of ethical considerations in AI language design and usage - Discussion on biases and fairness in AI algorithms implemented using different languages - Analysis of the societal impact of AI languages on employment, privacy, and security - Case studies highlighting ethical dilemmas and controversies related to AI language applications - Strategies for promoting responsible AI language development and deployment

TOTAL: 45 PERIODS

TEXTBOOK:

1. The Age of AI: And Our Human Future" by Henry Kissinger, Eric Schmidt, and Daniel Huttenlocher: This book explores the historical context, current state, and future implications of AI for humanity.
2. "Artificial Intelligence: A Guide for Thinking Humans" by Melanie Mitchell: Offering a comprehensive overview, this book examines the history, controversies, and societal impacts of AI.
3. "Life 3.0: Being Human in the Age of Artificial Intelligence" by Max Tegmark: Tegmark explores the potential future trajectories of AI and their implications for humanity.

REFERENCES:

1. Sha, A. (2023). OpenAI GPT-5: Release Date, Features, AGI Rumors, Speculations, and More. Beebom. Retrieved June 7, 2023

WEB REFERENCES:

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

ONLINE RESOURCES:

1. https://ocw.mit.edu/index.htm
2. https://online.stanford.edu/

OUTCOMES:

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

1. Gain a comprehensive understanding of the historical development of AI languages. (K2)
2. Demonstrate proficiency in using traditional AI languages such as Lisp and Prolog. (K3)
3. Adapt to modern AI languages such as Python, R, and Julia. (K3)
4. Develop critical analysis skills to evaluate the strengths, weaknesses, and trade-offs of different AI languages and paradigms. (K3)
5. Explore advanced concepts and techniques in AI language development, including domain-specific languages. (K3)
6. Develop awareness of ethical and societal implications associated with AI language development and usage. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	1	-	1	2	1	-	1	-	1	-	3	2
CO2	2	2	1	2	3	2	1	-	2	-	2	-	1	3
CO3	-	1	2	1	3	1	3	-	2	-	1	-	3	3
CO4	3	-	1	3	-	1	2	-	1	-	2	-	3	2
CO5	1	-	2	-	1	3	2	3	2	-	1	-	2	3
CO6	-	1	3	2	1	2	-	-	-	-	-	-	2	3

PROFESSIONAL ELECTIVES – I

20AMEL503 SDG NO. 4 & 9	DATA MINING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know how to derive meaning from a huge volume of data and information.
- To understand how knowledge discovery is used in business decision making.

UNIT I DATA WAREHOUSING AND INTRODUCTION TO DATA MINING 9

Basics of Data Warehousing: Models, Architectures - Data Warehouse Design: Three-tier Architecture, Data Cube, OLAP - Introduction to Data Mining: Key Functionalities, Process Overview - Classification of Data Mining Systems

UNIT II DATA PREPROCESSING AND PATTERN MINING 9

Data Preprocessing Techniques: Cleaning, Integration, Reduction, Transformation - Introduction to Pattern Mining: Concepts and Significance - Frequent Pattern Mining Methods: Apriori and FP-Growth Algorithms - Utilizing Vertical Data Formats for Efficient Mining

UNIT III ADVANCED CLASSIFICATION TECHNIQUES 9

Overview of Classification Techniques - Decision Tree and Bayes Classification Methods - Improving Accuracy in Classification: Advanced Methods and Model Evaluation - Bayesian Networks and Lazy Learners: Detailed Study

UNIT IV CLUSTER ANALYSIS AND OUTLIER DETECTION 9

Cluster Analysis: Types of Data and Partitioning Methods - Advanced Clustering: K Medoid, Density-Based, Grid-Based Methods - Outlier Analysis: Techniques and Applications

UNIT V TRENDS AND SPECIALIZED TECHNIQUES IN DATA MINING 9

Current Trends in Data Mining: Web, Temporal, and Spatial Mining - Statistical Data Mining: Concepts and Methodologies - Practical Applications of Data Mining Across Various Domains

TOTAL: 45 PERIODS

TEXTBOOK:

1. R. Agrawal, T. Imielinski, and A. Swami (1993). "Mining associations between sets of items in massive databases," in Proceedings of the 1993 ACM-SIGMOD International Conference on Management of Data (pp. 207–216), New York: ACM Press.
2. M. J. A. Berry, and G. S. Linoff (1997). Data Mining Techniques. New York: Wiley.
3. M. J. A. Berry, and G. S. Linoff (2000). Mastering Data Mining. New York: Wiley.
4. L. Breiman, J. Friedman, R. Olshen, and C. Stone (1984). Classification and Regression Trees. Boca Raton, FL: Chapman & Hall/CRC (orig. published by Wadsworth).

REFERENCES:

1. Jaiwei Ham and Micheline Kamber, Data Mining concepts and techniques, Kauffmann Publishers 2006
2. Efraim Turban, Ramesh Sharda, Jay E. Aronson and David King, Business Intelligence, Prentice Hall, 2008.
3. W.H.Inmon, Building the Data Warehouse, fourth edition Wiley India pvt. Ltd. 2005.
4. Ralph Kimball and Richard Merz, The data warehouse toolkit, John Wiley, 3rd edition,2013.
5. Michel Berry and Gordon Linoff, Mastering Data mining, John Wiley and Sons Inc, 2nd Edition,2011
6. Michel Berry and Gordon Linoff, Data mining techniques for Marketing, Sales and Customer support, John Wiley, 2011
7. G. K. Gupta, Ïntroduction to Data mining with Case Studies, Prentice Hall of India, 2011
8. Giudici, Applied Data mining – Statistical Methods for Business and Industry, John Wiley. 2009
9. Elizabeth Vitt, Michael Luckevich Stacia Misner, Business Intelligence, Microsoft, 2011
10. Michalewicz Z., Schmidt M. Michalewicz M and Chiriac C, Adaptive Business Intelligence, Springer – Verlag, 2007 381
11. GalitShmueli, Nitin R. Patel and Peter C. Bruce, Data Mining for Business Intelligence – Concepts, Techniques and Applications Wiley, India, 2010.

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc24_cs22/preview
2. https:// onlinecourses.nptel.ac.in/noc24_mg08/preview

OUTCOMES:

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

1. Learn to apply various data mining techniques into various areas of different domains. (K2)
2. Be able to interact competently on the topic of data mining for business intelligence. (K3)
3. Apply various prediction techniques. (K3)
4. About supervised and unsupervised learning techniques. (K3)
5. Develop and implement machine learning algorithms. (K3)
6. Be able to apply methods to real-world data. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	1	-	1	3	1	-	1	1	1	-	3	2
CO2	1	2	1	3	2	2	1	2	2	-	2	-	3	3
CO3	-	1	2	1	3	1	2	-	2	1	1	-	3	3
CO4	3	1	2	3	-	3	2	-	1-	-	2	-	3	3
CO5	1	-	2	-	1	2	2	3	1	1	1	2	2	3
CO6	2	1	3	2	1	2	1	2	-	-	-	2	2	3

PROFESSIONAL ELECTIVES – I

20AIEL507 SDG NO. 4	HUMAN COMPUTER INTERACTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the foundations of Human Computer Interaction.
- To become familiar with the design technologies for individuals and persons with disabilities.
- To be aware of mobile HCI
- To learn the guidelines for user interface.

UNIT I FOUNDATIONS OF HCI **9**

The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. – Case Studies

UNIT II DESIGN & SOFTWARE PROCESS 9

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design

UNIT III MODELS AND THEORIES 9

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV MOBILE HCI 9

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. – Case Studies

UNIT V WEB INTERFACE DESIGN 9

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow – Case Studies

TOTAL: 45 PERIODS

TEXTBOOK:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, —Human Computer Interaction, 3rd Edition, Pearson Education, 2004 (UNIT I, II & III)
2. Brian Fling, —Mobile Design and Development, First Edition, O'Reilly Media Inc., 2009 (UNIT – IV)
3. Bill Scott and Theresa Neil, —Designing Web Interfaces, First Edition, O'Reilly, 2009. (UNIT-V)

REFERENCES:

1. Julie A. Jacko and Andrew Sears, The human-computer interaction handbook: fundamentals, evolving Technologies, and emerging applications, Lawrence Erlbaum Associates, Inc., Publishers, 2003
2. Lloyd P. Rieber, Computers, Graphics, & Learning, Brown & Benchmark publishers, 2005.
3. Yvonne Rogers, Helen Sharp, Jenny Preece, Interaction Design: beyond human-computer interaction, Second Edition, John-Wiley and Sons Inc., 2009
4. DovTe-eni, Jane Carey, Ping Zhang, Human-Computer Interaction: Developing Effective Organizational Information Systems, John-Wiley and Sons Inc., 2007

WEB REFERENCES:

1. https://nptel.ac.in/courses/106103115
2. https://nptel.ac.in/courses/106106177

ONLINE RESOURCES:

1. https://freevideolectures.com/course/4491/nptel-introduction-human-computer-interaction
2. https://www.iare.ac.in/sites/default/files/lecture_notes/HCI%20LECTURE%20NOTES.pdf
3. https://mrcet.com/pdf/Lab%20Manuals/IT/R15A0562%20HCI.pdf

OUTCOMES:

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

1. Design effective dialog for HCI. (K4)
2. Demonstrate the software process and design rules. (K2)
3. Design effective HCI for individuals and persons with disabilities. (K4)
4. Identify the importance of user feedback. (K2)
5. Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Websites. (K2)
6. Develop a meaningful user interface. (K4)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	3	-	-	2	-	-	-	1	2	2
CO2	2	2	-	-	2	-	-	2	-	-	-	1	2	2
CO3	2	2	-	-	3	-	-	1	-	-	-	1	2	2
CO4	2	2	-	-	2	-	-	2	-	-	-	1	2	2
CO5	2	2	-	-	2	-	-	1	-	-	-	1	2	2
CO6	2	2	-	-	3	-	-	1	-	-	-	1	2	2

PROFESSIONAL ELECTIVES – I

20AIEL505 SDG NO. 4 & 9	SOCIAL NETWORK ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the components of the social network.
- To model and visualize the social network.
- To mine the users in the social network.
- To understand the evolution of the social network.
- To know the applications in real time systems.

UNIT I INTRODUCTION **9**

Introduction to Web - Limitations of current Web – Development of Semantic Web– Emergence of the Social Web– Statistical Properties of Social Networks - Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities -Web-based networks.

UNIT II MODELING AND VISUALIZATION **9**

Visualizing Online Social Networks - A Taxonomy of Visualizations – Graph Representation - Centrality- Clustering - Node-Edge Diagrams – Visualizing Social Networks with Matrix- Based Representations- Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data – Random Walks and their Applications –Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships.

UNIT III MINING COMMUNITIES **9**

Aggregating and reasoning with social network data, Advanced Representations – Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks – Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks.

UNIT IV EVOLUTION **9**

Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis – Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location

in Social Networks - Expert Location without Graph Constraints - with Score Propagation – Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction – Bayesian Probabilistic Models – Probabilistic Relational Models.

UNIT V APPLICATIONS 9

A Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection

TOTAL: 45 PERIODS

TEXTBOOK:

1. Ajith Abraham, Aboul Ella Hassanien, Vaclav Snasel, —Computational Social Network Analysis: Trends, Tools and Research Advances, Springer, 2012
2. Borko Furht, —Handbook of Social Network Technologies and Applications, Springer, 1 st edition, 2011

REFERENCES:

1. Charu C. Aggarwal, —Social Network Data Analytics, Springer; 2014
2. Giles, Mark Smith, John Yen, —Advances in Social Network Mining and Analysis, Springer, 2010.
3. Guandong Xu , Yanchun Zhang and Lin Li, —Web Mining and Social Networking – Techniques and applications, Springer, 1st edition, 2012.
4. Peter Mika, —Social Networks and the Semantic Web, Springer, 1st edition, 2007.
5. Przemyslaw Kazienko, Nitesh Chawla, Applications of Social Media and Social Network Analysis, Springer,2015

WEB REFERENCES:

1. http://www.coursera.org/learn/social-network-analysis

ONLINE RESOURCES:

1. https:/https://mylifemynotes.files.wordpress.com/2012/03/handbook-of-social-network-technologies-and-applns-b-furht-springer-2010-bbs.pdf/nptel.ac.in/courses/112105249
2. https://freevideolectures.com/course/4824/nptel-privacy-security-in-online-social-media/21

OUTCOMES:

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

1. Identify the work on the internals components of the social network (K1).
2. Demonstrate the model and visualize the social network. (K2)
3. Use of Hadoop and map reduce in the social network. (K3)
4. Interpret the behavior of the users in the social network. (K2)
5. Analyze the possible next outcome of the social network. (K4)
6. Apply social networks in real time applications. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	2	3	3	2	3	2	3	3	3	1	3
CO2	3	2	-	2	3	3	2	2	2	3	3	3	1	3
CO3	3	2	-	2	3	3	2	2	2	3	3	3	1	3
CO4	3	2	-	2	3	3	2	3	2	3	2	3	1	3
CO5	3	3	-	3	3	3	3	1	2	3	3	3	2	3
CO6	3	2	-	2	3	3	3	1	2	3	3	3	2	3

PROFESSIONAL ELECTIVES – I

20CBEL604 SDG NO. 4	COMPUTER GRAPHICS AND MULTIMEDIA	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Develop an understanding and awareness of how issues such as content, information architecture, motion, sound, design, and technology merge to form effective and compelling interactive experiences for a wide range of audiences and end users.
- Be familiar with various software programs used i the creation and implementation of multimedia (interactive, motion/animation, presentation, etc.).
- Be aware of current issues relative between new emerging electronic technologies and graphic design (i.e. social, cultural, cognitive, etc.). understand the relationship between critical analysis and the practical application of design.
- Appreciate the importance of technical ability and creativity within design practice

UNIT I OUTPUT PRIMITIVES **9**

Basic – Line – Curve and ellipse drawing algorithms – Examples – Applications -Attributes – Two- Dimensional geometric transformations – Two-Dimensional clipping and viewing – Input techniques.

UNIT II THREE-DIMENSIONAL CONCEPTS **9**

Three-Dimensional object representations – Three-Dimensional geometric and modeling transformations – Three-Dimensional viewing – Hidden surface elimination – Color models – Virtual reality - Animation.

UNIT III MULTIMEDIA SYSTEMS DESIGN **9**

Multimedia basics – Multimedia applications – Multimedia system architecture – Evolving technologies for multimedia – Defining objects for multimedia systems – Multimedia data interface standards – Multimedia databases.

UNIT IV MULTIMEDIA FILE HANDLING **9**

Compression and decompression – Data and file format standards – Multimedia I/O technologies – Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval technologies

UNIT V HYPERMEDIA **9**

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.

TOTAL: 45 PERIODS

TEXTBOOK:

1. Donald Hearn and M. Pauline Baker, "Computer Graphics C Version", Pearson Education, 2003.
2. Andleigh, P. K and Kiran Thakrar, "Multimedia Systems and Design", PHI, 2003.

REFERENCES:

1. Judith Jeffcoate, "Multimedia in practice: Technology and Applications", PHI, 1998.
2. Foley, Vandam, Feiner and Huges, "Computer Graphics: Principles and Practice", 2nd Edition, Pearson Education, 2003.

OUTCOMES:

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

1. Understand the basic concepts in output primitives. (K2)
2. Understand and apply three dimensional concepts in animation. (K3)
3. Describe how multimedia systems are designed. (K3)
4. Manipulate multimedia file handling with various storage and retrieval techniques. (K3)
5. Discuss issues related to emerging electronic technologies and graphic design. (K2)
6. To give idea about basic building blocks of multimedia and a study about how these blocks together with the current technology and tools. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	1	-	1	2	1	-	1	-	1	-	2	2
CO2	2	2	3	2	-	1	1	-	2	-	1	-	2	3
CO3	3	1	1	1	3	2	3	-	2	-	1	3	2	3
CO4	1	-	-	2	-	1	2	-	1-	2	1	-	1	2
CO5	-	-	2	-	1	3	3	1	2	-	1	-	2	3
CO6	-	1	2	3	1	2	2	-	-	2	-	-	2	3

PROFESSIONAL ELECTIVES – I

20AMEL504 SDG NO. 4 & 9	DATA AND INFORMATION SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand Information Security basics.
- Explore legal and ethical issues in Information Security.
- Learn professional issues in Information Security.
- Study digital signatures and email security.
- Understand web security.

UNIT I INTRODUCTION **9**

History, what is Information Security? Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

UNIT II SECURITY INVESTIGATION 9

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies

UNIT III DIGITAL SIGNATURE AND AUTHENTICATION 9

Digital Signature and Authentication Schemes: Digital Signature-Digital Signature Schemes and their Variants- Digital Signature Standards-Authentication: Overview- Requirements Protocols - Applications - Kerberos - X.509 Directory Services

UNIT IV E-MAIL AND IP SECURITY 9

E-mail and IP Security: Electronic mail security: Email Architecture -PGP – Operational Descriptions- Key management- Trust Model- S/MIME.IP Security: Overview- Architecture - ESP, AH Protocols IPSec Modes – Security association - Key management.

UNIT V WEB SECURITY 9

Web Security: Requirements- Secure Sockets Layer- Objectives-Layers -SSL secure communication-Protocols - Transport Level Security. Secure Electronic Transaction- Entities DS Verification-SET processing.

TOTAL: 45 PERIODS

TEXTBOOK:

1. Michael E Whitman and Herbert J Mattord, “Principles of Information Security, Course Technology, 6th Edition, 2017.
2. Stallings William. Cryptography and Network Security: Principles and Practice, Seventh Edition, Pearson Education, 2017.

REFERENCES:

1. Harold F. Tipton, Micki Krause Nozaki, “Information Security Management Handbook, Volume 6, 6th Edition, 2016.
2. Stuart McClure, Joel Scrambray, George Kurtz, “Hacking Exposed”, McGraw-Hill, Seventh Edition, 2012.
3. Matt Bishop, “Computer Security Art and Science, Addison Wesley Reprint Edition, 2015.
4. Behrouz A Forouzan, Debdeep Mukhopadhyay, Cryptography And network security, 3rd Edition, McGraw-Hill Education, 2015.

WEB REFERENCES:

1. http://stateofthemedia.org/2012/audio-how-far-will-digital-go/audio-by-the-numbers/

OUTCOMES:

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

1. Understand the basics of data and information security. (K2)
2. Understand the legal, ethical and professional issues in information security. (K3)
3. Understand the various authentication schemes to simulate different applications. (K3)
4. Understand various security practices and system security standards. (K3)
5. Understand the Web security protocols for E-Commerce applications. (K3)
6. Demonstrate knowledge of security objectives and policy development. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	1	-	1	2	1	-	1	-	1	-	3	2
CO2	2	3	1	3	3	2	1	-	2	-	2	-	1	3
CO3	-	1	2	1	3	1	3	-	2			-	3	3
CO4	2	-	1	3	-	1	2	-	1-			-	3	2
CO5	2	-	3	-	2	3	2	2	2	1	1	-	1	3
CO6	-	1	3	2	1	3	2	3	-	-	-	-	2	3

PROFESSIONAL ELECTIVES – I

20AMEL505 SDG NO. 4 & 9	DATA SCIENCE FOR INTERNET OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the key technologies in analytics for IoT.
- To understand the IoT data and requirement of analysis.
- To gain practical, hands-on experience with statistics programming languages, tools.

UNIT I Introduction to Data Analytics 9

Defining IoT Analytics and Challenges: The situation, Defining IoT analytics, IoT analytics challenges, Business value concerns, IoT Analytics for the Cloud. Types of Analytics: Streaming Analytics, Spatial, Time Series and Prescriptive Analytics.

UNIT II Data Collection 9

Getting to know your data, Types of Data, Data collection strategies, Data Pre - processing, Feature engineering with IoT data, Exploratory Data Analytics, Descriptive Statistics, Mean, Standard Deviation, Skewness and Kurtosis.

UNIT III Data Visualization and Representation 9

Model Development Simple and Multiple Regression, Residual Plot, Distribution Plot, Polynomial Regression and Pipelines, Measures for In - sample Evaluation, Prediction and Decision Making, Box Plots, Pivot Table, Heat Map.

UNIT IV Strategies to Organize Data for Analytics 9

Linked Analytical Datasets, linking together datasets, managing data lakes, Data retention strategy, Economics of IoT Analytics, Cost considerations for IoT analytics, Thinking about revenue opportunities, The economics of predictive maintenance example, Data Analytics Life Cycle.

UNIT V Application of Analytics in IoT 9

IoT based applications, Healthcare, Marketing, Finance, Smart cities, Cyber security, video surveillance, Agriculture and Weather Forecasting and other domains; Real Time IoT-based data analysis.

TOTAL: 45 PERIODS

TEXTBOOK:

1. JojoMoolayil, "Smarter Decisions: The Intersection of IoT and Data Science", PACKT, 2016
2. Cathy O'Neil and Rachel Schutt, "Doing Data Science", O'Reilly, 2015
3. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013.
4. Andrew Minteer, "Analytics for the Internet of Things (IoT)" (1 ed.), Packt Publishing, 2017, ISBN 978-1787120730.
5. HwaiyuGeng, Internet of Things and Data Analytics Handbook (1st st ed.), Wiley, 2017, ISBN 978-1119173649.

REFERENCES:

1. Abu-Elkheir, M., Hayajneh, M., Ali, N.A.: Data management for the internet of things: design primitives and solution. Sensors 13(11), 15582–15612 (2013).
2. Riggins, F.J., Wamba, S.F.: Research directions on the adoption, usage, and impact of the internet of things through the use of big data analytics. In: Proceedings of 48th Hawaii International Conference on System Sciences (HICSS'15), pp. 1531–1540. IEEE (2015).
3. Cheng, B., Papageorgiou, A., Cirillo, F., Kovacs, E.: Geelytics: geo-distributed edge analytics for large scale iot systems based on dynamic topology. In: 2015 IEEE 2nd World Forum on Internet of Things (WF-IoT), pp. 565–570. IEEE (2015)

WEB REFERENCES:

1. http://people.howstuffworks.com/lie-detector.htm
2. http://www.vox.com/2014/8/14/5999119/polygraphs-lie-detectors-do-they-work

OUTCOMES:

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

1. Explain the fundamentals of data science and its importance. (K3)
2. Classify the evolution, roles, stages in data science projects. (K3)
3. Analyze the pre-processing and data reduction strategies. (K3)
4. Explain the different data visualization and representation techniques. (K3)
5. Evaluate the performance of algorithms in data science. (K3)
6. To familiarize the students to the basics of Internet of things and protocols. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	1	-	1	2	1	-	1	-	1	-	3	2
CO2	1	1	2	2	3	1	1	-	2	-	1	-	2	3
CO3	-	3	1	2	3	2	3	-	2	-	1	1	1	3
CO4	3	-	-	2	-	1	1	-	1-	-	1	3	3	2
CO5	-	-	2	-	1	3	2	3	2	-	1	-	3	3
CO6	3	1	3	3	1	2	3	-	2	-	-	2	2	3

PROFESSIONAL ELECTIVES – I

20ITEL806 SDG NO. 4	PATTERN RECOGNITION TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand about Unsupervised algorithms suitable for pattern classification.
- To familiarize with the Feature Selection algorithms and method of implementing them in applications.
- To learn about the basis of algorithm used for training and testing the dataset.
- To learn basic Fuzzy System and Neural Network architectures, for applications in Pattern Recognition, Image Processing and Computer Vision.

UNIT I PATTERN CLASSIFIER 9

Overview of Pattern Recognition – Discriminant Functions – Supervised Learning – Parametric Estimation – Maximum Likelihood Estimation – Bayes Theorem – Bayesian Belief Network–Naive Bayesian Classifier.

UNIT II CLUSTERING 9

Clustering Concept – Hierarchical Clustering Procedures – Partitional Clustering – Clustering of Large Data Sets – EM Algorithm – Grid Based Clustering– Density Based Clustering.

UNIT III FEATURE SELECTION AND GENERATION 9

Feature Selection-Introduction-Preprocessing -The Peaking Phenomenon-Feature Selection Based on Statistical Hypothesis Testing-The Receiver Operating Characteristics (ROC) Curve-Class Separability Measures-Feature Subset Selection-Feature Generation - Introduction - Regional Features - Features for Texture Characterization - Moments - Parametric Models-Optimal Feature Generation.

UNIT IV HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINE 9

State Machines – Hidden Markov Models - Maximum Likelihood for the HMM, Forward-Backward Algorithm - Sum and Product Algorithm for the HMM-Scaling Factors - Viterbi Algorithm - Extensions of the Hidden Markov Model – Support Vector Machines - Maximum Margin Classifiers - Relevance Vector Machines.

UNIT V RECENT ADVANCES 9

Fuzzy Classification - Fuzzy Set Theory - Fuzzy and Crisp Classification - Fuzzy Clustering - Fuzzy Pattern Recognition – Introduction to Neural Networks: Elementary Neural Network for Pattern Recognition - Hebbnet - Perceptron - ADALINE and Back Propagation.

TOTAL: 45 PERIODS

TEXTBOOK:

1. R O Duda, P.E. Hart and D.G. Stork, "Pattern Classification and Scene Analysis", John Wiley, First Edition, 2000.
2. Rajasekaran, G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications", Prentice Hall, 2010.

REFERENCES:

1. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. M. Narasimha Murthy, V. Susheela Devi, "Pattern Recognition", Springer, 2011
3. Andrew Webb, "Statistical Pattern Recognition", Arnold Publishers, 1999.
4. Robert J. Schalkoff, "Pattern Recognition: Statistical, Structural and Neural Approaches", John Wiley & Sons Inc., 2007.
5. S.Theodoridis and K.Koutroumbas, "Pattern Recognition", Fourth Edition, Academic Press, 2009.

WEB REFERENCES:

1. https://iapr.org/
2. https://www.inderscience.com/jhome.php?jcode=ijapr

OUTCOMES:

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

1. Understand basic Pattern Classification algorithms (K2)
2. Discuss different types of Clustering techniques (K2)
3. Acquire knowledge about various Feature Extraction techniques (K2)
4. Apply SVM and HMM algorithms for Real time applications (K3)
5. Describe basic Fuzzy System and Neural Network architectures, for applications in Pattern Recognition, Image Processing and Computer Vision (K2).
6. Describe basic fuzzy System and Neural Network architectures, for applications in Pattern Recognition, Image Processing and Computer Vision (K2).

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	1	1	1	-	1	-	1	-	2	2
CO2	3	3	3	3	3	1	1	-	2	-	1	-	2	2
CO3	3	3	3	3	3	1	1	-	2	-	1	-	2	2
CO4	3	3	3	3	3	1	1	-	2	-	1	-	2	2
CO5	3	3	3	3	3	1	1	1	2	-	1	-	2	2
CO6	3	3	2	3	3	2	-	-	-	-	-	-	1	1

PROFESSIONAL ELECTIVES – I

20AIEL504 SDG NO. 9, 11	INTELLECTUAL PROPERTY RIGHTS AND DESIGN THINKING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs 9

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS 9

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs **9**

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL: 45 PERIODS

TEXTBOOK:

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S. V. Satakar, "Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002

REFERENCES:

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli," Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

WEB REFERENCES:

1. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=3278de8b8471f5b623619b0452210cf998099b48

OUTCOMES:

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

1. Distinguish and explain the needs, benefits and various forms of IPRs. (K2)
2. Ability to understand IPR and registration of IPR. (K2)
3. Identify procedures to protect different forms of IPRs national and international level. (K1)
4. Understand the different acts in the IPR. (K2)
5. Identify the digital innovations and developments assets, IP laws, cyber law and digital content protection of laws. (K1)
6. Interpret the infringement of IPRs and enforcement measures of the IPR. (K2)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	1	-	1	-	2	-	-	-	-	-	-
CO2	-	-	-	1	-	1	-	2	-	-	-	-	-	-
CO3	-	-	-	1	-	1	-	2	-	-	-	-	-	-
CO4	-	-	-	1	-	1	-	2	-	-	-	-	-	-
CO5	-	-	-	1	-	1	-	2	-	-	-	-	-	-
CO6	-	-	-	1	-	1	-	2	-	-	-	-	-	-

PROFESSIONAL ELECTIVES – II

20AMEL601 SDG NO. 4 & 9	AI FOR CYBERSECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Overview cyber security issues, tools, and techniques.
- Understand computer security and cryptography.
- Develop problem-solving skills in AI cyber security.
- Learn techniques to protect Information Systems.
- Explore national security perspectives in information security.

UNIT I INTRODUCTION - Cyber Security Concepts 9

Essential Terminologies: CIA, Risks, Breaches, Threats, Attacks, Exploits. Information Gathering (Social Engineering, Foot Printing & Scanning).

UNIT II Cryptography and Cryptanalysis 9

Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography. Overview of Firewalls-Types of Firewalls, User Management, VPN Security, Security Protocols: - security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec.

UNIT III Infrastructure and Network Security 9

Introduction to System Security, Server Security, OS Security, Physical Security, Introduction to Networks, Network packet Sniffing, Network Design Simulation. DOS/ DDOS attacks. Asset Management and Audits, Vulnerabilities and Attacks. Intrusion detection and Prevention Techniques, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation.

UNIT IV Cyber Security Vulnerabilities and Safeguards 9

Internet Security, Cloud Computing & Security, Social Network sites security, Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Authorization, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, IT Audit, Authentication.

UNIT V Security in Evolving Technology 9

Biometrics, Mobile Computing and Hardening on android and ios, IOT Security, Web server configuration and Security. Introduction, Basic security for HTTP Applications and Services, Basic Security for Web Services like SOAP, REST etc., Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. William Stallings, "Cryptography and Network Security", Pearson Education/PHI, 2006.
2. V.K. Jain, "Cryptography and Network Security", Khanna Publishing House.
3. Gupta Sarika, "Information and Cyber Security", Khanna Publishing House, Delhi.
4. Atul Kahate, "Cryptography and Network Security", McGraw Hill.
5. V.K. Pachghare, "Cryptography and Information Security", PHI Learning.
6. Nina Godbole, "Information System Security", Wiley.
7. Bothra Harsh, "Hacking", Khanna Publishing House, Delhi.

ONLINE RESOURCES & WEB REFERENCES:

1. Wiafe, I., Koranteng, F.N., Obeng, E.N., Assyne, N., Wiafe, A. and Gulliver, S.R., 2020. Artificial intelligence for cybersecurity: a systematic mapping of literature. IEEE Access, 8, pp.146598-146612.
2. Consortium Enabling Cybersecurity Opportunities and Research. (n.d.). K-20 Cybersecurity - CECOR Project. Retrieved from http://cset.nsu.edu/programs/k20cybersecurity.
3. Martínez Torres, J., Iglesias Comesaña, C. & García-Nieto, P.J. Review: machine learning techniques applied to cybersecurity. Int. J. Mach. Learn. & Cyber. 10, 2823–2836 (2019). https://doi.org/10.1007/s13042-018-00906-1

OUTCOMES:

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

1. Understand Cybersecurity Fundamentals. (K2)
2. Apply Cryptographic Techniques. (K3)
3. Analyze Network Security Threats. (K4)
4. Analyze Cybersecurity Vulnerabilities. (K4)
5. Design Secure Systems. (K4)
6. Apply Security Solutions for Evolving Technologies. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	3	1	1	-	1	1	3
CO2	3	2	2	2	2	-	-	3	1	1	-	1	1	3
CO3	3	2	2	2	2	-	-	3	1	1	-	1	1	3
CO4	3	2	2	2	2	-	-	3	1	1	-	1	1	3
CO5	3	2	2	2	2	-	-	3	1	1	-	1	1	3
CO6	3	2	2	2	2	-	-	3	1	1	-	1	1	3

PROFESSIONAL ELECTIVES – II

20AMEL602 SDG NO. 4 & 9	VIRTUAL REALITY AND AUGMENTED REALITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide historical and modern overviews and perspectives on virtual reality.
- To facilitate the complete understanding of VR and AR.
- To describe the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.
- To familiarize the motion tracking in real and virtual cases with suitable devices and components.
- To enable students to analyze the applications of VR and AR in different domains.

UNIT I Introduction to Immersive Technologies 9

A Brief History of Virtual Reality- The five Classic Components of a VR System- Early Commercial VR Technology- VR Becomes an Industry- VR Becomes an Industry- VR Becomes an Industry- Current trends and state of the art in immersive technologies, developing platforms and consumer devices- The future of human experience

UNIT II Motion Tracking, Navigation and Controllers 9

Int Position and Motion Trackers- Inside Out/Outside In - Tracker Performance Parameters - Optical - Active and Passive Trackers - Optical - Active and Passive Trackers - Optical - Active and Passive Trackers - Optical - Active and Passive Trackers - Optical - Active and Passive Trackers -Position

and Motion Trackers- Tracker-Based Navigation/Manipulation Interfaces- Three-Dimensional Probes and Controllers- Data Gloves and Gesture Interfaces

UNIT III The Human behind the Lenses **9**

Human Perception and Cognition - The Human Visual System - The Human Auditory System - The Human Vestibular System - Physiology, Psychology and the Human Experience - Adaptation and Artefacts- Ergonomics - Ethics - Scientific Concerns - VR Health and Safety Issues - Effects of VR Simulations on Users -Cybersickness, before and now - Guidelines for Proper VR Usage - User Centered Design, User Experience and an Ethical Code of Conduct

UNIT IV The Present and the Future of XR **9**

Areas and industries for immersive reality applications- Entertainment - Education - Training - Medical - Industrial -Military - Use-cases, applications and production pipelines - From Sensing to Rendering - Mobile, Standalone and high- end immersive computing platforms - VR, Immersive Tech and the Society - Impact on Professional Life - Impact on Private Life - Impact on Public Life.

UNIT V Camera Tracking and 3D rendering for Immersive Environments **9**

Inside-Out Camera tracking - Depth Sensing - Microsoft HoloLens - Vrvana Totem - Low cost AR and MR systems - Mobile Platforms - Full-Body tracking - Inverse & Forward Kinematics - Kinect - Intel Real sense - Full body inertial tracking -Ikinema - Holographic Video - Rendering Architecture - Graphics Accelerators- D Rendering API's, OpenGL, DirectX, Vulcan, Metal - Best practices and Optimization techniques - Distributed VR Architectures - Multi-pipeline Synchronization - Co-located Rendering Pipelines - Distributed Virtual Environments.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016.
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002.
3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.

REFERENCES:

1. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach",2005.
2. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2005.
3. Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Meging Real and Virtual Worlds", 2005.
4. Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Interscience, India, 2003.

OUTCOMES:

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

1. Describe the basics of VR and AR. (K3)
2. Describe how VR systems work and list the applications of VR. (K3)
3. Understand the design and implementation of the hardware that enables VR systems to be built. (K4)
4. Explain the concepts of motion and tracking in VR systems. (K3)
5. List and comprehend the suitable components and devices required for AR. (K3)
6. Conduct an inter disciplinary research in Various fields such as manufacturing systems through AR and VR. (K4)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	-	-	-	-	2	1	3	-	3	2
CO2	3	2	2	3	-	-	1	-	-	-	2	-	2	1
CO3	3	3	3	3	-	-	-	-	-	-	3	-	3	1
CO4	3	3	3	3	-	-	-	-	-	-	3	-	2	2
CO5	3	3	3	3	-	-	-	-	-	-	3	-	3	2
CO6	3	3	3	3	-	-	-	-	-	-	3	-	3	2

PROFESSIONAL ELECTIVES – II

20AMEL603 SDG NO. 4 & 9	FUZZY SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To develop the fundamental concepts such as fuzzy sets, operations and fuzzy relations.
- To learn about the fuzzification of scalar variables and the defuzzification of membership functions.
- To learn three different inference methods to design fuzzy rule-based systems.
- To develop fuzzy decision making by introducing some concepts and also Bayesian decision methods.
- To learn different fuzzy classification methods.

UNIT I CLASSICAL SETS 9

Operations and properties of classical sets, Mapping of classical sets to the functions. Fuzzy sets - Membership functions, Fuzzy set operations, Properties of fuzzy sets. Classical and Fuzzy relations: Cartesian product, Crisp relations-cardinality, operations and properties of crisp relations. Fuzzy relations-cardinality, operations, properties of fuzzy relations, fuzzy Cartesian product and composition, Fuzzy tolerance and equivalence relations, value assignments and other formats of the composition operation.

UNIT II FUZZIFICATION AND DEFUZZIFICATION 9

Natural language, Linguistic hedges, Fuzzy (Rule based) System, Aggregation of fuzzy rules, Graphical techniques of inference, Membership value assignments: Intuition, Inference, rank ordering, Fuzzy Associative memories.

UNIT III FUZZY SYSTEMS 9

The Logic of Hypothesis Testing- Single Tail and Two Tail Hypothesis Tests-Application of Hypothesis Test -Hypothesis Test for a Population Proportion-Differences in Mean- Applications of the Difference-In-Means Hypothesis Test- The Equal & Unequal Variance Assumption and the Paired t-test for difference in means.

UNIT IV FUZZY DECISION MAKING 9

Fuzzy synthetic evaluation, Fuzzy ordering, Preference and consensus, Multi objective decision making, Fuzzy Bayesian, Decision method, Decision making under Fuzzy states and fuzzy actions.

UNIT V FUZZY CLASSIFICATION 9

Classification by equivalence relations-crisp relations, Fuzzy relations, Cluster analysis, Cluster validity, C-Means clustering, Hard C-Means clustering, Fuzzy C-Means algorithm, Classification metric, Hardening the Fuzzy C-Partition.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Timothy J. Ross - Fuzzy logic with engineering applications, 3rd edition, Wiley,2010.
2. George J. KlirBo Yuan - Fuzzy sets and Fuzzy logic theory and Applications, PHI, New Delhi,1995.
3. S. Rajasekaran, G. A. Vijayalakshmi - Neural Networks and Fuzzy logic and Genetic Algorithms, Synthesis and Applications, PHI, New Delhi,2003.

REFERENCES:

1. Klir.G, Yuan B.B. "Fuzzy sets and Fuzzy Logic Prentice Hall of India private limited, 1997.
2. Laurance Fausett, "Fundamentals of Neural Networks", Prentice Hall, 1992.
3. Gen, M. and Cheng R. "Genetic Algorithm and Engineering Design", John wiley 1997.

WEB RESOURCES:

1. http://www.nptel.ac.in/syllabus/syllabus.php?subjectId=111106048
2. https://nptel.ac.in/courses/127105006
3. https://nptel.ac.in/courses/108104157

OUTCOMES:

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

1. Develop the skill in basic understanding on Fuzzy and Neural Network. (K3)
2. Understand the basic features of membership functions, fuzzification process and defuzzification process. (K3)
3. Design a fuzzy rule-based system. (K4)
4. Foster competence in recognizing the feasibility and applicability of the design and implementation of Decision-making Systems (that employ fuzzy logic) for specific application areas. (K3)
5. Interpret the knowledge about fuzzy C-Means clustering. (K3)
6. Analyze various Fuzzy classification Techniques. (K4)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	0	3	-	1	-	-	-	-	3	3	2	2
CO2	3	3	3	1	-	1	-	-	-	-	3	3	2	2
CO3	3	3	2	1	-	1	-	-	-	-	3	3	2	2
CO4	3	3	2	1	-	1	-	-	-	-	3	3	2	2
CO5	3	3	2	1	1	3	1	-	-	-	3	3	2	2
CO6	3	3	2	1	1	3	1	-	-	-	3	3	2	2

PROFESSIONAL ELECTIVES – II

20AMEL604 SDG NO. 4 & 9	STATISTICS FOR BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand business analytics fundamentals across various sectors.
- To master descriptive statistics and data visualization techniques.
- To model uncertainty and perform statistical inference for decision-making.
- To apply big data analytics using Hadoop and MapReduce frameworks.
- To explore additional data analytical frameworks and tools like Apache Spark and NoSQL databases.

UNIT I OVERVIEW OF BUSINESS ANALYTICS 9

Introduction – Drivers for Business Analytics – Applications of Business Analytics: Marketing and Sales, Human Resource, Healthcare, Product Design, Service Design, Customer Service and Support – Skills Required for a Business Analyst – Framework for Business Analytics Life Cycle for Business Analytics Process.

UNIT II ESSENTIALS OF BUSINESS ANALYTICS 9

Descriptive Statistics – Using Data – Types of Data – Data Distribution Metrics: Frequency, Mean, Median, Mode, Range, Variance, Standard Deviation, Percentile, Quartile, z-Score, Covariance, Correlation – Data Visualization: Tables, Charts, Line Charts, Bar and Column Chart, Bubble Chart, Heat Map – Data Dashboards.

UNIT III MODELING UNCERTAINTY AND STATISTICAL INFERENCE 9

Modeling Uncertainty: Events and Probabilities – Conditional Probability – Random Variables – Discrete Probability Distributions – Continuous Probability Distribution – Statistical Inference: Data Sampling – Selecting a Sample – Point Estimation – Sampling Distributions – Interval Estimation – Hypothesis Testing.

UNIT IV ANALYTICS USING HADOOP AND MAPREDUCE FRAMEWORK9

Introducing Hadoop – RDBMS versus Hadoop – Hadoop Overview – HDFS (Hadoop Distributed File System) – Processing Data with Hadoop – Introduction to MapReduce – Features of MapReduce – Algorithms Using Map-Reduce: Matrix-Vector Multiplication, Relational Algebra Operations, Grouping and Aggregation – Extensions to MapReduce.

UNIT V OTHER DATA ANALYTICAL FRAMEWORKS 9

Overview of Application development Languages for Hadoop – Pig Latin – Hive – Hive Query Language (HQL) – Introduction to Pentaho, JAQL – Introduction to Apache: Sqoop, Drill and Spark, Cloudera Impala – Introduction to NoSQL Databases – HBase and MongoDB.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Vignesh Prajapati, "Big Data Analytics with R and Hadoop", Packt Publishing, 2013.
2. Umesh R Hodeghatta, Umesh Nayak, "Business Analytics Using R – A Practical Approach", A press, 2017.

REFERENCE BOOK:

1. Anand Rajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
2. Jeffrey D. Camm, James J. Cochran, Michael J. Fry, Jeffrey W. Ohlmann, David R. Anderson, "Essentials of Business Analytics", Cengage Learning, second Edition, 2016
3. U. Dinesh Kumar, "Business Analytics: The Science of Data-Driven Decision Making", Wiley, 2017.
4. A. Ohri, "R for Business Analytics", Springer, 2012 7. Rui Miguel Forte, "Mastering Predictive Analytics with R", Packt Publication, 2015.

ONLINE RESOURCES:

1. https://onlinecourses.swayam2.ac.in/aic20_sp06/preview
2. https://onlinecourses.swayam2.ac.in/arp19_ap79/preview

OUTCOMES:

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

1. Understand and critically apply the concepts and methods of business analytics. (K2)
2. Demonstration of the various methodologies of descriptive statistics. (K3)
3. Understanding of modeling uncertainty and statistical inference. (K2)
4. Understanding of analytical frameworks. (K2)
5. Understand basic probability concepts and apply various probability distributions to solve business problems. (K2)
6. Make informed decisions in the dynamic world of business analytics. (K4)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	1	-	1	1	1	-	1	-	1	-	2	2
CO2	2	2	2	2	3	1	1	-	2	-	1	-	2	3
CO3	-	1	1	1	3	2	3	-	2	-	1	-	2	3
CO4	-	-	-	-	-	1	1	-	1-	-	1	-	1	2
CO5	-	-	2	-	1	3	3	3	2	-	1	-	2	3
CO6	-	1	2	3	1	2	-	-	-	-	-	-	2	3

PROFESSIONAL ELECTIVES – II

20AMEL605 SDG NO. 4 & 9	DATA ACQUISITION SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explore the fundamental concepts of data pre-processing, extraction, cleaning, annotation, integration.
- To understand the various information visualization techniques.
- To understand data productization using the Internet of things.

UNIT I Introduction to Data Warehouse **9**

OLTP and OLAP concepts, Introduction to Data Mining, Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Exploratory Data analysis, Measuring Data Similarity and Dissimilarity, Graphical representation of data.

UNIT II Introduction to Data Acquisition 9

Applications, Process, Data Extraction, Data Cleaning and Annotation, Data Integration, Data Reduction, Data Transformation, Data Discretization and Concept Hierarchy Generation.

UNIT III Visualization 9

Introduction, Terminology, Basic Charts and Plots, Multivariate Data Visualization, Data Visualization Techniques, Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations, Data Visualization Tools, Rank Analysis Tools, Trend Analysis Tools, Multivariate Analysis Tools, Distribution Analysis Tools, Correlation Analysis Tools, Geographical Analysis Tools.

UNIT IV IoT Overview 9

IoT Design methodology, Semantic Web Infrastructure, Intelligence Applications, Programming Framework for IoT, Distributed Data Analysis for IoT, Security and Privacy in IoT, Applied IoT, Cloud Based Smart Facilities Management.

UNIT V Virtualization on Embedded Boards IoT 9

Stream Processing in IoT, Internet of Vehicles and Applications, Case study on Data Acquisition using Dashboards, Android, and iOS apps.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Han, Jiawei, Jian Pei, and Micheline Kamber, “Data mining: concepts and techniques”, 3rd Edition, Elsevier, 2011.
2. Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education, 2012.
3. Arshdeep Bahga, Vijay Madisetti, “Internet of Things -A hands-on approach”, Universities Press, 2015.

REFERENCE BOOKS:

1. Manoel Carlos Ramon, “Intel Galileo and Intel Galileo Gen
2. API Features and Arduino Projects for Linux Programmers”, Apress, 2014. 2. Karl Pover, “Learning Qlikview Data Visualization”, Packt, 2013.
3. Rajkumar Buyya, Amir Vahid Dastjerdi, “Internet of Things: Principles and Paradigms”, Elsevier, 2016.

ONLINE RESOURCES:

1. https://www.youtube.com/watch?v=I_9Pwyxhe40&t=18s

OUTCOMES:

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

1. Recall Fundamentals of Data Warehousing. (K2)
2. Apply Data Acquisition Techniques. (K3)
3. Analyze and Visualize Data. (K4)
4. Analyze IoT Design Methodologies. (K4)
5. Design IoT Applications. (K4)
6. Implement IoT Solutions. (K4)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	1	-	-	1	1	1	-	1	-	1	-	2
CO2	2	2	2	2	-	3	1	1	-	2	-	1	-	2
CO3	-	1	1	1	-	3	2	3	-	2	-	1	-	2
CO4	-	-	-	-	-	-	1	1	-	1	-	1	-	1
CO5	-	-	2	-	-	1	3	3	3	2	-	1	-	2
CO6	-	1	2	3	-	1	2	-	-	-	-	-	-	2

PROFESSIONAL ELECTIVES – II

20CBEL504 SDG NO. 4	WEB TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand different Internet Technologies.
- To learn java-specific web services architecture
- To understand dynamic web pages using server-side scripting
- To get an introduction about various Scripting Languages.
- To know techniques involved to support real-time Software development.

UNIT I WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0 9

Web Essentials: Clients, Servers and Communication – The Internet – Basic Internet protocols – World wide web – HTTP Request Message – HTTP

Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Semantic elements – Drag and Drop – Audio – Video controls - CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.

UNIT II CLIENT-SIDE PROGRAMMING 9

Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects, - Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling DHTML with JavaScript- JSON introduction – Syntax – Function Files – Http Request – SQL.

UNIT III SERVER-SIDE PROGRAMMING 9

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions-Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server- DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example - JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.

UNIT IV PHP and XML 9

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in Functions-Form Validation- Regular Expressions - File handling – Cookies - Connecting to Database. XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

UNIT V INTRODUCTION TO AJAX and WEB SERVICES 9

AJAX: Ajax Client Server Architecture-XML Http Request Object-Callback Methods; Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application –SOAP.

TOTAL: 45 PERIODS

TEXTBOOK:

1. Deitel and Deitel and Nieto, "Internet and World Wide Web - How to Program", Prentice Hall, 5th Edition, 2011.

REFERENCES:

1. Stephen Wynkoop and John Burke "Running a Perfect Website", QUE, 2nd Edition,1999.
2. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2009.

3. Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective", Pearson Education, 2011.
4. Gopalan N.P. and Akilandeswari J., "Web Technology", Prentice Hall of India, 2011.
5. UttamK.Roy, "Web Technologies", Oxford University Press, 2011.

OUTCOMES:

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

1. Construct a basic website using HTML and Cascading Style Sheets. (K3)
2. Build dynamic web pages with validation using JavaScript objects and by applying different event handling mechanisms. (K3)
3. Develop server-side programs using Servlets and JSP. (K3)
4. Use PHP for designing simple web pages. (K3)
5. Representation of data in XML format, XSL and XSLT Transformation. (K3)
6. Understand AJAX and web services to develop interactive web applications. (K2)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	-	-	-	-	-	-	2	2	2
CO2	3	2	2	1	1	-	-	-	-	-	-	2	2	2
CO3	2	2	2	1	1	-	-	-	-	-	-	2	2	2
CO4	2	2	2	1	1	-	-	-	-	-	-	2	2	2
CO5	2	1	2	1	1	-	-	-	-	-	-	2	2	2
CO6	3	2	2	1	1	-	-	-	-	-	-	2	2	2

PROFESSIONAL ELECTIVES – II

20AIEL601 SDG NO. 9	ETHICAL HACKING AND SYSTEM DEFENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The primary objective of this course is to evaluate the security of and identify vulnerabilities in target systems, networks or system infrastructure.
- Understand the core foundations of ethics in regards to computer security.
- Learn about the hacker mindset and the history of hackers.
- Learn about basic system defense infrastructure.

UNIT I INTRODUCTION TO ETHICAL HACKING 9

Introduction-Ethical hacking Terminology-types of hacking technologies-phases of ethical hacking Foot Printing-Social Engineering-Scanning and enumeration Practical: hacking the server (through virtual machine).

UNIT II SYSTEM HACKING 9

Understanding the password hacking techniques-Rootkits-Trojans-Back doors-Viruses and worms sniffers-denial of service-Session hijacking. Practical: Password hacking.

UNIT III TCP/IP OVERVIEW CONCEPTS AND PORT SCANNING 9

Overview of TCP/IP-IP addressing-numbering systems- Introduction to port scanning-types of port scan port scanning tools-ping sweeps- Understanding Scripting-Enumeration. Practical: Identifying vulnerabilities in OS.

UNIT IV DESKTOP AND SERVER OS VULNERABILITIES 9

Windows OS vulnerabilities-tools for identifying vulnerabilities in windows-Linux OS vulnerabilities of embedded OS.

UNIT V NETWORK PROTECTION SYSTEMS 9

Understanding routers-understanding firewalls-risk analysis tools for firewalls- understanding intrusion and detection and prevention systems-honeypots. Mini Project.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Michael T. Simpson, Kent Backman, James Corley —Hands-On Ethical Hacking and Network Defense,2016.

2. Steven DeFino, Barry Kaufman, Nick Valenteen —Official Certified Ethical Hacker Review Guide,2015

REFERENCES:

1. The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy (Syngress Basics Series).

E BOOKS:

1. https://www.nationalcyberwatch.org/resource/ethical-hacking-systems-defense-national- cyberwatch-center-edition/

WEB REFERENCES:

1. https://nptel.ac.in/courses/106105217
2. https://www.coursera.org/learn/hacking-patching

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106105217

OUTCOMES:

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

1. Understand the concepts of ethical hacking. (K1)
2. Understand the concepts of System hacking. (K2)
3. Analyze how to perform TCP/IP and Port scanning. (K2)
4. Identify the desktop and server OS vulnerabilities. (K3)
5. Analyze how penetration testing and ethical hacking fit into a comprehensive enterprise information security program (K2)
6. Enumerate various attacks and its counter measures. (K2)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	3	3	-	2	-	2	-	1	2	2
CO2	2	2	-	2	2	3	2	2	-	2	-	1	2	2
CO3	2	2	3	3	3	3	3	1	3	2	-	1	2	2
CO4	2	2	2	-	2	3	2	2	3	3	-	1	2	2
CO5	2	2	-	-	2	3	3	1	3	3	-	1	2	2
CO6	2	2	2	-	3	3	2	1	3	3	-	1	2	2

PROFESSIONAL ELECTIVES – II

20AMEL607 SDG NO. 4	SOFTWARE AND PROGRAMMING IN IOT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Comprehend IoT Concepts and Architecture
- Master IoT Programming Skills
- Implement Embedded Systems and Microcontroller Programming
- Apply Data Processing and Analytics Techniques

UNIT I INTRODUCTION TO IOT AND SOFTWARE BASICS 9

Overview of Internet of Things (IoT) and its significance - Understanding the architecture of IoT systems - Basics of software development in IoT - Introduction to programming languages commonly used in IoT (e.g., Python, C/C++, Java) - Setting up development environments and tools for IoT programming.

UNIT II EMBEDDED SYSTEMS AND MICROCONTROLLER PROGRAMMING 9

Introduction to embedded systems and microcontrollers - Understanding the role of microcontrollers in IoT devices - Programming microcontrollers using C/C++ or Arduino IDE - Interfacing sensors and actuators with microcontrollers - Hands-on projects to demonstrate microcontroller programming for IoT applications.

UNIT III COMMUNICATION PROTOCOLS FOR IOT 9

Overview of communication protocols used in IoT (e.g., MQTT, CoAP, HTTP, Web Sockets) - Understanding the differences between various IoT communication protocols - Implementing communication protocols in IoT applications - Security considerations in IoT communication - Hands-on exercises to implement communication protocols in IoT projects.

UNIT IV DATA PROCESSING AND ANALYTICS IN IOT 9

Introduction to data processing and analytics in IoT - Handling sensor data streams in real-time - Data aggregation, filtering, and transformation techniques - Introduction to edge computing and its role in IoT data processing - Hands-on projects to implement data processing and analytics in IoT applications.

UNIT V IOT APPLICATIONS AND CASE STUDIES 9

Exploring real-world IoT applications across various domains (e.g., smart home, healthcare, agriculture, industrial IoT) - Case studies highlighting successful IoT implementations - Design principles and best practices for developing IoT applications - Ethical and societal implications of IoT technology - Final project: students design and implement an IoT application incorporating concepts learned throughout the course.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. "Internet of Things: Principles and Paradigms" by Rajkumar Buyya, Amir Vahid Dastjerdi, and Sriram Guruprasad.
2. Embedded Systems: Introduction to ARM Cortex-M Microcontrollers" by Jonathan Valvano.
3. "IoT Solutions in Microsoft's Azure IoT Suite: Data Acquisition and Analysis in the Real World" by Scott Klein and Chris Green
4. "Programming Internet of Things: A Getting Started Guide to Building IoT Applications" by Andy King.

REFERENCE BOOKS:

1. "Designing Connected Products: UX for the Consumer Internet of Things" by Claire Rowland, Elizabeth Goodman, Martin Charlier, and Ann Light.
2. "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things" by David Hanes, Gonzalo Salgueiro, Patrick Grossetete
3. "Building Wireless Sensor Networks: with ZigBee, XBee, Arduino, and Processing" by Robert Faludi
4. "Practical Industrial Internet of Things Security" by Sravani Bhattacharjee and Ray Doerr

WEB REFERENCES:

1. https://www.iotforall.com/
2. https://www.arduino.cc/en/Tutorial

ONLINE REFERENCES:

1. https://www.raspberrypi.org/documentation/
2. https://learn.microsoft.com/en-us/azure/iot-fundamentals/
3. https://www.hivemq.com/mqtt-essentials/

OUTCOMES:

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

1. Proficiency in programming languages commonly used in IoT, such as Python, C/C++, or Java, to develop software for IoT devices and applications. (K3)
2. Understanding of IoT architectures, communication protocols, and standards, enabling them to design and implement efficient IoT solutions. (K3)
3. Acquire the skills to develop embedded systems and program microcontrollers for IoT applications, including interfacing with sensors and actuators. (K3)
4. Able to process, analyze, and manage data generated by IoT devices, implementing techniques such as real-time data processing, aggregation, and filtering. (K4)
5. Ability to design, develop, and deploy IoT applications across various domains, incorporating best practices for software development in IoT. (K4)
6. Develop an awareness of security considerations in IoT, including data privacy, authentication, and encryption, as well as ethical and societal implications of IoT technology. (K4)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	-	3	3	-	2	3	-	-	-	2	3
CO2	2	1	1	-	3	-	3	3	3	-	-	-	3	3
CO3	1	1	-	-	3	3	-	3	3	-	-	-	3	3
CO4	3	2	1	1	3	2	1	1	2	-	-	-	1	2
CO5	3	3	-	2	2	1	1	1	2	-	-	-	1	2
CO6	3	2	-	-	2	2	1	1	2	-	-	-	1	2

PROFESSIONAL ELECTIVES – II

20AMEL608 SDG NO. 3, 4 & 9	SENSORS AND TRANSDUCERS IN HEALTHCARE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the purpose of measurements and characteristics.
- To know the principle of transduction, classification and the characteristics of transducers.
- To know the different bridges for measurement.
- To know the different display and recording devices.

UNIT I SENSOR BASED MEASUREMENT SYSTEM 9

Generalized measurement system- Sensor classification- Static characteristics- Dynamic characteristics- Primary sensors and materials for sensors.

UNIT II DISPLACEMENT, PRESSURE AND TEMPERATURE SENSORS 9

Strain Gauge: Gauge factor- Sensing elements- Bonded and Unbonded strain gauge, Capacitive transducer, Inductive transducer, LVDT, Pressure transducer, Temperature Sensors: Passive type: RTD materials and range- Relative resistance versus temperature characteristics, Characteristics of Thermistor, Active type: Characteristics of Thermocouple, Case Study: Sensors for Environmental monitoring.

UNIT III PHOTOELECTRIC AND PIEZOELECTRIC SENSORS 9

Phototube - Scintillation counter - Photomultiplier tube - Photovoltaic - Photoconductive cells - Photo detector -Phototransistor - Comparison of photoelectric transducers, Optical displacement sensors, Piezoelectric active transducer: Equivalent circuit and its characteristics, Case study: Optical sensors for diagnosis - Oxygen Saturation monitor.

UNIT IV SIGNAL CONDITIONING CIRCUITS 9

Functions of signal conditioning circuits – Preamplifiers, Concepts of passive filters, Impedance matching circuits, AC and DC Bridges: Wheatstone, Kelvin, Maxwell, Hay, Schering.

UNIT V DISPLAY AND RECORDING DEVICES 9

Digital voltmeter, Multimeter, CRO: Block diagram, CRT, Vertical & horizontal deflection system, DSO, LCD monitor, PMMC writing systems, Servo recorders,

Photographic recorder, Magnetic tape recorder, Inkjet recorder, Thermal recorder.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. A.K. Sawhney, "Electrical & Electronics Measurement and Instrumentation", Dhanpat Rai & Co, New Delhi, 2017.
2. John G. Webster, "Medical Instrumentation Application and Design", Wiley India Pvt Ltd, New Delhi, 2020.

REFERENCES

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2015.
2. Albert D. Helfrick, William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, New Delhi, 2016.
3. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2014.
4. Banshi Dhar Gupta, Anand Mohan Shrivastav and Sruthi Prasood Usha, "Optical Sensors for Biomedical Diagnostics and Environmental Monitoring", CRC Press, New York, 2018.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_ee41/preview
2. http://www.nptelvideos.in/2012/11/industrial-instrumentation.html
3. https://nptel.ac.in/content/storage2/courses/112103174/pdf/mod2.pdf

ONLINE RESOURCES:

1. https://instrumentationtools.com/tag/sensors-and-transducers-nptelpdf/
2. https://electronics-tutorials.ws/io/io

OUTCOMES:

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

1. Measure various electrical parameters with accuracy, precision, resolution (K3)
2. Select appropriate passive or active transducers for measurement of physical phenomenon (K2).
3. Analyze the problems related to sensors & transducers (K2)

4. Understand Photoelectric and Piezoelectric Sensors with its equivalent circuits. (K3)
5. Use AC and DC bridges for relevant parameter measurement (K3)
6. Employ multimeter, CRO, and recorders for appropriate measurements (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	2	3	-	-	-	-	2	1	2	3
CO2	3	2	2	1	2	3	-	-	-	-	2	2	2	3
CO3	3	2	2	1	2	3	-	-	-	-	2	1	1	3
CO4	3	2	2	1	2	3	-	-	-	-	2	1	1	3
CO5	3	2	2	1	2	3	-	-	-	-	2	1	1	3
CO6	3	2	2	1	2	3	-	-	-	-	2	1	1	3

PROFESSIONAL ELECTIVES – II

20AMEL609 SDG NO. 4	ACCOUNTING AND FINANCIAL MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire and practice knowledge in internal accounting systems, including cost classification and behavior.
- To understand and apply cost-volume-profit analysis for strategic decision-making.
- To master budgeting and variance analysis techniques.
- To understand various financial management concepts for effective financial decision-making.
- To enhance decision-making skills using financial and accounting insights.

UNIT I MECHANICS OF FINANCIAL ACCOUNTING 9

Accounting – Meaning – Objectives - Scope of Accounting -GAAP - Introduction to Financial, Cost and Management Accounting – Preparation of Trading, Profit and Loss account and Balance sheet - Uses - Inflation Accounting - Human Resources Accounting.

UNIT II CORPORATE ACCOUNTING 9

Company Accounts – Meaning – Issue of Shares – Forfeiture – Reissue - Final Accounts of Company-Profit prior to incorporation – Employee stock option Buy-back of securities.

UNIT III FINANCIAL STATEMENT ANALYSIS 9

Analysis of financial statements – Significance – Classifications – Comparative statement – Common size balance sheet - Ratio analysis – Uses and Abuses - Fund flow and Cash flow (as per Accounting Standard 3) statement. - Analysis of Annual Reports -Manufacturing -Trading and Service Sector

UNIT IV FINANCIAL MANAGEMENT – AN OVERVIEW 9

Finance – Objectives, Goals and Scope of Financial Management; Organization of Finance Function and Role of Finance Managers in Emerging Business Scenario. Time Value of Money. Concept of Risk and Return, Option valuation.

UNIT V FINANCIAL PLANNING & DECISIONS 9

Capital Structure – Meaning, Pattern of Capital Structure, Optimum Capital Structure, Factors of Capital Structure – Financial Decision, Capital Structure Theories. Leverages-Financial and Operating Leverage, Dividend Policy, Forms of Dividends, Theories of Dividend Policy, Dividend Policy Practices in Indian and MNC's, Bonus Issue, Right Issue, Share splits.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. M.Y. Khan & P.K. Jain, "Management Accounting", Tata McGraw Hill, 5th edition,2009.
2. R. Narayanaswamy, "Financial Accounting – A managerial perspective", PHI Learning, NewDelhi,4th edition,2011.
3. Vanhorne, James C: Financial Management and Policy; Prentice Hall of India, New Delhi,2008.
4. Pandey, I. M.: Financial Management; Vikas Publishing House, New Delhi, 2015.

REFERENCE BOOKS:

1. Jan Williams, "Financial and Managerial Accounting – The basis for business Decisions", TataMcGrawHillPublishers,15th edition,2011.
2. Horngren, Surdem, Stratton, Burgstahler, Schatzberg, "Introduction to Management Accounting" , PHI Learning,16th edition,2013.
3. Stice & Stice, "Financial Accounting Reporting and Analysis", Cengage Learning,11th edition2010.

4. Singhvi Bodhanwala, "Management Accounting - Text and cases", PHI Learning,2008.

WEB REFERENCES:

1. https://www.icai.org/new_post.html?post_id=2805
2. https://www.saralaccounts.com/blogs/indian-accounting-standards/
3. https://www.taxmann.com/blogpost/2000000574/accountingstandards.aspx
4. https://www.managementstudyguide.com/financial-management.htm
5. https://icmai.in/upload/Students/Syllabus-2008/Study Material Final/P-12.pdf
6. https://www.oreilly.com/library/view/fundamentals-of-financial/9789332508170/

REFERENCES:

1. https://swayam.gov.in/nd2_cec20_mg23/preview
2. https://swayam.gov.in/nd2_imb20_mg31/preview
3. https://www.edx.org/course/management-accounting
4. https://nptel.ac.in/courses/110/107/110107144/
5. https://nptel.ac.in/courses/110/106/110106147/
6. https://www.udemy.com/course/financial-management-a-completestudy/

OUTCOMES:

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

1. To learn the basic concepts of financial, cost and management accounting. (K2)
2. Understand the interpretation of various financial, cost and management accounting results. (K3)
3. Enable to enhance skills in accounting decision making in management professions. (K3)
4. Enable to learn and gain basic concepts of financial management. (K3)
5. Understand the role of financial management for performing business. (K3)
6. Gain knowledge for financial oriented problem solving in an organization. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	-	3	3	-	2	3	-	-	-	2	3
CO2	2	1	1	-	3	-	3	3	3	-	-	-	3	3
CO3	1	1	-	-	3	3	-	3	3	-	-	-	3	3
CO4	3	2	1	1	3	2	1	1	2	-	-	-	1	2
CO5	3	3	-	2	2	1	1	1	2	-	-	-	1	2
CO6	3	2	-	-	2	2	1	1	2	-	-	-	1	2

PROFESSIONAL ELECTIVES – III

20AIEL705 SDG NO. 4 & 9	EXPERT SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To grasp expert systems fundamentals including their development and application.
- To learn knowledge representation techniques used in expert systems.
- To master reasoning methods in expert systems, including inference rules.
- To understand uncertainty management in expert systems with probability theories.
- To apply expert system development practices in practical scenarios.

UNIT I INTRODUCTION **9**

The meaning of an expert system, problem domain and knowledge domain, the advantages of an expert system, general stages in the development of an expert system, general characteristics of an expert system, history and uses of expert systems today, rule-based expert systems, procedural and nonprocedural paradigms, characteristics of artificial neural systems.

UNIT II KNOWLEDGE REPRESENTATION **9**

The study of logic, difference between formal logic and informal logic, meaning of knowledge, how knowledge can be represented, semantic nets, how to translate semantic nets into PROLOG, limitations of semantic nets, schemas, frames and their limitations, how to use logic and set symbols to represent knowledge, the meaning of propositional and first order predicate logic, quantifiers, limitations of propositional and predicate logic.

UNIT III REASONING **9**

Trees, lattices, and graphs, state and problem spaces, AND-OR trees and goals, methods of inference, rules of inference, limitations of propositional logic, logic systems, resolution rule of inference, resolution systems, and deduction, shallow and causal reasoning, applying resolution to first-order predicate logic, forward and backward chaining, additional methods of reference, Meta knowledge, the Markov decision process.

UNIT IV UNCERTAINTY **9**

The meaning of uncertainty and theories devised to deal with it, types of errors attributed to uncertainty, errors associate, with induction, features of classical

probability, experimental and subjective probabilities, compound and conditional probabilities, hypothetical reasoning and backward induction, temporal reasoning, Markov chains, odds of belief, sufficiency and necessity, role of uncertainty in inference chains, implications of combining evidence, role of inference nets in expert systems, how probabilities are propagated.

UNIT V EXPERT SYSTEM 9

Sources of uncertainty in rules, methods of dealing with uncertainty, Dempster-Shafer theory, theory of uncertainty based on fuzzy logic, commercial applications of fuzzy logic. How to select an appropriate problem, the stages in the development of an expert system, types of errors to expect in the development stages, the role of the knowledge engineer in the building of expert systems, the expected life cycle of an expert system, how to do a life cycle model.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. J. Giarratano and G. Riley, "Expert Systems -- Principles and Programming". 4th Edition, PWS Publishing Company, 2004.
2. Durkin, J., Expert systems Design and Development, Macmillan, 1994 2. Elias M. Awad, Building Expert Systems, West Publishing Company 1996.
3. Peter Jackson, Introduction to Expert Systems, Addison Wesley Longman, 1999.ISBN 0- 20187686-8.
4. Gonzalez and D. Dankel, "The Engineering of Knowledge-Based Systems'', Prentice Hall, 1994.
5. Nikolopoulos, "Expert Systems", Marcel Dekker Inc. 1997. ISBN 0 8247 9927.

REFERENCE BOOKS:

1. "Artificial Intelligence: A Guide to Intelligent Systems" by Michael Negnevitsky
2. "Expert Systems: Principles and Programming" by Joseph C. Giarratano and Gary D. Riley
3. "Principles of Expert Systems" by Peter Lucas and Linda van der Gaag
4. "Artificial Intelligence: Structures and Strategies for Complex Problem Solving" by George F. Luger

WEB REFERENCES:

1. https://plato.stanford.edu/entries/logic-ai/
2. https://www.aaai.org/

OUTCOMES:

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

1. Understand the basic concepts of expert systems. (K2)
2. Apply the intelligent techniques for problem solving(K1)
3. Understand the various types of Knowledge Representation techniques. (k2)
4. Understand advanced learning techniques. (k2)
5. Solve various problems using Expert system. (k2)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	1	2	1	3
CO2	3	3	3	3	3	2	-	-	-	-	1	1	1	3
CO3	3	2	3	3	3	-	-	-	-	-	-	-	1	3
CO4	3	3	2	3	3	-	-	2	2	-	2	1	1	3
CO5	3	3	3	3	3	-	-	-	-	-	2	3	1	3
CO6	3	3	3	3	3	-	-	-	-	-	2	1	1	3

PROFESSIONAL ELECTIVES – III

20AMEL701 SDG NO. 4 & 9	DECISION MAKING UNDER UNCERTAINTY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To become aware of the scope of management problems that can be addressed with stochastic optimization models; and learn to identify opportunities for creating value using these models;
- To develop models that can be used to improve decision making under uncertainty within an organization;
- To Sharpen their ability to structure problems and to perform logical analyses.
- To know how to assess the significance of model outputs for managerial insights and action.

UNIT I Background and Introduction **9**

Risk, uncertainty and variability; probability, random variables and expectation; optimization criteria; types of decisions Simple Static Stochastic

Optimization Models - Using data to model currency exchange rates, stock prices, commodity prices, air travel demand - Brief introduction to Monte Carlo simulation - Optimal financial hedging strategies - Supply contract selection

UNIT II Decision Tree and Rules 9

Introduction to decision tree - Value of information - Bayesian update -Real Options and Decision Tree - Value an R&D project: managing technology risk - Value a license agreement - Options to postpone, expand, and contract

UNIT III Sequential Decision Making 9

Sequential Decision Making: Implementing Simple Policies - Inventory management at a retail pharmacy - Optimal timing for market entry Forecasting Methods - Moving average - Trends - Seasonality-Re-optimization - linear programming

UNIT IV Strategic and Operational Programming 9

stochastic programming; Simpson's Paradox; Markov decision process Chance-Constrained Stochastic Optimization - Capital budgeting: when projects have uncertain NPVs and uncertain capital usage - Production strategy: managing quality risk of raw materials - Value-at-risk0: Combing Simulation with Linear Optimization - Plant location for a multinational firm: hedging currency exchange risk - Process flexibility: hedging demand risk Two-Stage Stochastic Optimization with Recourse

UNIT V APPLICATIONS 9

Airline booking control - Production planning with forecasted demand - Airline revenue management - Cash management at a retail bank- Inventory transshipment: managing demand risk - Capacity planning for an electric utility

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Decision Making Under Uncertainty with RISK Optimizer (2nd edition), by Wayne Winston.
2. Financial Models Using Simulation and Optimization II (3rd edition), by Wayne Winston

REFERENCES:

1. https://web-docs.stern.nyu.edu/ioms/SYLLABI/Zhang_OPMGGB2351_Spring16.pdf

WEB REFERENCES:

1. https://plato.stanford.edu/entries/logic-ai/
2. https://www.aaai.org/

OUTCOMES:

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

1. Understand the concept of real time problems that can be addressed with stochastic optimization models
2. Learn to identify the opportunities for creating value using these models
3. Improvement in the decision making under uncertainty within an organization
4. Sharpen their ability to structure problems and to perform logical analysis
5. Assess the significance of model outputs for managerial insights and action
6. Incorporate with applications including banking, electricity and airline systems.

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	2	-	-	-	-	-	-	2	1	3
CO2	3	1	2	-	2	-	-	-	-	-	-	2	1	3
CO3	3	1	2	-	2	-	-	-	-	-	-	2	1	3
CO4	3	1	2	-	2	-	-	-	-	-	-	1	1	3
CO5	3	1	2	-	1	-	-	-	-	-	-	2	1	3
CO6	3	1	2	-	1	-	-	-	-	-	-	1	1	3

PROFESSIONAL ELECTIVES – III

20AIEL710 SDG NO. 4, 8 & 9	GAME THEORY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the student to the notion of a game, its solutions concepts, and other basic notions and tools of game theory, and the main applications for which they are appropriate, including electronic trading markets.
- To formalize the notion of strategic thinking and rational choice by using the tools of game theory, and to provide insights into using game theory in 41odelling applications.

- To draw the connections between game theory, computer science, and economics, especially emphasizing the computational issues.
- To introduce contemporary topics in the intersection of game theory, computer science, and economics.
- To apply game theory in searching, auctioning and trading.

UNIT I INTRODUCTION 8

Introduction – Making rational choices: basics of Games – strategy – preferences – payoffs – Mathematical basics – Game theory – Rational Choice – Basic solution concepts-non-cooperative versus cooperative games – Basic computational issues – finding equilibria and learning in games. Typical application areas for game theory (e.g. Google's sponsored search, eBay auctions, electricity trading markets.

UNIT II GAMES WITH PERFECT INFORMATION 10

Games with Perfect Information – Strategic games – prisoner's dilemma, matching pennies – Nash equilibria – theory and illustrations – Cournot's and Bertrand's models of oligopoly – auctions –mixed strategy equilibrium – zero-sum games – Extensive Games with Perfect Information –repeated games (prisoner's dilemma) – sub game perfect Nash equilibrium; computational issues.

UNIT III GAMES WITH IMPERFECT INFORMATION 9

Games with Imperfect Information – Bayesian Games – Motivational Examples – General Definitions– Information aspects – Illustrations – Extensive Games with Imperfect – Information – Strategies –Nash Equilibrium – Beliefs and sequential equilibrium – Illustrations – Repeated Games – The Prisoner's Dilemma – The Bargaining

UNIT IV NON-COOPERATIVE GAME THEORY 9

Non-cooperative Game Theory – Self-interested agents – Games in normal form – Analyzing games: from optimality to equilibrium – Computing Solution Concepts of Normal – Form Games – Computing Nash equilibria of two-player, zero-sum games – Computing Nash equilibria of two-player, general sum games – Identifying dominated strategies.

UNIT V MECHANISM DESIGN 9

Aggregating Preferences – Social Choice – Formal Model – Voting – Existence of social functions –Ranking systems – Protocols for Strategic Agents: Mechanism Design – Mechanism design with unrestricted preferences – Efficient mechanisms – Vickrey and VCG mechanisms (shortest paths)

–Combinatorial auctions – profit maximization Computational applications of mechanism design –applications in Computer Science – Google's sponsored search – eBay auctions – K-armed bandits.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. M. J. Osborne, An Introduction to Game Theory. Oxford University Press, 2004.
2. M. Machler, E. Solan, S. Zamir, Game Theory, Cambridge University Press, 2013.
3. N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani (Editors), Algorithmic Game Theory. Cambridge University Press, 2007.

REFERENCES:

1. A. Dixit and S. Skeath, Games of Strategy, Second Edition. W W Norton & Co Inc, 2004.
2. YoavSoham, Kevin Leyton-Brown, Multiagent Systems: Algorithmic, Game-Theoretic, andLogical Foundations, Cambridge University Press 2008.
3. Zhu Han, DusitNiyati, WalidSaad, Tamer Basar and Are Hjorungnes, "Game Theory in Wirelessand Communication Networks", Cambridge University Press, 2012.
4. Y.Narahari, "Game Theory and Mechanism Design", IISC Press, World Scientific.

OUTCOMES:

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

1. Understand the concept of real time problems that can be addressed with stochastic optimization models
2. Learn to identify the opportunities for creating value using these models
3. Improvement in the decision making under uncertainty within an organization
4. Sharpen their ability to structure problems and to perform logical analysis
5. Assess the significance of model outputs for managerial insights and action
6. Incorporate with applications including banking, electricity and airline systems.

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	1	-	-	-	-	2	1	-	-	-	3
CO2	3	-	2	3	-	-	1	-	-	-	-	-	-	2
CO3	3	-	3	3	-	-	-	-	-	-	-	-	-	3
CO4	3	-	3	3	-	-	-	-	-	-	-	-	-	2
CO5	3	-	3	3	-	-	-	-	-	-	-	-	-	3
CO6	3	-	3	3	-	-	-	-	-	-	-	-	-	3

PROFESSIONAL ELECTIVES – III

20AMEL702 SDG NO. 4 & 9	SENTIMENT ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the concept of sentiment analysis and its importance in text mining and NLP.
- Explore the theoretical foundations and methodologies of sentiment analysis.
- Learn about sentiment lexicons and their role in sentiment analysis.
- Gain practical experience in preprocessing text data for sentiment analysis.
- Implement and evaluate machine learning algorithms for sentiment classification.
- Explore advanced topics in sentiment analysis, such as aspect-based sentiment analysis and sentiment analysis in multilingual text.

UNIT I INTRODUCTION TO SENTIMENT ANALYSIS 9

Definition and scope of sentiment analysis-Applications and importance of sentiment analysis-Challenges and limitations-Tokenization and text normalization-Stop word removal and stemming-Feature extraction techniques

UNIT II SENTIMENT LEXICONS AND CLASSIFICATION 9

Introduction to sentiment lexicons-Overview of popular sentiment lexicons (e.g., AFINN, Senti WordNet)-Building custom sentiment lexicons-Introduction to supervised learning algorithms (e.g., Naive Bayes, Support

Vector Machines)-Feature selection and feature engineering-Model evaluation and performance metrics

UNIT III SENTIMENT ANALYSIS WITH DEEP LEARNING 9

Topic modeling and sentiment analysis-Lexicon-based approaches Aspect-based sentiment analysis-Introduction to deep learning architectures (e.g., Recurrent Neural Networks, Convolutional Neural Networks)-Sentiment analysis with deep learning models-Transfer learning for sentiment analysis

UNIT IV SENTIMENT ANALYSIS EVALUATION AND VALIDATION 9

Sentiment analysis in social media-Sentiment analysis in customer feedback analysis-Sentiment analysis in marketing and advertising-Methods for evaluating sentiment analysis systems-Challenges in sentiment analysis evaluation-Cross-validation and model validation techniques

UNIT V MULTILINGUAL SENTIMENT ANALYSIS 9

Challenges and approaches in multilingual sentiment analysis-Machine translation and sentiment analysis-Cross-lingual sentiment analysis techniques-Sentiment analysis in domain-specific text (e.g., healthcare, finance)-Ethical considerations in sentiment analysis-Future trends and research directions.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. "Mining Opinions, Sentiments, and Emotions" edited by Bing Liu

REFERENCES:

1. "Sentiment Analysis and Opinion Mining" by Bing Liu

WEB REFERENCES:

1. https://www.nltk.org/
2. https://www.ibm.com/products/natural-language-understanding
3. https://huggingface.co/docs/transformers/index

ONLINE RESOURCES:

1. https://www.nltk.org/
2. https://www.ibm.com/products/natural-language-understanding
3. https://huggingface.co/docs/transformers/index

OUTCOMES:

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

1. Understanding of Sentiment Analysis Concepts
2. Acquire the knowledge of Sentiment Lexicons and Resources
3. Understand the Evaluation and Performance Metrics
4. Learn about the application to Real-world Problems
5. Develop critical thinking skills by analyzing and interpreting sentiment analysis
6. Develop critical thinking skills by analyzing and interpreting sentiment analysis

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	1	1	1	2	1	1	2	1	2
CO2	3	3	3	3	3	1	2	2	3	2	1	2	1	2
CO3	3	3	3	3	3	1	1	1	1	2	1	2	1	2
CO4	3	3	3	2	3	1	2	2	2	2	1	2	2	2
CO5	3	3	3	3	3	1	2	2	3	3	2	2	2	2
CO6	3	3	-	-	2	2	-	-	-	-	1	1	2	2

PROFESSIONAL ELECTIVES – III

20AIEL706 SDG NO. 4 & 9	COGNITIVE COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamentals and architecture of cognitive computing systems.
- To explore machine learning and neural network applications in cognitive computing.
- To gain proficiency in natural language processing and its relevance to cognitive technologies.
- To examine the implementation of cognitive computing across various industries.
- To analyze the ethical implications and future trends of cognitive computing.

UNIT I INTRODUCTION TO COGNITIVE COMPUTING 9

Overview of cognitive computing: definition, scope, and significance - Key components: natural language processing, machine learning, robotics, and human-computer interaction - Cognitive systems and architectures: IBM Watson, Google DeepMind - Applications in real-world scenarios: healthcare, finance, customer service

UNIT II MACHINE LEARNING AND NEURAL NETWORKS 9

Introduction to machine learning algorithms: supervised and unsupervised learning - Neural networks: basics, architecture, and types - Deep learning fundamentals: layers, activation functions, and frameworks - Implementing neural networks in cognitive computing systems

UNIT III NATURAL LANGUAGE PROCESSING (NLP) 9

Fundamentals of NLP: tokenization, syntactic and semantic analysis - Speech recognition and generation technologies - Text analytics and sentiment analysis in cognitive computing - Practical NLP applications: chatbots, virtual assistants

UNIT IV COGNITIVE COMPUTING APPLICATIONS 9

Cognitive computing in industry: case studies from sectors like retail, automotive, and telecommunications - Ethical implications and decision-making in cognitive systems - User experience and interface design for cognitive applications - Future trends: augmented reality and virtual reality integrations

UNIT V ADVANCED TOPICS AND INNOVATIONS 9

Quantum computing and its impact on cognitive computing - Edge computing and cognitive technologies - Challenges in scalability and data privacy - Emerging research areas and future directions in cognitive computing

TOTAL: 45 PERIODS

TEXTBOOKS:

1. "Cognitive Computing: Theory and Applications" by Venkat N. Gudivada, Dhana Rao, Vijay V. Raghavan
2. "Fundamentals of Cognitive Neuroscience: A Beginner's Guide" by Bernard Baars, Nicole Gage

REFERENCES:

1. "Next Generation Artificial Intelligence: Emerging Trends and Ethical Issues" edited by Richard D. Sutcliffe

2. "Cognitive Computing and Big Data Analytics" by Judith Hurwitz, Marcia Kaufman, and Adrian Bowles
3. Journal of Cognitive Engineering and Decision Making
4. "Building Cognitive Applications with IBM Watson Services" by Ahmed Azraq

ONLINE RESOURCES:

1. https://cognitiveclass.ai/
2. https://aischool.microsoft.com/

OUTCOMES:

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

1. Master foundational concepts and architectures
2. Apply machine learning and neural networks
3. Design and execute natural language processing tasks
4. Implement cognitive computing solutions across diverse industries
5. Evaluate the ethical, privacy, and security considerations
6. Analyze emerging trends and technologies

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	3	2	2	3	3	3
CO2	3	2	3	2	3	3	2	2	3	3	3	3	3	3
CO3	2	2	3	1	2	1	1	1	3	2	3	3	3	2
CO4	3	2	2	1	2	1	1	1	3	2	3	3	3	2
CO5	3	2	2	1	2	1	1	1	3	2	3	3	3	2
CO6	3	2	2	2	3	2	2	2	2	2	3	3	3	3

PROFESSIONAL ELECTIVES – III

20CSEL703 SDG NO. 4 & 12	INFORMATION RETRIEVAL TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of Information Retrieval
- To apply Machine Learning techniques for Text Classification and Clustering
- To implement various Search engine system operations
- To learn different techniques of Recommender system

UNIT I INTRODUCTION 9

Information Retrieval – Early Developments – The IR Problem – The Users Task – Information Vs Data Retrieval - The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes - The Web – The e-Publishing Era – How the Web Changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

UNIT II MODELING AND RETRIEVAL EVALUATION 9

Basic IR Models - Boolean Model - TF / IDF (Term Frequency/Inverse Document Frequency) Weighting - Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-Based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.

UNIT III TEXT CLASSIFICATION AND CLUSTERING 9

A Characterization of Text Classification – Unsupervised Algorithms - Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – KNN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation Metrics – Accuracy and Error – Organizing the Classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-Dimensional Indexing.

UNIT IV WEB RETRIEVAL AND WEB CRAWLING 9

The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations - Search Engine

Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

UNIT V RECOMMENDER SYSTEM 9

Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-Based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-Based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", Second Edition, ACM Press Books, 2011.
2. Ricci, F, Rokach, L. Shapira, B. Kantor, "Recommender Systems Handbook", First Edition, 2011.

REFERENCES:

1. C. Manning, P. Raghavan, and H. Schütze, "Introduction to Information Retrieval", Cambridge University Press, 2008.
2. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, "Information Retrieval: Implementing and Evaluating Search Engines", The MIT Press, 2010.
3. Cheng Xiang Zhai, "Statistical Language Models for Information Retrieval (Synthesis Lectures Series on Human Language Technologies)", Morgan & Claypool Publishers, 2008.
4. Gerald J. Kowalski, Mark T. Maybury, "Information Storage and Retrieval Systems – Theory and Implementation", Second Edition, Springer 2013.
5. Frakes, W.B., Ricardo Baeza-Yates, "Information Retrieval Data Structures and Algorithms", Prentice Hall, 2007.

WEB REFERENCES:

1. https://libguides.lamk.fi/informationretrieval/techniques

ONLINE RESOURCES:

1. www.informationretrieval.org
2. https://nlp.stanford.edu/IR-book/html/htmledition/irbook.html

OUTCOMES:

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

1. Identify and design the various components of an Information Retrieval system. (K1)
2. Use an open-source Search engine framework and explore its capabilities. (K3)
3. Apply appropriate method of Classification or Clustering. (K3)
4. Design and implement innovative features in a Search engine. (K2)
5. Design and implement a Recommender system. (K2)
6. Demonstrate Information visualization technologies like Cognition and perception in the Internet or Web search engine. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	1	1	1	2	1	1	2	1	2
CO2	3	3	3	3	3	1	2	2	3	2	1	2	1	2
CO3	3	3	3	3	3	1	1	1	1	2	1	2	1	2
CO4	3	3	3	2	3	1	2	2	2	2	1	2	2	2
CO5	3	3	3	3	3	1	2	2	3	3	2	2	2	2
CO6	3	3	-	-	2	2	-	-	-	-	1	1	2	2

PROFESSIONAL ELECTIVES – III

20AMEL703 SDG NO. 9 & 11	INDUSTRY IoT 4.0	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Introduce the state of art of Industrial IoT with smart machines that performs pervasive sensing distinct from M2M communication.
- To connect the blend of engineering and business of IoT.
- To deal with connectivity in industrial networks, building systems
- To enable delivery of software services networked to the cloud platforms
- To start an Industrial IoT business at the end of the course

UNIT I INTRODUCTION TO INDUSTRY 4.0 9

The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, Industry 4.0: Globalization and

Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories

UNIT II Implementation systems for IIoT **9**

Sensors and Actuators for Industrial Processes, Sensor networks, Process automation and Data Acquisitions on IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Wireless Sensor nodes with Bluetooth, WiFi, and LoRa Protocols and IoT Hub systems.

UNIT III IIoT Data Monitoring & Control **9**

IoT Gateway, IoT Edge Systems and Its Programming, Cloud computing, Real Time Dashboard for Data Monitoring, Data Analytics and Predictive Maintenance with IIoT technology.

UNIT IV Cyber Physical Systems **9**

Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis

UNIT V Industrial IoT- Applications **9**

Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. "The Fourth Industrial Revolution" by Klaus Schwab
2. "Industrial Internet of Things: Cybermanufacturing Systems" by Sabina Jeschke, Christian Brecher, Houbing Song, and Danda B. Rawat
3. "Design, Deployment and Maintenance of Sensor Networks for IIoT" by Nguyen Cong Luong, Dinh Thai Hoang, Dusit Niyato, Ping Wang, Dong In Kim, and Zhu Han
4. "Cyber-Physical Systems: Foundations, Principles, and Applications" edited by Houbing Song, Danda B. Rawat, Sabina Jeschke, and Christian Brecher

REFERENCES:

1. Industry 4.0: The Industrial Internet of Things Alasdair Gilchrist Publications: A press

2. The Concept Industry 4.0 An Empirical Analysis of Technologies and Applications in Production Logistics Authors: Bartodziej, Christoph Jan Springer: Publication in the field of economic science.
3. Embedded System: Architecture, Programming and Design by Rajkamal, TMH3.

OUTCOMES:

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

1. Knowledge of theory and practice related to Industrial IoT Systems. [K1]
2. Interpret the concepts of Globalization, lean manufacturing and smart systems. [K2]
3. Recite cyber physical systems, AI and big data, concepts of security. [K2]
4. Contrast on the IIOT, their application in real time industry [K2]
5. Restate the computing, storage and analytical aspects of IIOT [K2]
6. Ability to implement real field problems by gaining knowledge of Industrial applications with IoT capability. [K2]

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	2	-	-	-	-	-	-	2	1	3
CO2	3	1	2	-	2	-	-	-	-	-	-	2	1	3
CO3	3	1	2	-	2	-	-	-	-	-	-	2	1	3
CO4	3	1	2	-	2	-	-	-	-	-	-	1	1	3
CO5	3	1	2	-	1	-	-	-	-	-	-	2	1	3
CO6	3	1	2	-	1	-	-	-	-	-	-	1	1	3

PROFESSIONAL ELECTIVES – III

20AMEL704 SDG NO. 4 & 9	IOT FOR SMART CITIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Study the morality and ethics in IoT.
- Learn about the Ethical initiatives in the field of Internet of Things.
- Study about IoT standards and Regulations.
- Study about social and ethical issues of IoT Ethics.
- Study about IoT and Ethics- challenges and opportunities.

UNIT I INTRODUCTION TO IOT SYSTEMS 10 **9**

Introduction to IoT: Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs

UNIT II M2M for IoT **9**

The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT

UNIT III M2M vs IoT An Architectural Overview **9**

Building architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. Reference Architecture and Reference Model of IoT.

UNIT IV IoT Reference Architecture **9**

Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment. Constraints affecting design in IoT World-Introduction, Technical design Constraints

UNIT V Domain specific applications of IoT **9**

Home automation, Industry applications, Surveillance applications, Other IoT applications. Cisco IoT system – IBM Watson IoT platform – Manufacturing – Converged Plantwide Ethernet Mode l(CPwE) – Power Utility Industry – Grid Blocks Reference Model – Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Ejaz, W., Anpalagan, A. (2019). Internet of Things for Smart Cities: Overview and Key Challenges. In: Internet of Things for Smart Cities. Springer Briefs in Electrical and Computer Engineering. Springer, Cham. https://doi.org/10.1007/978-3-319-95037-2_1

REFERENCES:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things:Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014.

2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-onApproach)", 1st Edition, VPT, 201.
3. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.
4. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1.

WEB REFERENCES:

1. https://www.particle.io/iot-guides-and-resources/smart-cities-iot/
2. https://www.scnsoft.com/blog/iot-for-smart-city-use-cases-approaches-outcomes.
3. https://www.insiderintelligence.com/insights/internet-of-things-devices-examples/

ONLINE RESOURCES:

1. https://www.scnsoft.com/blog/iot-for-smart-city-use-cases-approaches-outcomes
2. https://www.insiderintelligence.com/insights/internet-of-things-devices-examples/

OUTCOMES:

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

1. Learn about morality and ethics in IoT.
2. Acquire the knowledge of real time application ethics, issues and its challenges.
3. Understand the ethical harms and ethical initiatives in IoT.
4. Learn about IoT standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems.
5. Understand the concepts of Robo ethics and Morality with professional responsibilities.
6. Learn about the societal issues in IoT with National and International Strategies on IoT.

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	3	2	2	3	3	3
CO2	3	2	3	2	3	3	2	2	3	3	3	3	3	3
CO3	2	2	3	1	2	1	1	1	3	2	3	3	3	2
CO4	3	2	2	1	2	1	1	1	3	2	3	3	3	2
CO5	3	2	2	1	2	1	1	1	3	2	3	3	3	2
CO6	3	2	2	2	3	2	2	2	2	2	3	3	3	3

PROFESSIONAL ELECTIVES – III

20AMEL705 SDG NO. 3 & 4	HEALTHCARE ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the transformation in healthcare, focusing on the shift to value-based care and the role of data analytics.
- To explore the impact of modern IT on clinical care and future advancements.
- To examine data types and infrastructure necessary for supporting new healthcare workflows and models.
- as supported by electronic health records and other clinical datasets.

UNIT I INTRODUCTION 8

Introduction to Healthcare Data Analytics- Electronic Health Records– Components of EHR- Coding Systems- Benefits of EHR- Barrier to Adopting EHR- Challenges- Phenotyping Algorithms.

UNIT II ANALYSIS 9

Biomedical Image Analysis- Mining of Sensor Data in Healthcare- Biomedical Signal Analysis- Genomic Data Analysis for Personalized Medicine.

UNIT III BASIC ANALYTICS 9

Natural Language Processing and Data Mining for Clinical Text- Mining the Biomedical Social Media Analytics for Healthcare.

UNIT IV ADVANCED DATA ANALYTICS 10

Review of Clinical Prediction Models- Temporal Data Mining for Healthcare Data- Visual Analytics for Healthcare- Predictive Models for Integrating Clinical and Genomic Data Information Retrieval for Healthcare- Privacy-Preserving Data Publishing Methods in Healthcare

UNIT V APPLICATIONS 9

Applications and Practical Systems for Healthcare– Data Analytics for Pervasive Health Fraud Detection in Healthcare- Data Analytics for Pharmaceutical Discoveries- Clinical Decision Support Systems- Computer-Assisted Medical Image Analysis Systems- Mobile Imaging and Analytics for Biomedical Data.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. "Healthcare Data Analytics" by Chandan K. Reddy and Charu C. Aggarwal
2. "Biomedical Informatics: Computer Applications in Health Care and Biomedicine" by Edward H. Shortliffe and James J. Cimino
3. "Predictive Analytics in Healthcare: Concepts, Tools, and Techniques" by Dr. Bert G. Hibbitts

REFERENCES:

1. "Natural Language Processing in Action: Understanding, Analyzing, and Generating Text with Python" by Hobson Lane, Cole Howard, and Hannes Max Hapke
2. "Data Mining: Concepts and Techniques" by Jiawei Han, Micheline Kamber, and Jian Pei

OUTCOMES:

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

1. Explain the philosophy and methods of Lean / Six Sigma and their application to healthcare performance management and improvement.
2. Analyze the attributes of high-performing healthcare systems.
3. Discuss and contrast the various methods for comparing healthcare delivery across populations of patients.
4. Understand the role of clinical integration in improving quality, safety and outcomes.
5. Define clinical care processes and how technology and decision support can be used to improve processes and workflow.
6. Describe how healthcare performance is measured according to existing quality frameworks.

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	2	-	-	-	-	-	-	2	1	3
CO2	3	1	2	-	2	-	-	-	-	-	-	2	1	3
CO3	3	1	2	-	2	-	-	-	-	-	-	2	1	3
CO4	3	1	2	-	2	-	-	-	-	-	-	1	1	3
CO5	3	1	2	-	1	-	-	-	-	-	-	2	1	3
CO6	3	1	2	-	1	-	-	-	-	-	-	1	1	3

PROFESSIONAL ELECTIVES – III

20AIEL711 SDG NO. 8, 9 & 17	ENTREPRENEURSHIP	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To enable students to understand concepts and techniques from functional areas of management in the context of entrepreneurial ventures.
- Identify many contexts in which entrepreneurship manifests, including start-up, corporate, social, and public sectors.
- To impart the fundamentals of launching and growing adventure.

UNIT I DYNAMICS OF ENTREPRENEURIAL DEVELOPMENT 6

Fundamentals of entrepreneurship, Entrepreneurial mindset, Facets of Entrepreneurship, Myths and Challenges. Economic wealth creation& Entrepreneurship development–the role of the government schemes & clusters. Global/ Indian Entrepreneurs.

UNIT II CREATIVITY AND BUSINESS IDEAS 9

Generation of a New Entry Opportunity, Creativity and entrepreneurship, Idea generation and evaluation, Opportunity recognition, and steps in tapping the opportunity. Launching a venture– steps involved in launching a business, types of business models, Understanding the market and the team, managing cash, and Implementation plan.

UNIT III BUSINESS PLAN PREPARATION 15

Business Plan – Business Model, Marketing plan, Operations and production plan, Venture team and organizational plan, financial statements, and Risk evaluation. Financing ventures – sources of raising capital, seed funding, venture capital funding, and funding opportunities for startups in India.

UNIT IV MANAGEMENT OF SMALL BUSINESS 7

Preparing for growth by creating synergy in vision, values, and strategies, Stages of growth, Strategies for growth, Accessing resources for growth, and Global expansions. Role of incubators, accelerators, mentors, government, and academic-Cases.

UNIT V LEGALASPECTS, REVIVAL AND EXIT STRATEGIES 8

Legal aspects–Formation, Taxation, Procedures for setting up business in India, Legal Acts governing business in India. Revival, Exit, and End Strategies-Key strategies to turn around a company, Liquidation, and Exit strategies for entrepreneurs-Cases.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd "Entrepreneurship", 11thEdition, McGraw Hill Educ ati on,2020.
2. Desai, Vasant, "The Dynamics of Entrepreneurial Development & Management" Himalaya Publishing House, Delhi.
3. Justin G. Longenecker, J. William Petty, Leslie E. Palich, Frank Hoy, "Small BusinessManagement",17thEdition, Cengage Learning, IndiaEdition,2014.
4. Donald F Kuratko, "Entrepreneurship– Theory, Process and Practice", 9th Edition, Cengage Learning, 201 4.
5. Khanka.S. S., "Entrepreneurial Development", S. Chandand Co. Ltd., Ram Nagar, NewDelhi,2013.

REFERENCE BOOKS:

1. Rajshankar, "Entrepreneurship Theory and Practice", Vijay Nicole Imprints Privatelimited,2015.
2. Rajeev Roy, "Entrepreneurship", OxfordUniversityPress,2011
3. Jayshree Suresh, "Entrepreneurial Development", Margam Publications, 2015.
4. Poornima M Charantimath, Entrepreneurship Development Small Business Enterprises, PearsonEducation,2006.

MOOC RESOURCES:

1. https://www.coursera.org/learn/entrepreneurship-development?
2. https://www.coursera.org/specializations/wharton-entrepreneurship
3. https://www.coursera.org/learn/wharton- entrepreneurship-opportunity
4. https://www.coursera.org/learn/entrepreneurship-strategy
5. https://www.edx.org/course/entrepreneurship-in-emerging-economies6.https://nptel.ac.in/courses/110/106/110106141/
6. https://nptel.ac.in/courses/110/107/110107094/#

WEB REFERENCES:

1. https://www.startupindia.gov.in/content/sih/en/government-schemes.html
2. https://inc42.com/buzz/startup-scheme-indian-government-startups

OUTCOMES:

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

1. Demonstrate entrepreneurial thinking and approach. (K3)
2. Develop a business plan. (K6)
3. Relate the concepts of various functional entrepreneurial context. (K6)
4. Equip the competencies required for entrepreneurs are imparted to students. (K1)
5. Imbibe the intricacies of feasibility study and procedure of starting business. (K3)
6. Apply Key Strategies required for entrepreneurs to turn around a company(K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PS01	PS02
CO1	2	2	2	3	-	3	3	-	2	2	2
CO2	2	2	3	3	-	2	2	-	2	2	2
CO3	2	2	-	3	-	3	2	3	-	2	2
CO4	3	2	-	2	-	-	2	2	-	2	2
Co5	1	3	2	2	-	3	3	2	3	2	2
Co6	2	2	-	3	-	3	2	3	-	2	-

PROFESSIONAL ELECTIVES – IV

20AIEL714 SDG NO. 4 & 9	ARTIFICIAL INTELLIGENCE SEARCH METHODS FOR PROBLEM SOLVING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand foundational AI concepts and search methodologies
- To apply game theory and logic in AI
- To employ probabilistic reasoning and models
- To gain proficiency in data mining and machine learning methods
- To explore advanced topics in AI

UNIT I **9**

Introduction to AI, Administrivia, Search- Evaluation Functions, Heuristic Search, A*-Advanced search: Goal Reduction, MEA, B*- Deliberative Planning, Abstraction, CBR- Moore\Constraint Satisfaction & Scheduling

UNIT II **9**

Game-tree Search, Minimax, A-B-pruning- Game Theory, Zero-sum and asymmetric- Logic: Propositional and First-order- Unification and Resolution in Logic- Beyond FOL, Semantic Nets, Frames

UNIT III **9**

Probabilistic Reasoning and Methods- Markoff Decision Processes- Bayesian Models and Networks- Knowledge-Engineering and Rule-Based Systems- Naive Bayes & Regression models- Logistic Regression, NNets-Overfitting and Model Selection

UNIT IV **9**

Data Mining: KNN& KD-trees- Reinforcement Learning- Optimization: Multivariate HC, Simulated Annealing- Real-world optimization, case study

UNIT V **9**

Information Retrieval: Vector Space Model- Natural Language Processing (Parsing)- Real-time problem-solving systems- Enrichment lecture: Speech Understanding- Enrichment lecture: Autonomous Agents.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Deepak Khemani. A First Course in Artificial Intelligence, McGraw Hill Education (India), 2013.

REFERENCE BOOKS:

1. Stefan Edelkamp and Stefan Schroedl. Heuristic Search: Theory and Applications, Morgan Kaufmann, 2011.
2. John Haugeland, Artificial Intelligence: The Very Idea, A Bradford Book, The MIT Press, 1985.
3. Pamela McCorduck, Machines Who Think: A Personal Inquiry into the History and Prospects of Artificial Intelligence, A K Peters/CRC Press; 2 editions, 2004.
4. Zbigniew Michalewicz and David B. Fogel. How to Solve It: Modern Heuristics. Springer; 2nd edition, 2004.
5. Judea Pearl. Heuristics: Intelligent Search Strategies for Computer Problem Solving, Addison-Wesley, 1984.
6. Elaine Rich and Kevin Knight. Artificial Intelligence, Tata McGraw Hill, 1991.
7. Stuart Russell and Peter Norvig. Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall, 2009.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc20_cs81
2. https://www.classcentral.com/course/swayam-artificial-intelligence-search- methods-for-problem-solving

WEB RESOURCES:

1. https://onlinedegree.iitm.ac.in/course_pages
2. https://www.cet.edu.in/noticefiles/271_AI%20Lect%20Notes.pdf

OUTCOMES:

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

1. Understand the historical and philosophical perspective on artificial intelligence. (K2)
2. Demonstrate domain independent search-based problem-solving algorithms. (K3)
3. Explain the foundations of problem decomposition and rule-based methods. (K2)
4. Understand the relation between search methods and other with other formulations including planning, constraints and logical reasoning. (K2)

5. Analyze stochastic, local, and population-based search algorithms. (K4)
6. Implement game playing algorithms. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PS01	PS02
CO1	3	3	3	3	1	_	_	_	2	1	2
CO2	3	3	3	3	1	_	_	_	2	1	2
CO3	2	2	2	2	1	_	_	_	2	1	2
CO4	2	2	2	2	1	_	_	_	2	1	2
Co5	3	3	3	3	1	_	_	_	2	1	2
Co6	3	3	3	3	1	_	_	_	2	1	2

PROFESSIONAL ELECTIVES – IV

20AIEL719 SDG NO. 4 & 9	BUSINESS INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Be exposed with the basic concepts of business intelligence system.
- Understand the modeling aspects behind Business Intelligence.
- Be exposed with different data analysis tools and techniques.
- Apply business intelligence in different domain

UNIT I INTRODUCTION **9**

Introduction to Business Intelligence BI concept, BI architecture, BI in today's perspective, BI Process, Applications of BI like Financial analysis, statistical analysis, sales analysis, CRM, result pattern and ranking analysis, Balanced Scorecard, BI in Decision Modelling: Optimization, Decision making under uncertainty. Ethics and business intelligence.

UNIT II DATA SCIENCE **9**

The concept, process and typical tools in data science. Example of different algorithms i.e segmentation, classification, validation, regressions, recommendations. Exercises using Excel and R to work on histograms, regression, clustering and text analysis. Co-relation between Algorithm and Code in data science

UNIT III DATA VISUALIZATION 9

Data Visualization and Dashboard Design Responsibilities of BI analysts by focusing on creating data visualizations and dashboards. Importance of data visualization, types of basic and composite charts.

UNIT IV PERFORMANCE 9

Performance Dashboard Measuring, Monitoring and management of Business, KPIs and dashboard, the types of dashboards, the common characteristics of Enterprise dashboard, design of enterprise dashboards, and the common pitfalls of dashboard design.

UNIT V MODELLING AND ANALYSIS 9

Exploring Excel Modeling capabilities to solve business problems, summarize and present selected data, introduction to business metrics and KPIs, creating cubes using Microsoft Excel - Future of Business Intelligence Emerging Technologies, Machine Learning, Predicting the Future with the help of Data Analysis, BI Search & Text Analytics – Advanced Visualization – Rich Report, Future beyond Technology.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Efraim Turban, Ramesh Sharda, Dursun Delen, "Decision Support and Business Intelligence Systems", 9th Edition, Pearson 201
2. Business Intelligence – Grundlagen und praktischeAnwendungen: Eine Einführung in die IT" by Hans-Georg Kemper and Henning Baars.
3. David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager‟s Guide", Second Edition, 2012.

REFERENCES:

1. "Business Intelligence Guidebook: From Data Integration to Analytics" by Rick Sherman
2. "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett
3. "Information Dashboard Design: Displaying Data for At-a-Glance Monitoring" by Stephen Few

ONLINE RESOURCES:

1. www.udemy.com/course/business-data-analysis-using-microsoft-power-bi/
2. https://www.coursera.org/learn/business-intelligence- tools
3. https://onlinecourses.nptel.ac.in/noc20_mg11/preview
4. https://nptel.ac.in/courses/110105089

OUTCOMES:

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

1. Understand concepts, process, and practice of the data science and how methodologies are applied to visualize information from raw data. (K2).
2. Explain BI involving predictive and statistical approach. (K2).
3. Describe appropriate managerial decisions in future real-life situations. (K2).
4. Implement BI techniques by using various tools and Create data visualization. (K3).
5. Apply business intelligence methods to various situations and decide on appropriate techniques. (K3).
6. Prepare systematic investigation/research related to the decision support and BI systems and technologies for today's dynamic business environment. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PS01	PS02
CO1	2	2	2	1	2	2	-	-	2	2	1
CO2	-	2	3	1	2	2	-	-	1	2	-
CO3	-	2	2	1	2	2	-	-	2	1	1
CO4	-	2	3	1	2	1	-	-	1	2	-
Co5	-	2	3	3	2	2	-	-	1	2	-
Co6	-	2	3	1	2	2	-	-	1	1	-

PROFESSIONAL ELECTIVES – IV

20AMEL711 SDG NO. 4 & 9	DEEP REINFORCEMENT LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To recollect the machine learning algorithms techniques
- To understand the basics of reinforcement learning techniques
- To connect machine learning engineering and business automation.
- To explore various methods used in reinforcement learning
- To apply reinforcement learning techniques for various case studies.

UNIT I INTRODUCTION 9

Reinforcement Learning – Examples – Elements of Reinforcement Learning – Limitations and Scope – Tic-Tac-Toe; Multi-armed Bandits; Finite Markov Decision Processes.

UNIT II TABULAR SOLUTION METHODS 9

Dynamic Programming; Monte Carlo Methods: Prediction – Estimation of Action Values – Control – Control without Exploring Starts – Off-policy Prediction via Importance Sampling – Incremental Implementation – Off-policy Monte Carlo Control; Temporal-Difference Learning.

UNIT III INTEGRATION OF TABULAR METHODS 9

n-step Bootstrapping: TD Prediction – Sarsa – Off-policy Learning; Planning and Learning with Tabular Methods.

UNIT IV APPROXIMATE SOLUTION METHODS 9

On-policy Prediction with Approximation; On-policy Control with Approximation; Eligibility Traces: The λ-return – TD(λ) – n-step Truncated λ-return Methods – Online λ-return Algorithm – True Online TD(λ); Policy Gradient Methods.

UNIT V APPLICATIONS AND CASE STUDIES 9

TD-Gammon; Watson's Daily-Double Wagering; Optimizing Memory Control; Human-level Video Game Play.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Richard S Sutton & Andrew G. Barto, "Reinforcement Learning: An Introduction", The MIT Press, 2nd Edition, 2018.
2. Marco Wiering, Martijn van Otterlo, "Reinforcement Learning State-of-the-Art", Springer, 2012.

REFERENCES:

1. Boris Belousov, Hany Abdulsamad, Pascal Klink, Simone Parisi & Jan Peters, "Reinforcement Learning Algorithms: Analysis and Applications'', Springer, 1st edition, 2021.
2. Micheal Lanham, "Hands-On Reinforcement Learning for Games'', Packt Publishing Ltd., 2020.
3. Taweh Beysoloqw II, "Applied Reinforcement Learning with Python", Apress, 2019.

4. Dimitri Bertsekas, "Reinforcement Learning and Optimal Control", Athena Scientific, 2019.

OUTCOMES:

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

1. Illustrate the basics of reinforcement learning problem. (K2)
2. Solve various problems using tabular solution methods. (K3)
3. Compare the concept of reinforcement problems with other algorithms.
4. Apply the integrated tabular methods for problem solutions. (K3)
5. Illustrate approximate solution methods for larger state space problems. (K2)
6. Apply reinforcement learning techniques for various case studies. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	2	-	-	-	-	-	-	2	1	3
CO2	3	1	2	-	2	-	-	-	-	-	-	2	1	3
CO3	3	1	2	-	2	-	-	-	-	-	-	2	1	3
CO4	3	1	2	-	2	-	-	-	-	-	-	1	1	3
CO5	3	1	2	-	1	-	-	-	-	-	-	2	1	3
CO6	3	1	2	-	1	-	-	-	-	-	-	1	1	3

PROFESSIONAL ELECTIVES – IV

20AMEL712 SDG NO. 4 & 9	KNOWLEDGE ENGINEERING AND INFERENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Unfolds foundational concepts in Knowledge Engineering and Inference.
- Provides a solid understanding of knowledge representation, reasoning techniques, and their applications.
- Explores advanced topics with the latest developments in the field and case studies to demonstrate real-world applications of the concepts learned.

UNIT I INTRODUCTION TO KNOWLEDGE ENGINEERING AND INFERENCE 9

Overview of Knowledge Engineering: Definition, Scope, and Importance, Introduction to Inference: Basics, Types, and Applications, Knowledge Representation: Semantic Networks, Frames, Ontologies, Inference Engines: Rule-based Systems, Expert Systems

UNIT II KNOWLEDGE ACQUISITION AND REPRESENTATION 9

Knowledge Acquisition Techniques: Elicitation, Analysis, and Validation, Ontology Engineering: RDF, OWL, SPARQL, Rule-based Knowledge Representation: Production Rules, Forward and Backward Chaining, Frames and Semantic Networks: Concepts, Attributes, Relationships

UNIT III REASONING AND INFERENCE TECHNIQUES 9

Logical Reasoning: Propositional Logic, Predicate Logic, Uncertain Reasoning: Bayesian Networks, Fuzzy Logic, Probabilistic Inference: Bayesian Inference, Dempster-Shafer Theory, Defeasible Reasoning: Default Logic, Argumentation Frameworks.

UNIT IV KNOWLEDGE-BASED SYSTEMS AND APPLICATIONS 9

Expert Systems: Architecture, Components, Development Process, Case-based Reasoning: Retrieval, Reuse, Adaptation, Ontology-driven Information Retrieval, Knowledge-based Decision Support Systems

UNIT V ADVANCED TOPICS AND CASE STUDIES 9

Machine Learning for Knowledge Engineering: Supervised, Unsupervised, and Reinforcement Learning, Deep Learning for Knowledge Representation and Inference, Knowledge Engineering in Natural Language Processing (NLP) and Computer Vision, Case Studies: Real-world applications of Knowledge Engineering and Inference in various domains.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig
2. "Knowledge Representation and Reasoning" by Ronald Brachman and Hector Levesque
3. "Introduction to Artificial Intelligence" by Wolfgang Ertel
4. "Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy
5. "Introduction to Data Mining" by Pang-Ning Tan, Michael Steinbach, and Vipin Kumar

REFERENCES:

1. "Ontological Engineering" by Asunción Gómez-Pérez, Mariano Fernández-López, and Oscar Corcho
2. "Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL" by Dean Allemang and Jim Hendler
3. "Probabilistic Graphical Models: Principles and Techniques" by Daphne Koller and Nir Friedman
4. "Fuzzy Logic with Engineering Applications" by Timothy J. Ross
5. "Bayesian Reasoning and Machine Learning" by David Barber
6. "Case-Based Reasoning: Experiences, Lessons, and Future Directions" edited by Ian Watson and Frank Schaffer

ONLINE RESOURCES:

1. https://www.coursera.org/
2. https://www.edx.org/
3. https://www.udacity.com/

WEB REFERENCES:

1. https://towardsdatascience.com/
2. https://medium.com/
3. https://arxiv.org/

OUTCOMES:

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

1. Define and Explain Knowledge Engineering Concepts such as knowledge representation, inference, and ontology engineering. (K3)
2. Apply Knowledge Acquisition Techniques for representation in knowledge-based systems. (K3)
3. Analyze and Evaluate Inference Techniques including logical reasoning, uncertain reasoning, and probabilistic inference. (K4)
4. Design and Develop Knowledge-based Systems using appropriate knowledge representation languages and inference mechanisms to solve real-world problems. (K4)
5. Apply Machine Learning Techniques for Knowledge Engineering. (K3)
6. Apply Case Studies. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	2	1	1	-	1	-	-	1	3	3
CO2	2	3	2	3	2	1	1	-	1	-	-	1	3	3
CO3	2	3	2	3	2	1	1	-	1	-	-	1	3	2
CO4	2	3	2	3	3	1	1	-	2	-	-	1	2	2
CO5	2	3	2	3	3	1	1	-	2	-	-	1	2	3
CO6	2	3	2	3	3	1	1	-	2	-	-	1	2	2

PROFESSIONAL ELECTIVES – IV

20AMEL601 SDG NO. 4 & 9	MICROSERVICES AND DEVOPS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Explain an overview of Microservices and Containers.
- Understand the key concepts and principles of DevOps.
- List the most common DevOps tools.
- Identify the business benefits of DevOps and continuous delivery.
- Recall the specific DevOps methodologies and frameworks.

UNIT I INTRODUCTION TO MICROSERVICES 9

Definition of Microservices – Characteristics - Microservices and Containers – Interacting with Other Services – Monitoring and Securing the Services – Containerized Services – Deploying on Cloud.

UNIT II MICROSERVICES ARCHITECTURE 9

Monolithic architecture- Microservice architectural style- Benefits - Drawbacks of Microservice architectural style - decomposing monolithic applications into Microservices.

UNIT III BASICS OF DEVOPS 9

History of DevOps- DevOps and software development life cycle- water fall model – agile model – DevOps life cycle – DevOps tools: distributed version control tool –Git- automation testing tools – Selenium - reports generation – TestNG - User Acceptance Testing – Jenkins.

UNIT IV MICROSERVICES IN DEVOPS ENVIRONMENT 9

Evolution of Microservices and DevOps – Benefits of combining DevOps and Microservices working of DevOps and Microservices in Cloud environment - DevOps Pipeline representation for a NodeJS based Microservices.

UNIT V VELOCITY AND CONTINUOUS DELIVERY 9

Velocity - Delivery Pipeline- test stack - Small/Unit Test – medium /integration testing – system testing- Job of Development and DevOps - Job of Test and DevOps – Job of Op and Devops- Infrastructure and the job of Ops.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. "Building Microservices: Designing Fine-Grained Systems" by Sam Newman
2. "Microservices Patterns: With examples in Java" by Chris Richardson
3. "Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation" by Jez Humble and David Farley
4. "The DevOps Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations" by Gene Kim, Patrick Debois, John Willis, and Jez Humble

ONLINE RESOURCES:

1. https://microservices.io/
2. https://devopsinstitute.com/
3. https://aws.amazon.com/blogs/architecture/
4. https://thenewstack.io/

REFERENCES:

1. Namit Tanasseri, Rahul Rai, "Microservices with Azure", 1st Edition, Packt Publishing, UK, 2017.
2. Eberhard Wolff, "Microservices: Flexible Software Architecture", 1st Edition, Pearson Education, 2017.
3. James A Scott, "A Practical Guide to Microservices and Containers", Map R Data Technologies e–book. https://mapr.com/ebook/microservices- and containers/assets/microservices-and-containers.pdf.
4. Joyner Joseph, Devops for Beginners, First Edition, Mihails Konoplovs publisher, 2015.

OUTCOMES:

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

1. Understand the Microservices and containers.
2. Explain the architecture of Microservices
3. Describe DevOps and the common tools used in DevOps.
4. Apply Microservices in DevOps.
5. Develop, integrate and deploy projects using DevOps.

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	1	-	1	1	-	-	-	1	2	2
CO2	3	3	3	2	2	-	1	1	-	-	-	1	2	2
CO3	3	3	2	2	2	-	1	1	-	-	-	1	2	2
CO4	2	2	3	2	2	-	1	1	-	-	-	1	2	2
CO5	3	3	3	2	2	-	1	1	-	-	-	1	2	2
CO6	3	3	2	2	2	-	1	1	-	-	-	1	2	2

PROFESSIONAL ELECTIVES – IV

20ITEL708 SDG NO. 4 & 9	FULL STACK SOFTWARE DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gain knowledge on front-end and back-end technologies
- To become proficient in J Query and Bootstrap
- To build strong expertise on Typescript, React and Node.js
- To implement MVC and responsive design to provide unified and intuitive user experience
- To Use Docker and Kubernetes platform for building, running, managing and distributing applications

UNIT I INTRODUCTION TO FULL STACK DEVELOPMENT 9

Introduction – Full Stack Development – Front-end – Back-end, Technologies essential for Full Stack Development – Introduction to Web Application Development – Front-end Technologies – Back-end Technologies – Introduction to MVC – Introduction to Web Services – Communication

between front-end and back-end – Build responsive websites with HTML5 and CSS3 – Java script basic building blocks – Object oriented JS – Functional JS.

UNIT II JQUERY AND BOOTSTRAP 9

Overview of Bootstrap – Structure of a Bootstrap-enabled Webpage – Grids – Typography – Colors – Images – Jumbotron – Alerts – Buttons – Button Groups – Progress Bars – Pagination – Navigation menu and bar – Forms – Media Objects – Overview of jQuery – Configuration of jQuery – Selectors – Events – Effects – Working with HTML – jQuery with CSS – Traversing.

UNIT III TYPE SCRIPT, REACT, NODEJS 9

Node and NPM – NPM commands – Standard modules - React – Components – JSX – TypeScript – Configuring Typescript Compilation – Types – Block scope – Functions – Spread and Rest – DE structuring – Classes – Interfaces – Namespaces and Modules.

UNIT IV SPRING, SPRING MVC AND HIBERNATE 9

Spring Framework – Spring Architecture – Spring MVC – Interception – Chain of resolvers – Multiple view page and controllers – Model Interface – Forms – CRUD – File Upload – Validation – Hibernate Introduction – Architecture – Java objects in Hibernate – Inheritance Mapping – Collection Mapping – HCQL – Caching – Spring Integration.

UNIT V CONTAINERS 9

Kubernetes and Container Operations – Overview – Microservices and orchestration – Kubernetes Architecture – Core constructs – Health checks – Application Scheduling - Docker – Introduction to Containers and Containerization – Building Docker Images – Deploying to Docker hub.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. 1. Mayuir Ramgir, "Full Stack Java Development with Spring MVC, Hibernate, jQuery and Bootstrap", Wiley India Pvt. Ltd., 2020.
2. Frank Zammetti, "Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack and Docker", Apress, 2020.

REFERENCES:

1. Chris Northwood, "The Full Stack Developer", Apress, 2018.
2. Adam Bretz, Colin J. Ihrig, "Full Stack Javascript Development with MEAN", SitePoint Pty. Ltd., 2014.

3. Dinesh Rajput, "Designing Applications with Spring Boot 2.2 and React JS", BPB Publications, 2019.
4. Juha Hinkula, Hands-on Full Stack Development with Spring Boot 2 and React, Packt Publishing, 2019.
5. Jonathan Baier, "Getting Started with Kubernetes", Packt Publishing, 2015.

WEB REFERENCES:

1. https://docs.spring.io/spring-framework/docs/3.2.x/spring- framework -reference/html/index.html
2. https://www.w3spoint.com/hibernate-tutorial
3. https://www.w3schools.com/
4. https://docs.docker.com/get-started/
5. https://kubernetes.io/docs/tutorials/

OUTCOMES:

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

1. Understand the basic principles of full stack software development. (K2)
2. Classify the libraries, user interfaces and runtime environments for data communication. (K2)
3. Architect solutions to real time problems by combining visual components and classes. (K3)
4. Use the frameworks for developing enterprise class applications. (K3)
5. Design and develop interactive and responsive web pages. (K3)
6. Build and manage container orchestration for elastic web server framework. (K3)

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	3	-	-	-	-	-	-	2	2	2
CO2	1	2	1	1	3	-	-	-	-	-	-	2	2	2
CO3	1	2	1	1	3	-	-	-	-	-	-	2	2	2
CO4	1	2	2	2	3	-	-	1	-	-	-	2	2	2
CO5	1	2	2	2	3	-	-	1	-	-	-	2	2	2
CO6	1	2	2	2	3	-	-	1	-	-	-	2	2	2

PROFESSIONAL ELECTIVES – IV

20AIEL711 SDG NO. 4 & 9	CYBER CRIME AND COMPUTER ETHICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamentals of cyber-crime and digital ethics.
- To analyze global and national legal responses to cyber-crime.
- To explore investigative techniques and challenges in cyber-crime cases.
- To study evidence handling and cyber-crime prevention strategies.
- To evaluate ethical and human rights issues in the context of cyber security.

UNIT I FOUNDATIONS OF CYBER CRIME AND INFORMATION TECHNOLOGY 9

Definition of Cyber Crime - Nature and Extent - Challenges in the Cyber World - Information Technology: Growth, Future, and Regulatory Perspectives - Legal Aspects and Inadequacy of Current Laws.

UNIT II GLOBAL LEGAL RESPONSES TO CYBER CRIME 9

Country-wise Legal Response - Analysis of the Indian Information Technology Act 2000 - Global Cyber Crime Laws - Role of International Organizations in Cyber Crime Regulation.

UNIT III ANALYSIS AND INVESTIGATION OF CYBER CRIMES 9

Criminological Aspects of Cyber Crimes - Opportunities for Cyber Criminals - Mens Rea and Criminal Liability - Investigative Challenges - Modern Investigative Techniques.

UNIT IV CYBER CRIME EVIDENCE AND PREVENTION 9

Law of Evidence in Cyber Crimes - Computer Generated Evidence and its Admissibility - Prevention of Cyber Crimes: National and International Endeavors - Policy Initiatives and Legal Reforms.

UNIT V ETHICAL AND HUMAN RIGHTS CONSIDERATIONS 9

Human Rights and Cyber Crimes - Ethical Challenges in Cyber Space - Role of Guardians and Ethical Issues - Precaution and Prevention Strategies in Cyber Crimes.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. "Cyberethics: Morality and Law in Cyberspace" by Richard Spinello
2. "Cybercrime and Digital Forensics: An Introduction" by Thomas J. Holt, Adam M. Bossler, and Kathryn C. Seigfried-Spellar
3. "Guide to Computer Forensics and Investigations" by Bill Nelson, Amelia Phillips, Christopher Steuart
4. "Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet" by Eoghan Casey

REFERENCES:

1. "Digital Crime and Digital Terrorism" by Robert W. Taylor, Eric J. Fritsch, and John Liederbach
2. "Computer Forensics and Cyber Crime: An Introduction" by Marjie T. Britz

ONLINE RESOURCES:

1. https://cyber.fsi.stanford.edu/cybersecurity
2. https://www.eff.org/

OUTCOMES:

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

1. Demonstrate a thorough understanding of cyber-crime dynamics and ethical frameworks.
2. Critically assess various national and international legal mechanisms combating cyber-crime.
3. Apply effective investigative and forensic techniques in cyber-crime scenarios.
4. Design and implement strategic measures for preventing and mitigating cyber-crimes.
5. Analyze the implications of cyber security decisions on human rights and ethical standards.

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	1	1	1	-	3	-	1	-	2	2
CO2	2	1	1	1	2	1	1	-	3	-	1	-	2	3
CO3	1	1	1	1	2	2	3	-	3	-	1	-	2	3
CO4	1	-	-	-	1	1	1	-	3	-	1	-	1	2
CO5	1	-	-	-	1	3	3	3	3	-	1	-	2	3
CO6	1	1	1	1	1	2	-	-	3	-	-	-	2	3

PROFESSIONAL ELECTIVES – IV

20AIEL716 SDG NO. 4 & 9	SECURE CLOUD COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To grasp core cloud computing principles and architectures.
- To identify and mitigate cloud security risks.
- To implement effective data protection strategies.
- To manage secure cloud architectures and responses.
- To explore advanced cloud security technologies and cases.

UNIT I INTRODUCTION TO CLOUD COMPUTING 9

Definition of Cloud Computing – Characteristics of Cloud Services – Cloud Service Models (IaaS, PaaS, SaaS) – Deployment Models: Public, Private, Hybrid, Community – Benefits and Challenges: Scalability, Security, Privacy.

UNIT II CLOUD SECURITY FUNDAMENTALS 9

Security Objectives: Confidentiality, Integrity, Availability – Threats and Vulnerabilities in the Cloud – Security Techniques and Tools: Encryption, IAM, Firewalls – Legal and Compliance Issues: GDPR, HIPAA.

UNIT III DATA SECURITY AND PRIVACY IN THE CLOUD 9

Data Protection Techniques: Encryption, Tokenization, Data Masking – Privacy Concerns: Data Residency, Sovereignty – Implementing Data Security: Best Practices for Data at Rest, in Transit, and in Use – Cloud Security Best Practices.

UNIT IV SECURE CLOUD ARCHITECTURE AND MANAGEMENT 9

Designing Secure Cloud Architecture – Cloud Security Management: Risk Assessment, Incident Response, Disaster Recovery – Tools for Security Management: Vulnerability Scanners, Configuration Management – Virtualization Security: Security in Virtualized Environments.

UNIT V ADVANCED TOPICS IN CLOUD SECURITY 9

Emerging Threats: Advanced Persistent Threats (APTs) – Security in Hybrid and Multi-Cloud Environments – Cloud Security Innovations: Blockchain, AI in Security – Case Studies: Real-world Applications and Security Solutions.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. 1. "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl, Ricardo Puttini, and Zaigham Mahmood
2. “Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance" by Tim Mather, Subra Kumaraswamy, and Shahed Latif
3. "Security in Computing and Clouds: Security Design and Implementation in Cloud Infrastructures" by Markus Helfert, Claus Pahl, Pooyan Jamshidi, and Andreas Holzinger

REFERENCES:

1. "The Basics of Cloud Computing: Understanding the Fundamentals of Cloud Computing in Theory and Practice" by Derrick Rountree and Ileana Castrillo
2. "Guide to Reliable Distributed Systems: Building High-Assurance Applications and Cloud-Hosted Services" by Kenneth P. Birman

ONLINE RESOURCES:

1. https://aws.amazon.com/architecture/security-identity-compliance/
2. https://docs.microsoft.com/en-us/azure/security/
3. https://cloud.google.com/docs/security/best-practices

OUTCOMES:

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

1. Understand the Microservices and containers.
2. Explain the architecture of Microservices
3. Describe DevOps and the common tools used in DevOps.
4. Apply Microservices in DevOps.
5. Develop, integrate and deploy projects using DevOps.

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	2	1
CO2	2	3	2	1	-	-	-	-	-	-	-	-	2	1
CO3	3	2	2	1	3	-	-	-	-	-	-	-	2	1
CO4	3	3	3	2	3	3	2	2	1	1	2	2	2	1
CO5	3	3	2	2	2	-	-	-	-	1	-	2	2	1
CO6	3	3	3	3	1	3	1	3	-	-	2	2	2	2

PROFESSIONAL ELECTIVES – IV

20AMEL713 SDG NO. 3 & 8	BIOMETRIC SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To emphasize the fundamental concepts and overview of fingerprint, iris, face and speech recognition technologies.
- To describe the general principles of design of biometric systems and the underlying trade-offs.
- To recognize personal privacy and security implications of biometrics-based identification technology.
- To identify issues in the realistic evaluation of biometrics-based systems

UNIT I INTRODUCTION TO BIOMETRICS 9

Introduction and background – biometric technologies – passive biometrics – active biometrics- Biometric systems – Enrollment – templates – algorithm – verification – Biometric applications – biometric characteristics- Authentication technologies –Need for strong authentication - Protecting privacy and biometrics and policy – Biometric applications – biometric characteristics.

UNIT II FINGERPRINT TECHNOLOGY 9

History of fingerprint pattern recognition - General description of fingerprints - Finger print feature processing techniques - fingerprint sensors using RF imaging techniques – fingerprint quality assessment – computer enhancement and modeling of fingerprint images – fingerprint enhancement – Feature extraction – fingerprint classification – fingerprint matching

UNIT III FACE RECOGNITION AND HAND GEOMETRY 9

Introduction to face recognition, Neural networks for face recognition – face recognition from correspondence maps – Hand geometry – scanning – Feature Extraction - Adaptive Classifiers - Visual-Based Feature Extraction and Pattern Classification - feature extraction – types of algorithms – Biometric fusion.

UNIT IV MULTIMODAL BIOMETRICS AND PERFORMANCE EVALUATION 9

Voice Scan – physiological biometrics –Behavioral Biometrics - Introduction to multimodal biometric system – Integration strategies – Architecture – level of fusion – combination strategy – training and adaptability – examples of multimodal biometric systems – Performance Evaluation-Statistical Measures of Biometrics – FAR – FRR – FTE – EER – Memory requirement and allocation.

UNIT V BIOMETRIC AUTHENTICATION 9

Introduction - Biometric Authentication Methods - Biometric Authentication Systems – Biometric authentication by fingerprint -Biometric Authentication by Face Recognition. Expectation-Maximization theory - Support Vector Machines. Biometric authentication by fingerprint – biometric authentication by hand geometry- Securing and trusting a biometric transaction – matching location – local host - authentication server – match on card (MOC) – Multibiometric and Two-Factor Authentication.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. James Wayman, Anil Jain, Davide Maltoni, Dario Maio, "Biometric Systems, Technology Design and Performance Evaluation", Springer, 2005.
2. S.Y. Kung, S.H. Lin, M.W.Mak, "Biometric Authentication: A Machine Learning Approach" Prentice Hall, 2005.

REFERENCES:

1. Paul Reid, "Biometrics for Network Security", Pearson Education, 2004.
2. Nalini K Ratha, Ruud Bolle, "Automatic finger print Recognition System", Springer,2003
3. L C Jain,I Hayashi, S B Lee, U Halici, "Intelligent Biometric Techniques in Fingerprint and Face Recognition" CRCPress,1999.
4. John Chirillo, Scott Blaul, "Implementing Biometric Security", John Wiley, 2003.
5. Arun A. Ross, Karthik Nanda Kumar, Anil K. Jain, "Handbook of Multibiometric", Springer, 2006.

OUTCOMES:

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

1. Demonstrate the knowledge of engineering principles underlying biometric systems. [K2]
2. Apply algorithms to model fingerprints. [K2]
3. Classify different face recognition and hand geometry pattern [K2]
4. Explain various computation of authentication methods [K2]
5. Illustrate the applications of biometric systems.

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	1	-	1	1	-	-	-	-	2	1
CO2	3	2	2	-	1	-	1	1	-	-	-	-	2	1
CO3	3	2	2	-	-	-	1	1	-	-	-	-	2	1
CO4	3	2	2	-	-	-	-	1	-	-	-	-	2	1
CO5	3	2	2	-	-	-	-	1	-	-	-	-	2	1
CO6	3	2	-	-	-	-	-	1	-	-	-	-	2	2

PROFESSIONAL ELECTIVES – IV

20AMEL714 SDG NO. 4 & 9	SUSTAINABLE BUSINESS MODELS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the concept of sustainability and its relevance to business.
- Analyze various sustainable business models and their effectiveness.
- Evaluate the economic, social, and environmental impacts of different business strategies.
- Explore tools and frameworks for developing and implementing sustainable business models.
- Examine case studies of companies implementing successful sustainable business practices.

UNIT I INTRODUCTION TO SUSTAINABLE BUSINESS 9

Overview of sustainability concepts-The triple bottom line approach Historical perspectives on sustainable development-Integration of

sustainability into business strategy-Stakeholder engagement and management-Corporate social responsibility (CSR) and ethics

UNIT II SUPPLY CHAIN MANAGEMENT AND CIRCULAR ECONOMY 9

Principles of sustainable supply chain management-Sustainable sourcing and procurement-Supplier engagement and collaboration-Understanding the circular economy model-Cradle-to-cradle design principles-Circular business strategies and practices

UNIT III GREEN MARKETING, CONSUMER BEHAVIOR AND INNOVATION 9

Principles of green marketing-Communicating sustainability to consumers-Consumer behavior and sustainable consumption-Role of innovation in sustainability-Sustainable product and service innovation-Design thinking for sustainability.

UNIT IV CORPORATE GOVERNANCE, REPORTING AND CASE STUDIES9

Corporate governance for sustainability-Sustainability reporting frameworks (e.g., GRI, SASB)-Transparency and accountability-Analysis of case studies from various industries-Lessons learned and best practices-Group discussion and presentations

UNIT V FUTURE TRENDS AND CHALLENGES 9

Sustainability assessment tools (e.g., life cycle analysis)-Frameworks for sustainable business model development-Implementation strategies and challenges-Emerging trends in sustainable business-Global challenges and opportunities-Reflections on the future of sustainable business

TOTAL: 45 PERIODS

TEXTBOOKS:

1. "Sustainable Business: Key Issues" by Helen Kopnina and John Blewitt"

REFERENCES:

1. "The Sustainability Revolution: Portrait of a Paradigm Shift" by Andres R. Edwards
2. "The Circular Economy: A Wealth of Flows" by Ken Webster

WEB REFERENCES:

1. https://sustainablebrands.com/
2. https://www.greenbiz.com/
3. https://www.wbcsd.org/

ONLINE RESOURCES:

1. https://www.unep.org/
2. https://www.iisd.org/

OUTCOMES:

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

1. Learn about morality and ethics in Sustainable Business Models.
2. Acquire the knowledge of real time application ethics, issues and its challenges.
3. Understand the analytical Skills for Sustainability Assessment.
4. Acquire the knowledge of Sustainable Practices and Technologies.
5. Understand the concepts of Ethical and Social Responsibility.
6. Learn about leadership and Advocacy Skills.

CO – PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	-	3	3	-	2	3	-	-	-	2	3
CO2	2	1	1	-	3	-	3	3	3	-	-	-	3	3
CO3	1	1	-	-	3	3	-	3	3	-	-	-	3	3
CO4	3	2	1	1	3	2	1	1	2	-	-	-	1	2
CO5	3	3	-	2	2	1	1	1	2	-	-	-	1	2
CO6	3	2	-	-	2	2	1	1	2	-	-	-	1	2

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.

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