IQAC
Ensuring
Quality

Sri
SAI RAM
ENGINEERING COLLEGE
An Autonomous Institution
West Tambaram, Chennai - 44
www.sairam.edu.in

Approved by AICTE, New Delhi
Affiliated to Anna University

DEPARTMENT OF
ARTIFICIAL INTELLIGENCE & DATA SCIENCE ENGINEERING

REGULATIONS
2020

Academic Year 2020-21 onwards

AUTONOMOUS
CURRICULUM AND

SYLLABUS
I - VIII
SEMESTERS

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.

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE ENGINEERING

👁 VISION

To emerge as a "Centre of Excellence in the field of Artificial Intelligence and Data Science", The Department is committed to inculcate discipline, offering best Technical Education and Research Opportunities and ethically strong to meet the global challenges, who in turn shall contribute to the advancement and welfare of the society.

🚀 MISSION

Department of Artificial Intelligence and Data Science Engineering, Sri Sairam Engineering College is committed to

M1 Produce students with a sound understanding of the fundamentals of the theory and practise of Artificial Intelligence, Machine Learning and Data Science.

M2 Enable students to become leaders in the Industry and Academia Nationally as well as Internationally.

M3 Meet the pressing demands of the nation in the areas of Artificial Intelligence and Data Science.

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
TOTAL						29	23

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	2	2	1
11	20HSMG201	Interpersonal Values	2	0	0	2	0
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 Modelling	3	1	0	4	4
2	20CSPC401	Operating Systems	3	0	0	3	3
3	20CSPC402	Database Management Systems	3	0	0	3	3
4	20AIPW301	Fundamental of Data Science with lab	3	0	2	5	4
5	20AIPC302	Fundamental of Machine Learning Techniques	3	0	0	3	3
PRACTICAL							
6	20AIPL301	Probability & Statistical Modelling Laboratory	0	0	3	3	1.5
7	20CSPL402	Database Management Systems Laboratory	0	0	3	3	1.5
8	20AIPL302	Machine Learning Laboratory	0	0	3	3	1.5
VALUE ADDITIONS - III							
9	20AITE301	Live-in-Lab – 1	0	0	2	2	1
10	20AI TP 301	Skill Enhancement	0	0	2	2	1
		TOTAL				31	23.5

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	20CSPW401	Computer Networks with Lab	3	0	2	5	4
4	20AIPC401	Fundamentals of Artificial Intelligence	3	0	0	3	3
5	20AIPC402	Biomedical Signal & Image Processing	3	0	0	3	3
6	20AIPC403	Advanced Machine Learning	3	0	0	3	3
PRACTICAL							
7	20AIPL401	DAA and AI Laboratory	0	0	3	3	1.5
8	20AIPL402	Biomedical Signal & Image Processing Laboratory	0	0	3	3	1.5
9	20AIPL403	Advance Machine Learning Laboratory	0	0	3	3	1.5
10	20AITE401	Live-in-Lab – II	0	0	2	2	1
VALUE ADDITIONS - IV							
11	20AITP401	Skill Enhancement	0	0	2	2	1
12	20MGMC301	Constitution of India	2	0	0	2	0
		TOTAL				36	26.5

SEMESTER V

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20AIPC501	Computer Vision	3	0	0	3	3
2	20AIPC502	Deep Learning	3	0	0	3	3
3	20AIPC503	Natural language Processing and Chat Bot	3	0	0	3	3
4	20AIPC504	IoT & Sensors Technologies	3	0	0	3	3
5	20AI EL XXX	Professional Elective-I	3	0	0	3	3
PRACTICAL							
6	20AIPL501	Deep Learning 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	20AITE501	Live-in-Lab III	0	0	2	2	1
10	20AITP501	Skill Enhancement	0	0	2	2	1
		TOTAL				**28**	**21.5**

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	20AIPW602	Big Data Analytics with Lab	3	0	2	5	4
3	20AIPW603	Optimization Techniques for Programming 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	20HSPL501	Communication and Soft Skills Lab	0	0	2	2	1
8	20AIP 601	Innovative Design Project	0	0	2	2	1
VALUE ADDITIONS - VI							
9	20AITP601	Skill Enhancement	0	0	2	2	1
		TOTAL				**28**	**21.5**

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	20XXELXXX	Professional Elective-III	3	0	0	3	3
4	20XXELXXX	Professional Elective-IV	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	20AIPJ701	Project Phase - I	0	0	4	4	2
VALUE ADDITIONS - VII							
8	20AITP701	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	20XXOEXXX	Open Electives - III	3	0	0	3	3
PRACTICAL							
2	20AIPJ801	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													
Percentage													

*IS-Internship

PROFESSIONAL ELECTIVES - I

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20AIEL501	Control Systems	3	0	0	3	3	Mathematics
2	20AIEL502	Software Engineering	3	0	0	3	3	Testing
3	20AIEL503	Distributed Systems	3	0	0	3	3	Cloud
4	20AIEL504	Intellectual Property Rights and Design Thinking	3	0	0	3	3	Cloud
5	20AIEL505	Social Network Analysis	3	0	0	3	3	Automation
6	20AIEL506	Software Project Management	3	0	0	3	3	AI
7	20AIEL507	Human Computer Interaction	3	0	0	3	3	Machine Learning
8	20AIEL508	Embedded Systems	3	0	0	3	3	Data Science
9	20AIEL509	Ethics in Data Science	3	0	0	3	3	
10	20AIEL510	Principles of Computer Security						AI

PROFESSIONAL ELECTIVES - II

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20AIEL601	Etical Hacking and system defence	3	0	0	3	3	Security
2	20AIEL602	Wireless Sensor Networks	3	0	0	3	3	Management
3	20AIEL603	Information Retrieval Techniques	3	0	0	3	3	Data Mining
4	20AIEL604	Fundamentals of AI for Robotics	3	0	0	3	3	Robotics
5	20AIEL605	Cryptography and Network security	3	0	0	3	3	Security
6	20AIEL606	Statistics for Business Analytics	3	0	0	3	3	Mathematics
7	20AIEL607	Fuzzy COntrol Systems	3	0	0	3	3	AI
8	20AIEL608	Agent Based Intelligent System	3	0	0	3	3	AI
9	20AIEL609	Biomedical Instrumentation	3	0	0	3	3	AI
10	20AIEL610	Robotic Sensors	3	0	0	3	3	Security

PROFESSIONAL ELECTIVES - III

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20AIEL701	Block Chain Technology	3	0	0	3	3	Security
2	20AIEL702	Financial Management	3	0	0	3	3	Management
3	20AIEL703	Virtual Reality and Augmented Reality	3	0	0	3	3	AI
4	20AIEL704	Security Risk Assessment and Management	3	0	0	3	3	Security
5	20AIEL705	Expert System	3	0	0	3	3	AI
6	20AIEL706	Cognitive Computing	3	0	0	3	3	AI
7	20AIEL707	Reinforcement Learning	3	0	0	3	3	AI
8	20AIEL708	Mining Massive Datasets	3	0	0	3	3	Data Science
9	20AIEL709	Database Security and Auditing	3	0	0	3	3	Data Science
10	20AIEL710	Game Theory	3	0	0	3	3	AI

PROFESSIONAL ELECTIVES - IV

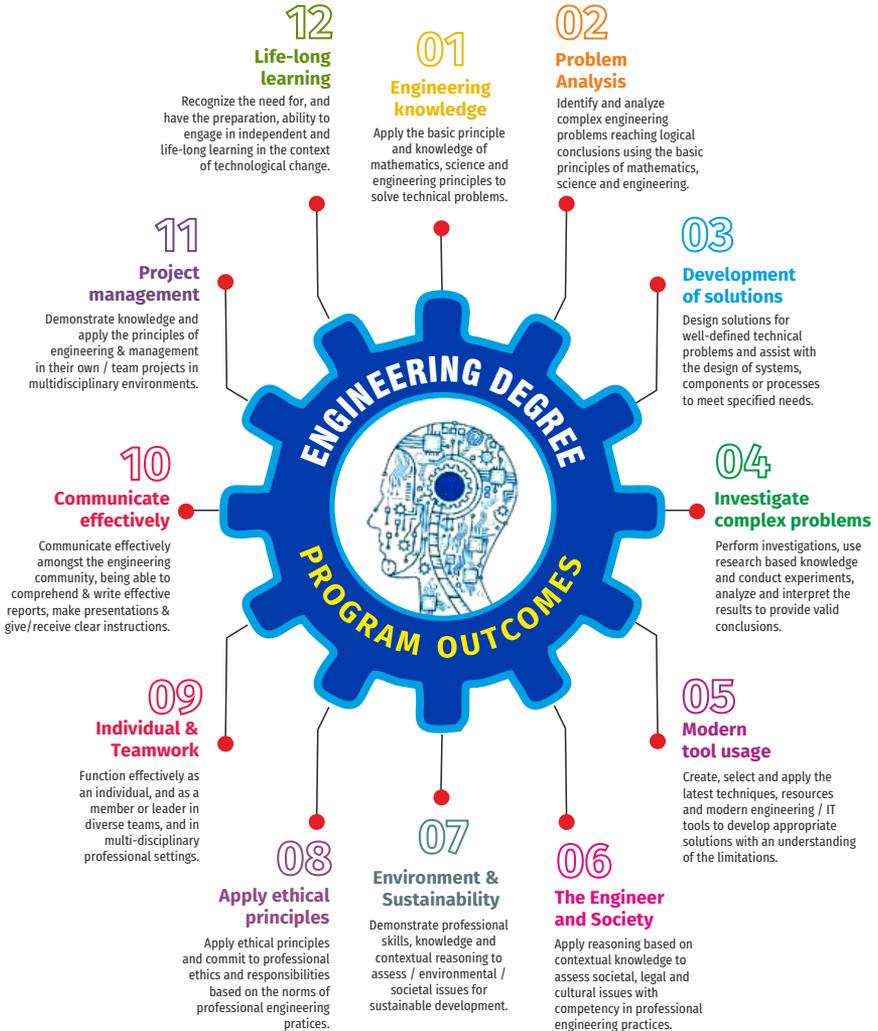| S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20AIEL711	Cyber Crime & Computer Ethics	3	0	0	3	3	Cyber Security
2	20AIEL712	Quantum Computing and Quantum Cryptography	3	0	0	3	3	AI
3	20AIEL713	Decision Making under Uncertainty	3	0	0	3	3	AI
4	20AIEL714	Artificial Intelligence Search Methods for Problem Solving	3	0	0	3	3	AI
5	20AIEL715	Actuarial Science Applications	3	0	0	3	3	Security
6	20AIEL716	Secure Cloud Computing	3	0	0	3	3	Cloud
7	20AIEL717	Time Series Analysis	3	0	0	3	3	AI
8	20AIEL718	Secure Web App	3	0	0	3	3	Security
9	20AIEL719	Business Intelligence	3	0	0	3	3	AI
10	20AIEL720	Artificial Intelligence Constraint Satisfaction	3	0	0	3	3	AI

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1   Graduates will have solid basics in Mathematics, Programming, Machine Learning, Artificial Intelligence and Data Science fundamentals and advancements to solve technical problems.

PEO2   Graduates will have the capability to apply their knowledge and skills acquired to solve the issues in real world Artificial Intelligence and Data Science sectors and to develop feasible and viable systems.

PEO3   Graduates will have the potential to participate in life-long learning through the successful completion of advanced degrees, continuing education, certifications and/or other professional developments.

PEO4   Graduates will have the ability to apply the gained knowledge to improve the society ensuring ethical and moral values.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1   Artificial Intelligence and Data Science graduates are able to become leaders in the Industry and Academia with the help of advanced knowledge and skill, which can empower them to analyse, design, develop and implement their learning to develop the society.

PSO2   Ability to develop skills to address and solve social and environmental problem with ethics and perform multidisciplinary projects with advanced technologies and tools.

PROGRAMME OUTCOMES(POs)

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.

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.

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

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.

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

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

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

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.

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

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

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

ENGINEERING DEGREE PROGRAM OUTCOMES

SEMESTER - I

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

OBJECTIVES:

The intent of the course is

- To understand and gain the knowledge of matrix algebra.
- To introduce the concepts of limits, continuity, derivatives and maxima and Minima
- To acquaint the concept of improper integrals and the properties of definite integrals.
- To provide understanding of double integration, triple integration and their application.
- To introduce the concept of sequence and series and impart the knowledge of Fourier 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) – Diagonalization of a Quadratic form using orthogonal transformation - Nature of Quadratic forms.

UNIT II   DIFFERENTIAL CALCULUS   12

Limits, continuity, Differentiation rules - Maxima and Minima of functions of one variable, partial derivatives (first and second order – basic problems), 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 integrals - 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 area of revolution and volume of revolution. Evaluation of improper integrals.

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. Diagonalize the matrix using orthogonal transformation and apply Cayley Hamilton Theorem to find the inverse and integral powers of a square matrix. (K3)
2. Evaluate the limit, examine the continuity and use derivatives to find extreme values of a function. (K3)
3. Evaluate definite and improper integrals using techniques of integration. (K3)
4. Apply double and triple integrals to find the area of a region and the volume of a surface. (K3)
5. Compute infinite series expansion of a function. (K3)

CO - PO MAPPING :

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

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. Express and explain short texts on different topics with key information applying suitable vocabulary (K2)
2. Interpret and dramatize fluently in informal and formal contexts(K2)
3. Choose and apply the right syntax in comprehending diversified general and technical articles (K3)
4. Analyze and write technical concepts in simple and lucid style (K3)
5. Construct informal letters and e-mails thoughtfully (K2)
6. Demonstrate technical concepts and summaries in correct grammar and vocabulary (K2)

CO - PO MAPPING :

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

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. To understand the crystal systems and elastic properties of Materials (K2)
2. To distinguish different crystal structures and heat conduction in conductor and insulators (K4)
3. To explain powder diffractionmethod-deformation of materials in response to action load,quantum mechanics to understand wave particle dualism (K2)
4. To apply quantum theory to set up one dimensional Schrodinger's wave equation and applications to a matter wave system and principle of laser action (K3)
5. To analyze bending of beams,types of optical fiber and modes of heat transfer (K4)
6. To discuss light propagation in optical fibers and transfer of heat energy in different measures and its applications (K2)

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.
4. Ravikrishnan A, 'Engineering Chemistry', Sri Krishna Hitech Publishing Company Pvt. Ltd, New Edition 2021.

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 and recognize the basic design of adsorption systems and its industrial applications. (K2)
2. Recognize the basic concepts of electrochemistry and apply the principles of electrochemistry to corrosion process and the applications of protective coatings to overcome the corrosion. (K2)
3. Disseminating the importance of chemistry of fuels and combustion to enhance the fuel efficiency. (K2)
4. Acquire the basics of non-conventional sources of energy and illustrate the principles and the reaction mechanism of batteries and fuel cells. (K2)
5. Explain 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	2	2	-	-	1	2	-	-	-	-	1
CO2	3	2	3	2	2	1	2	-	-	-	-	3
CO3	3	2	3	2	-	1	2	-	-	-	-	1
CO4	3	2	3	2	-	1	2	-	-	-	1	3
CO5	3	2	3	1	2	1	1	-	-	-	1	3

SEMESTER - I

20ESCS101	PROBLEM SOLVING AND	L	T	P	C
SDG NO. 4&9	PROGRAMMING IN 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	**PHYSICS AND CHEMISTRY**	**L**	**T**	**P**	**C**
SDG NO. 4	**LABORATORY**	**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. Interpret quantitative chemical analysis to generate experimental skills in building technical competence. (K3)

5. Analyze the quality of water for domestic and industrial purpose. (K3)

6. Standardize the solutions using volumetric titrations, conductivity, pH, redox potential and optical density measurements. (K3)

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 to check whether a given number is odd or even?
7. Write a program to find the factorial of a given number.
8. Write a program to find out the average of 4 integers.
9. Write a program to 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 - 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=PL3o9D 4Dl2FJ9q0_gtFXPh_H4POI5dK0yG

2 https://www.youtube.com/watch?v=xlUFkMKSB3Y&list=PL0862 D1A947252D203.

3 https://www.youtube.com/watch?v=4LlTmsfDS4Y&list=PLEAYk Sg4uSQ2Wfc_l4QEZUSRdx2ZcFziO&index=13

4 https://www.youtube.com/watch?v=jBsEKyx6Rj0&list=PLwdnzl V3ogoVxVxCTlI45pDVM1aoYoMHf

5. https://www.youtube.com/watch?v=rdXw7Ps9vxc&list=PLHXZ9O QGMqxersk8fUxiUMSIx0DBqsKZS

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, superconducting and optical properties of materials
- To educate the basic principles of semiconductor device and electron transport properties
- To become proficient in magnetic materials
- To acquire the basic working of nanoelectronic devices

UNIT I   CONDUCTING MATERIALS   9

Classical free electron theory - Expression for electrical conductivity - Thermal conductivity expression - Wiedemann-Franz law - 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 SEMICONDUCTOR MATERIALS   9

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

UNIT IV SUPERCONDUCTING & OPTICAL PROPERTIES OF MATERIALS 9

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 NANO DEVICES 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 nanomaterials - Tunneling: single electron phenomena and single electron transistor - Quantum dot laser - Carbon nanotubes: Properties and applications.

TOTAL: 45 PERIODS

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, ferrimagnetic 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 nanotubes 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	3	2	3	-	3	-	-	-	-	3
CO5	3	3	3	3	3	-	3	-	-	-	-	3
CO6	3	3	3	2	3	-	-	-	-	-	-	1

SEMESTER - II

20BSCY201	ENVIRONMENTAL SCIENCE	L	T	P	C
SDG NO. 4,17	AND ENGINEERING	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, ECOSYSTEMS AND BIODIVERSITY   9

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 – Biogeochemical cycle (C, N & P) – energy flow in the ecosystem – food chains, food webs and ecological pyramids – ecological succession - keystone species. Introduction to biodiversity 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 and ex-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 in prevention 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 groundwater – 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 non renewable 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   10

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: rain water 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 Control of 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 (Ecomark) - Issues involved in enforcement of environmental legislation - central and state pollution control boards, 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 human health – 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

TEXTBOOKS:

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
3. Ravikrishnan A, 'Environmental Science and Engineering', Sri Krishna Hitech Publishing Company Pvt. Ltd, Revised Edition 2020.

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 biodiversity 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	PYTHON PROGRAMMING	L	T	P	C
SDG NO. 4&9		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. Define the syntax and semantics of python programming language and Understand control flow statements, strings and functions. [K1]
2. Determine the methods to create and manipulate python programs by utilizing the data structures like lists, dictionaries, tuples and sets. [K3]
3. Annotate the concepts of functions, modules and packages in python. [K2]
4. Understand the concepts of files, exception handling and also apply the object oriented programming concept by creating classes and objects. [K6]
5. Illustrate and use some of the libraries available with python.[K4]
6. Applying the problem solving concepts to various applications using python.[K6]

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 ALGORITHM 7

Algorithm Specification - Recursion - Performance Analysis - Asymptotic Notation - The Big-O - Omega and Theta Notation - Programming Style - Refinement of Coding - Time-Space Trade 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 – Tree Traversals - 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.UIlman, "Data Structures and Algorithms", Pearson Education, 1983.

REFERENCES:

1. The Art of Computer Programming: Volume 1: 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: An Introduction (Open Paths to Enriched Learning), 31st Edition, Pat Morin, UBC Press.

WEB REFERENCES:
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	PYTHON PROGRAMMING	L	T	P	C
SDG NO. 4	LABORATORY	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	2	2	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	DATA STRUCTURES & ALGORITHMS	L	T	P	C
SDG NO. 4	**LABORATORY**	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 count showing 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 30 Nos OR Server with C compiler supporting 30 terminals or more.

OUTCOMES:
On completion of this 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	**ENGINEERING PRACTICES**	**L**	**T**	**P**	**C**
SDG NO. 4,9,12	**LABORATORY**	**0**	**0**	**3**	**1**

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	2 Nos
	Digital Live-wire detector	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	2 Nos
	Demolition Hammer	2 Nos
	Circular Saw	2 Nos
	Planer	2 Nos

Hand Drilling Machine		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	SKILL ENHANCEMENT	L	T	P	C
SDG NO. 4&5		0	0	2	1

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 - III

20BSMA302	**PROBABILITY AND STATISTICAL MODELLING**	L	T	P	C
SDG NO. 4		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

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 BOOK:
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 - 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. Execute various SQL queries for the Transaction Processing & Locking using concept of Concurrency control. (K4)
4. Evaluate the query processing techniques for the optimization of SQL queries. (K4)
5. Implement the indexing and hashing techniques for the organisation of database records. (K3)

6. Appraise how the advanced databases differ from the traditional databases. (K5)

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

20AIPW301 SDG NO. 4	FUNDAMENTAL OF DATA SCIENCE WITH LAB	L	T	P	C
		3	0	2	4

OBJECTIVES:

● To understand the concept of Real Time data representations.
● To learn the various Excel Function to solve Data Science Problems
● To understand the Mathematical Basics of Data Science.
● To gain Knowledge in data science Tools.
● To highlight different data science opportunities in industry

UNIT I   INTRODUCTION TO DATA SCIENCE   12

Introduction to Data Science – History of Data Science – Relationship between Data Warehouse – Big Data and Data Science –Scope of Data Science – Data Science with other fields – Relationship between Data Science and Information Science. Data: Data Types-Structured Vs. Unstructured data – Quantitative vs. Qualitative data-The four Levels of Data-Data Collection-Data Pre-Processing- Roles and Responsibilities of a data scientist- Data Science concerns

UNIT II DATA REPRESENTATION   12

Data Acquisition-Data Preparation-Data Formats-Data quality - High dimensionality of data- Principal Component Analysis-Data representation; Matrices, Vectors-   Libraries of graphs, matrices, and vectors - Data Frames - Lists - Graphs and Networks-Data Models

UNIT III DATA SCIENCE IN SPREADSHEET   12

Introduction to Basic functions of Spreadsheet– Data Collection and Preparation – Importing Data into Spreadsheet from Different Data Sources – Data Cleaning and Preliminary Data Analysis – Correlation and importance of variables technical requirements- Data Visualization in Spreadsheet – Pivot Tables and Charts-VLOOKUP-Dashboard in Spreadsheet

UNIT IV DATA SCIENCE TOOLS & DATA VISUALIZATION   12

Introduction to Data Science Tools – Data Cleaning Tools – Data Munging and Modelling Tools-Data Visualization Tools-Tools for Data Science- Need for visualization - Elementary visualization means - box plots, charts, graphs - Advanced tools for visualization

UNIT V DATA ANALYTICS, ETHICS AND APPLICATIONS   12

Data analytics – methodologies - CRISP-DM Methodology - SEMMA - Big data life cycle - SMAM - ASUM- DM- Ethical guidelines for Data Scientist - Data Science concerns - Data Privacy and Legal aspects - Rightful use of data science-Applications-Bioinformatics-Education-Engineering-Finance and Economy-Gaming.

                                                    TOTAL: 60 PERIODS

LIST OF EXPERIMENTS
1.   Study of Basic function in Excel
2.   Study of Basic Data Science Libraries in Python
3.   Working with Range Names and Tables
4.   Cleaning Data with Text Functions
5.   Cleaning Data containing Data Values
6.   Working with VLOOKUP functions and Pivot Table.
7.   Demonstration of Data Visualization in Excel.
8.   Demonstration of Data Visualization in Python.
9.   Importing Data from External Source Using Excel & Python
10.   Creating a data model
11.   Create a dashboard for a given requirement
12.   Implement a data analytics for the real time data set

LAB REQUIREMENTS :
1.   Microsoft Excel
2.   Python 3

TEXT BOOKS:
1. Chirag Shah, "A Hands-on Introduction to Data Science", Cambridge University Press, 2020.
2. Sinan Ozdemir, "Principles of Data Science", Packt Publication, 2016.
3. Julio Cesar Rodriguez Martino, "Hands-on Machine Learning with Microsoft Excel", Packt Publication, 2019.

REFERENCES:
1. Hector Guerrero, "Excel Data Analysis: Modelling and Simulation", Springer International Publishing, 2nd Edition, 2019.
2. Paul Curzon, Peter W McOwan, "The Power of Computational Thinking", World Scientific Publishing, 2017
3. Steven S Skiena, "Data Science Design Manual", Spring International Publication, 2017.
4. Rajendra Akekar, Priti Srinivas Sajja, "Intelligence Techniques for Data Science", Spring International Publication, 2016.
5. Longbing Cao, "Data Science Thinking: The Next Scientific, Technological and Economic Revolution", Spring International Publication, 2018.

WEB REFERENCES:
1. https://www.coursera.org/learn/excel-data-analysis
2. https://www.tutorialspoint.com/learn/excel_data_analysis/index.htm
3. https://www.coursera.org/learn/open-source-tools-for-data-science

ONLINE RESOURCES:
1. https://www.jeremyjordan.me/data-science
2. https://www.ngdata.com/top-data-science-resources

OUTCOMES:
Upon completion of the course, the student should be able to:
1. Understand the real-world data and information. (K2)
2. Apply data science using excel & Python. (K3)
3. Design of mathematical model for problem solving. (K5)
4. Interpret various tools and its advantages. (K2)
5. Illustrate the different opportunities in industries. (K3)
6. Apply data modelling for real-world 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	2	1	1	1	1	2	1	2	3	3
CO2	3	3	3	3	3	2	2	2	2	2	2	2	3	2
CO3	3	3	3	3	3	1	2	1	3	2	2	3	2	2
CO4	3	2	2	2	2	1	1	1	2	1	1	2	3	3
CO5	3	2	2	2	2	1	1	1	2	1	1	2	3	3
CO6	3	2	2	2	2	1	1	1	2	1	1	2	3	3

SEMESTER - III

20AIPC302 SDG NO. 4	FUNDAMENTAL 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 Pre-processing – 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 RESOURCES:
1. http://digimat.in/nptel/courses/video/106106213/L01.html
2. http://digimat.in/nptel/courses/video/106106198/L01.html

OUTCOMES:
Upon completion of the course, the student 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

20AIPL301 SDG NO. 9	PROBABILITY AND STATISTICAL MODELLING LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:
- To understand data definitions and data manipulation commands
- To learn the R Programming
- To understand functions, procedures and procedural extensions of data bases
- 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, the 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)
6. Design Different Models using R. (K6)

CO – PO, PSO MAPPING:

	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

20CSPL304 SDG NO. 9	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1

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

20AIPL302 SDG NO. 4	**MACHINE LEARNING LABORATORY**	L	T	P	C
		0	0	3	1

OBJECTIVES:

- 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
- To Analyze Decision Tree and back Propagation Algorithm

LIST OF EXPERIMENTS :

1. Study of Prolog
2. Write simple fact for the statements using prolog
3. Write predicates one convert's centigrade temperature to Fahrenheit, other checks if a temperature is below freezing.
4. Write a program to solve 4-Queen problem.
5. Write a program to solve 8-puzzle problem.
6. Write a program to solve any problem using Breadth First Search.
7. Write a program to solve any problem Depth First Search
8. Write a program to solve Travelling salesman Problem
9. Write a prolog program to solve water jug problem.
10. Write a program to solve missionaries and cannibal problem
11. Write a prolog program to implement library management system.
12. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
13. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Implement in prolog and its working environment. (K3)
2. Implement N-Queen problem and puzzle problem using Prolog. (K3)
3. Analyze the problem using BFS and DFS algorithm. (K4)
4. Implement water jug and missionaries and cannibal problem using prolog. (K3)
5. Develop library management system. (K5)
6. Develop Decision Tree and Artificial Neural Network Algorithm. (K5)

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

20AITE301	LIVE–IN–LAB - I	L	T	P	C
SDG NO. 4,11,15		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, the student 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

2OAITP301 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

APTITUDE & COGNITIVE SKILLS – PHASE 1

OBJECTIVE:
- 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 : Artificial 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), Sams, 2004
3. Stephen G. Kochan, "Programming in C", III Edition, Pearson Education.
4. Printed circuit Board Design and technology, Walter C. Bosshart,1983
5. Printed Circuits Handbook, Sixth Edition, by Clyde F. Coombs, Jr, Happy T. Holden, Publisher: McGraw-Hill Education Year: 2016
6. 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 RESOURCES
1. https://www.tutorialspoint.com/embedded_systems/index.htm

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 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	LINEAR ALGEBRA AND	L	T	P	C
SDG NO. 4	ITS APPLICATIONS	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-Least 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

TEXTBOOKS:
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)

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

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.

<div align="right">TOTAL: 45 PERIODS</div>

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, PSO 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

20CSPW401 SDG NO. 4&9	COMPUTER NETWORKS WITH LABORATORY	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 – 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   AND APPLICATION 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", Fifth Edition TMH, 2013.
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, 2013.
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.

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. Access the performance of a network. (K5)
3. Understand the basics of how data flows from one node to another. (K2)
4. Analyse IEEE standards and Analyze and design routing algorithms. (K3)
5. Implementing the working of various transport and application layer protocols.(K3)
6. Analyse the protocols for various functions in the network.(K4)

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

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

a1xN3oAhWawjgGHe8hAzoQ6AEIKDAA#v=onepage&q=Supervised%20Learning&f=false

OUTCOMES:

Upon 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. (K3)
3. Analyse the problem and infer new knowledge using suitable knowledge representation schemes. (K4)
4. Develop planning and apply learning algorithms on real world problems. (K5)
5. Design an expert system and implement natural language processing techniques. (K5)
6. Implement advance techniques in Artificial Intelligence. (K4)

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 - IV

20AIPC402	BIOMEDICAL SIGNAL AND	L	T	P	C
SDG NO. 4	IMAGE PROCESSING	3	0	0	3

OBJECTIVES:
- To understand the types and characteristics of standard and biomedical signals
- To gain knowledge about the various physiological parameters both electrical and non-electrical and the methods of recording and transmitting these parameters
- To gain knowledge in removing the noise and artifacts in biomedical signals
- To provide fundamentals of the image in time and frequency domain
- To understand the basic concepts of image enhancement, image restoration, image segmentation, feature extraction in medical images

UNIT I   CLASSIFICATION OF SIGNALS   9

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_ Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals

UNIT II ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING   9

Sources of bio medical signals, Bio-potentials, Biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics

UNIT III FILTERING FOR REMOVAL OF ARTIFACTS   9

Time-domain Filters - synchronized averaging, Moving Average Filters, Derivative-based operators to remove low-frequency artifacts. Frequency-domain filters - Removal of High Frequency noise, Removal of low frequency noise.

UNIT IV FUNDAMENTALS OF IMAGE PROCESSING   9

Image perception, MTF of the visual system, Image fidelity criteria, Image model, Image sampling and quantization – two-dimensional sampling theory, Image quantization, Optimum mean square quantizer, Image transforms – 2D-DFT and other transforms,

UNIT V BIO-MEDICAL IMAGE PREPROCESSING   9

Introduction - Overview of X-ray, CT, MRI and Ultrasound imaging, Preprocessing- Image Enhancement operations – Image noise and modeling, Image restoration – Image degradation model, Inverse and Weiner filtering, Geometric transformations and correction, Overview of image segmentation and Feature extraction.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Allan V. Oppenheim, S. Wilsky and S. H. Nawab, "Signals and System", Pearson, 2015(Unit-I)
2. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007. (UNIT II-III)
3. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2008, New Delhi (Unit IV-V)
4. Anil J Jain, "Fundamentals of Digital Image Processing", PHI, 2006 (Unit IV-V)

REFERENCES:

1. Khandpur, R.S., "Handbook of Biomedical Instrumentation", TATA Mc Graw-Hill, New Delhi, 2003.
2. John G. Webster, "Medical Instrumentation Application and Design", 3rd Edition, WileyIndia89Edition, 2007
3. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", John Wiley and Sons, New York, 2004.
4. https://www.physio-pedia.com/Medical_Imaging
5. Atam P. Dhawan, "Medical Image Analysis", Wiley Inter science Publication, NJ S. Sridhar, ―Digital Image Processing‖, Oxford University Press, 2011, New Delhi.
6.. Alasdair McAndrew, "Introduction to Digital Image Processing with Matlab", Cengage Learning 2011, India
7. John L. Semmlow, "Bio signal and Biomedical Image Processing Matlab Based applications", Marcel Dekker Inc., New York, 2004

WEB REFERENCES:

1. http://digimat.in/nptel/courses/video/108105101/L01.html
2. http://digimat.in/nptel/courses/video/117105135/L01.html

ONLINE RESOURCES:
1. http://digimat.in/nptel/courses/video/105107160/L01.html
2. http://digimat.in/nptel/courses/video/117105079/117105079.html

OUTCOMES

Upon Completion of the course, the students should be able to:
1. Summarize the fundamental concepts of various biomedical signals and images. (K2)
2. Identify the amplitude and frequency of ECG, EEG, EMG & PCG. (K1)
3. Examine the lead systems and recording setup of ECG, EEG, EMG & PCG for diagnosis. (K2)
4. Apply appropriate time domain and frequency domain filters on biomedical signals and biomedical images to remove artifacts and to enhance images. (K3)
5. Apply appropriate degradation and restoration models on medical images to recover the original image from degraded image. (K3)
6. Discuss types of image segmentation and feature extraction of medical images for analysis and classification. (K2)

CO – PO, PSO MAPPING:

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

SEMESTER - IV

20AIPC403 SDG NO. 4	ADVANCED MACHINE LEARNING	L	T	P	C
		3	1	0	4

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, PSO 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

SEMESTER - IV

20AIPL401	DAA AND AI LABORATORY	L	T	P	C
SDG NO. 4		3	1	0	4

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.
8. Study of Prolog
9. Write simple fact for the statements using prolog
10. Write predicates one convert's centigrade temperature to Fahrenheit, other checks if a temperature is below freezing.
11. Write a program to solve 4-Queen problem.
12. Write a program to solve 8-puzzle problem.
13. Write a program to solve any problem using Breadth First Search.
14. Write a program to solve any problem Depth First Search
15. 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	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 - IV

20AIPL402 SDG NO. 4	BIOMEDICAL IMAGE AND SIGNAL PROCESSING LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:
- To develop basic knowledge in Signal and Image.
- To expose the various Signal and image Processing Techniques
- To extend the skill to use Visualization Methods
- To Analyze the real time data sets
- To develop Image Compressed and Segmented Model
- To analyze and visualize Image and Signal data

LIST OF EXPERIMENTS :

SIGNAL PROCESSING:
1. Representation of basic discrete time signals
2. Computation of convolution -linear convolution
3. Response of a difference equation to initial conditions; stability
4. DFT and FFT computation
5. FIR filter design using windowing techniques
6. IIR filters design-digital Butterworth filter and Chebyshev filter
7. Simulation of Bio-signals.
8. Analysis of ECG signals.
9. Analysis of EEG signals
10. Analysis of EMG signals

IMAGE PROCESSING:
1. Display of an image, negative of an image.
2. Contrast stretching of a low contrast image.
3. Display of a histogram, and histogram equalization.
4. Bit plane slicing of an image.
5. Image enhancement by Intensity/Gray level slicing.
6. Implementation of FT for an image.
7. Implementation of High pass, Low pass filtering.
8. Mean and Median filtering of an image.
9. Implementation of image sharpening filters and edge detection using gradient filters.

10. Image Rotation (Clockwise and anticlockwise) and Flipping (Horizontal and Vertical)
11. Canny edge detection.
12. Image compression by DCT.
13. Implementation of image segmentation techniques.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Describe common Characteristics of Signal and image. (K1)
2. Analyze and Construct Signal and Image. (K4)
3. Configure different filters for Signal and Image. (K2)
4. Analyze real time data set. (K4)
5. Implement Image Segmentation Techniques. (K3)
6. Implement Visualization methods. (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
C06		2	3	2	3	3	1	1	-	2	-	-	1	2

SEMESTER - IV

20AIPL403 SDG NO. 4	**ADVANCE MACHINE LEARNING LABORATORY**	L	T	P	C
		0	0	3	1

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 naïve 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 naïve 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, 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	3

SEMESTER - IV

20AITE401 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 students 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	2	1	2	1	1	1	3	2	3	3	3	2
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	2	3	2	2	2	2	2	3	3	3	3

SEMESTER - IV

20CSTP301 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 - 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

                                              TOTAL : 30 PERIODS
TEXT BOOKS :
1.   Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.
4.   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
3.   Kernighan and Ritchie, "The C Programming Language", (2nd ed.) Prentice Hall, 1988.
4.   Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.
5.   Steven Holzner, "Java 2 Black book", Dreamtech press, 2011.

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 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 & 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

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

OBJECTIVES:
At the end of the course, the student is expected to
● To know about Indian constitution
● To know about central government functionalities in India
● To know about state government functionalities in India
● To know about Constitution function
● To Know about Constitutional remedies

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

TEXT BOOKS:
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.

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

20AIPC501	COMPUTER VISION	L	T	P	C
SDG NO. 4,9		3	1	0	4

OBJECTIVES:
- To understand the fundamentals of computer vision and image processing techniques.
- To review shape and region analysis.
- To study Hough Transform and its applications to detect lines, circles, ellipses.
- To understand three-dimensional image analysis techniques.
- To understand motion analysis.
- To demonstrate various pattern analysis in computer vision algorithms.

UNIT I   FOUNDATION OF COMPUTER VISION   9

Computer Vision Overview - Computer Imaging Systems – Lenses - Image Formation and Sensing - Image Analysis - Pre-processing and Binary Image Analysis - Mathematical morphology.

UNIT II IMAGE FORMATION AND PROCESSING   9

Fundamentals of Image Formation - Transformation: Orthogonal – Euclidean - Affine and Projective. Edge Detection - Edge Detection Performance - Corner Detection - Fourier Transform - Convolution and Filtering - Image Enhancement - Restoration - Histogram Processing.

UNIT III FEATURE EXTRACTION   9

Edges - Canny - LOG, Line Detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram - SIFT, HOG, SURF, Scale - Space Analysis - Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT. Case study: Human Iris location - Generalized Hough Transform (GHT) - Spatial Matched Filtering - GHT for ellipse detection - GHT for feature collation.

UNIT IV IMAGE SEGMENTATION   9

Region Growing - Edge Based approaches to segmentation - Graph-Cut - Mean-Shift - MRFs, Texture Segmentation - Object detection - 3D object recognition - 3D reconstruction - Introduction to Motion - Parametric motion – Spline-based motion.

UNIT V PATTERN ANALYSIS   9

Clustering: Clustering: K-Means - K-Medoids - Mixture of Gaussians - Classification: Discriminant Function, Supervised - Un-supervised - Semi-supervised; Classifiers: Bayes – KNN - ANN models; Dimensionality Reduction: PCA – LDA – ICA - Non-parametric methods.

TOTAL: 45 HOURS

TEXT BOOK:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003

REFERENCES:

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.
3. D. L. Baggio et al., "Mastering OpenCV with Practical Computer Vision Projects", Packt Publishing, 2012.
4. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press, 2012.
5. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
6. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992.

OUTCOMES:

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

1. Describe the foundation of Computer Imaging system and Analysis (K2)
2. Apply mathematical modeling methods for low-, intermediate- and high-level image processing tasks (K2)
3. Apply Hough Transform for line, circle, and ellipse detections and 3D vision technique (K3)
4. Gather a basic understanding about the geometric relationships between 2D images and the 3D world and implement motion related techniques (K3)
5. Perform pattern analysis on computer vision problems (K2)
6. Develop the practical skills necessary to build computer vision applications. (K3)

CO – PO, PSO 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 - V

20AIPC502	**DEEP LEARNING**	**L**	**T**	**P**	**C**
SDG NO. 4,9		**3**	**1**	**0**	**4**

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 BOOK:
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, PSO 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 - V

20AIPC503	NATURAL LANGUAGE PROCESSING	L	T	P	C
SDG NO. 9,11	AND CHAT BOT	3	1	0	4

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 unification - 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 flow, Microsoft Bot Framework, Amazon Lex, RASA Channels: Facebook Messenger, Google Home, Alexa, WhatsApp, Custom Apps.

TOTAL :45 PERIODS

TEXT BOOK:
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-language-processing-with-deep-learning
2. https://freevideolectures.com/course/4050/nptel-applied-natural-language-processing
3 https://freevideolectures.com/course/2272/artificial-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, PSO 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	2	-	1	2	2	-	-	1	-	2	2	1	2
CO3	3	2	-	1	2	2	-	-	1	-	2	2	-	3
CO4	3	2	-	1	2	2	-	-	1	-	2	2	1	-
CO5	3	3	-	1	2	2	-	-	1	-	2	2	-	2
CO6	3	2	-	1	2	3	-	-	1	-	2	2	2	2

SEMESTER - V

20AIPC504 SDG NO. 9,11	IOT & SENSORS TECHNOLOGIES	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To understand the fundamentals of the Internet of Things and its design along with their characteristics.
- To discuss IoT reference architecture and outline the overall context of M2M and IoT.
- To analyze distinct IoT Application layer Protocols.
- To learn to program Arduino, ESP8266 microcontroller for IoT
- Figure out IoT based systems for real-world applications.

UNIT I   INTRODUCTION TO IOT   8

Introduction to IoT - Characteristics of IoT - Benefits of IoT - Components of Internet of Thing devices: Control units - Sensors - Communication modules - Power sources - Physical and logical design of IoT - IoT Enabling Technologies - Design methodology of IoT - Recent Trends in the Adoption of IoT - Health Care - Machine to Machine (M2M) - Smart Living - Smart Cities - Communication technologies: RFID - Bluetooth - ZigBee - Wi-Fi - LoRaWAN.

UNIT II   STATE OF THE ART FOR IOT ARCHITECTURE   7

IoT reference architecture - Functional View - Information View - Deployment and Operational View - Other relevant architectural views - European Telecommunications Standards Institute (ETSI) model - Internet Engineering Task Force (IETF) model - Open Geospatial Consortium (OGC) architecture - IoT communication model - API based Architecture - SOA based Architecture.

UNIT III INTRODUCTION TO ARDUINO AND RASPBERRY PI AND IOT PROTOCOLS   10

Installation, Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, reading input from pins

IoT Protocols:TCP - UDP - MQTT- Publish Subscribe Modes - HTTP - COAP – XMPP - SCADA- WebSocket - IP based protocols: 6LoWPAN - RPL - Authentication Protocols - IEEE 802.15.4.

UNIT IV IOT PROGRAMMING AND SENSORS   12

Basics of sensors and actuators -Sensors- Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, Level Sensors, USB Sensors, Embedded Sensors, Distance Measurement with ultrasound sensor

Real Time Examples and working principles of sensors and actuators - Overview of Arduino, ESP8266 Microcontroller platform - Access point and station point mode - Programming for IoT - Communication: Connecting microcontroller with Bluetooth and USB - Connection with the Internet using Ethernet.

UNIT V APPLICATIONS OF IOT   8

Smart Home - Industrial applications - Agriculture - Transport and logistics - Other IoT applications - Introduction to various IoT tools - Developing sensor based application through embedded system platform case studies : Soil moisture monitoring - Weather monitoring - Air quality Monitoring - Movement Identification - Traffic Monitoring.

TOTAL :45 PERIODS

TEXT BOOK:

1.   Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-On Approach", VPT Publisher, 2014.

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.

3.   Olivier Hersent, David Boswarthick and Omar Elloumi, - The Internet of Things: Key Applications and Protocols, John Wiley and Sons Ltd., UK 2012.

4.   Charalampos Doukas, "Building Internet of Things with the Arduino", Create space, April 2002.

REFERENCES:

1. Boswarthick,Omar Elloumi., The Internet of Things: Applications and Protocols, Wiley publications., 2012.
2. Marco Schwatrz Internet of Things with Arduino Cookbook, Packt Publications, 2016.
3. Jean-Philippe Vasseur and Adam Dunkels "Interconnecting Smart Objects with IP: The Next Internet", Morgan Kaufmann Publishers, 2010.

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc21_cs17/preview.
2. https://onlinecourses.nptel.ac.in/noc21_ee85/preview.

ONLINE RESOURCES:

1. https://www.digimat.in/nptel/courses/video/106105166/L01.html.
2. https://www.digimat.in/nptel/courses/video/106105166/L02.html.

OUTCOMES:

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

1. Analyze the components of IoT devices and communication technologies. (K4)
2. Discriminate between M2M and IoT technologies. (K4)
3. Understand the significance of various IoT architectures. (K2)
4. Develop portable IoT applications using appropriate microcontrollers. (K6)
5. Create IoT solutions using sensors, actuators and Devices. (K6)
6. Develop IoT applications for real-world situations. (K6)

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	1	2
CO2	3	2	-	2	2	-	-	-	-	-	2	2	1	2
CO3	3	2	-	3	2	-	-	-	-	-	2	2	1	2
CO4	3	2	-	2	2	-	-	-	-	-	2	2	1	2
CO5	3	3	-	3	2	-	-	-	-	-	2	3	1	2
CO6	3	2	-	2	2	-	-	-	-	-	2	2	1	2

SEMESTER - V

20AIPL501 SDG NO. 4,9	DEEP LEARNING 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

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	3	3						2	3	3	2
CO5	2	3	2	3	3						2	3	2	2
CO6	3	3	3	3	3						2	3	3	3

SEMESTER - V

20AIPL502 SDG NO. 4,9	NLP AND 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   30 Nos.

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)

CO – PO, PSO 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 - 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

LIST OF EXPERIMENTS :

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. mplement 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

20AITE501 SDG NO. 4,11,15	DEEP LEARNING LABORATORY	L	T	P	C
		0	0	4	2

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&DS 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&DS 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:
●   First evaluation (Immediately after first internal examination) : 20 marks
●   Second evaluation (Immediately after second internal examination): 30 marks
●   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.   Facilitate change through thought leadership, research, market intelligence and membership engagement. (K2)
3.   Prototype the proposed system (K3)
4.   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)
5.   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	2	2	2	1	2	1	1	1	3	2	3	3	3	2
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

SEMESTER - V

20AITP501 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 – VI   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

OBJECTIVE:

● 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

COURSE 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)

CO- PO & PSO MAPPING:

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

SEMESTER - VI

20AIPC601 SDG NO. 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 flow 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. Understand Image, Text and Data Tables Automation. (K2)
4. Discover basic Knowledge about Robotic Sensors & Actuators (K2)
5. Interpret the principle behind robotic drive system, end effectors, sensor, machine vision robot kinematics and programming. (K3)
6. Understand the applications & Future Scope of Robotics in various fields (K2)

CO – PO, PSO 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

20AIPW602 SDG NO. 9	BIG DATA ANALYTICS WITH LAB	L	T	P	C
		3	0	2	5

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 flow - 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 modes. Startup scripts, Configuration files.
2.   Hadoop Implementation of file management tasks, such as Adding files and directories, Retrieving files and Deleting files
3.   Implement of Matrix Multiplication with Hadoop Map Reduce

4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
5. Implementation of K-means clustering using Map Reduce
6. Installation of Hive along with practice examples.
7. Installation of HBase, Installing thrift along with Practice examples
8. 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, PSO MAPPING:

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

20AIPW603	OPTIMIZATION TECHNIQUES	L	T	P	C
SDG NO. 9	FOR PROGRAMMING WITH LAB	3	0	2	4

OBJECTIVES:

- To model and solve problems using linear and nonlinear programming.
- To identify the Optimization problem to minimize the total cost.
- To solve sequence models for decision making problems.
- To apply genetic algorithms for solving problems in engineering and technology.
- To design mathematical models as phases of modeling for some real time situations.

UNIT I   INTRODUCTION TO CLASSICAL OPTIMIZATION TECHNIQUES   7

Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems - Single variable optimization, Constrained and unconstrained multi-variable optimization, Direct

substitution method, Lagrange's method of multipliers, Karush-Kuhn-Tucker conditions

UNIT II   LINEAR PROGRAMMING AND NONLINEAR PROGRAMMING 10

Introduction, basic terminology Techniques of linear programming: Simplex method, Revised simplex method: Dual Simplex Method, decomposition principle, post-optimality analysis. Non Linear Programming-Introduction, elimination methods: various search methods Fibonacci method and golden section method Interpolation method-Quadratic and cubic interpolation methods, KKT conditions, Direct root method

UNIT III   CONSTRAINED AND UNCONSTRAINED OPTIMIZATION
TECHNIQUES   12

Introduction; Standard form of the problem and basic terminology; Direct search method- Simplex method, Random search method, Univariate and pattern search method Indirect search methodSteepest Descent (Cauchy) method, Conjugate gradient method, Newton's method, Application to engineering problems. Constrained Optimization:Standard form of the problem and basic terminology; Direct method: Sequential Linear Programming; Generalized Reduced gradient method, Methods of feasible direction Indirect method: Penalty function method Interior and exterior penalty function method, Convex programming problem, Check for convergence Application to engineering problems.

UNIT IV   OPTIMIZATION METHODS   9

Modern methods of Optimization: Genetic Algorithms – Simulated Annealing – Ant colony optimization – Tabu search – Neural-Network based Optimization – Fuzzy optimization techniques – Applications.

Genetic Algorithm: Introduction, Representation of design variables, objective function and constraints, Genetic operators and numerical results. Introduction to Neural network based optimization.

UNIT V   SIMULATION MODELING AND NATURE INSPIRED
ALGORITHMS   7

Introduction - Definition and types – Limitations - Various phases of modeling-Monte Carlo method – Applications - advantages and limitations of simulation

Nature-Inspired Algorithms: Introduction to SI, Ant and Bee Algorithms, Particle Swarm Optimization, Firefly Algorithm, Cuckoo Search, Bat Algorithm, Flower Pollination Algorithm, Other Algorithms

LIST OF EXPERIMENTS
Implement using Python
1. Matrix Operations
2. Minimum Cost Path
3. Linear Programming Problem
4. Queuing Problem
5. Sequencing Problem
6. Dynamic Programming
7. Design a randomized algorithm that can solve TSP
8. Job Scheduling using PSO
9. Optimization techniques for N-Queen's problem
10. Use ant colony algorithm for generating good solutions to both symmetric and asymmetric instances of the Traveling Salesman Problem
11. Application of Genetic Algorithm as mini project
12. Application of PSO, ACO as mini projects

TOTAL:60 PERIODS

TEXT BOOK:
1. Optimization Techniques and Applications with Examples,Xin-She Yang Wiley,3rd edition 2018
2. S. S. Rao, Engineering Optimisation- Theory and Practice, New Age International.
3. Deb K., Optimisation for Engineering Design-Algorithms and Example, Prentice Hall.

REFERENCES:
1. Operations Research: An Introduction" by H A Taha, 5th Edition, Macmillan, New York.
2. D. Bertsekas Nonlinear programming, 2nd Edition, Athena Scientific, 1999, Nashua.
3. R. K. Sundaram, A first course in optimization theory, 1996, Cambridge University Press, Cambridge
4. Kanti Swarup, Gupta P.K and Man Mohan, "Operation Research", 16th Edition, Sultan Chand & sons, 2014.
5. Kasana, H.S., Introductory Operation Research: Theory and Applications, Springer Verlag (2005).
6. Rardin, Ronald L., Optimization in Operations research, Pearson Education (2005). Ravindran A, Phllips D.T. and Solberg J.J. Operation Research: Principles and Practice, John Wiley (2007).

WEB REFERENCE:
1.   https://nptel.ac.in/courses/112101298

ONLINE RESOURCE:
1.   https://nptel.ac.in/courses/112101298

OUTCOMES:
Upon completion of the course, the student should be able to:
1.   Understand the techniques for solving optimization problems. (K1)
2.   Apply basic concepts of mathematics to formulate an optimization problem using Linear programming (K3)
3.   Learn efficient computational procedures to solve optimization problems using Non Linear Programming (K2)
4.   Understand the maximization and minimization of convex functions and Interpret the potential solution and frames the better solution for optimization of genetic algorithm (K3)
5.   Analyze the adaptation of TS to the optimization of continuous function to solve various combinatorial optimization problems. (K3)
6.   Understand Neural network based optimization techniques. (K2)

CO – PO, PSO 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 - VI

20AITE501 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. 3 DOF ROBOT
4. 6DOF ROBOT
5. 5DOF ROBOT
6. MOBILE BOTS
7. SENSOR MODULE

OUTCOMES:
Upon completion of the course, the student should be able to:
1. Understand the differen 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, PSO MAPPING:

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

SEMESTER - VI

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

20AIPJ601 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. Think innovatively on the development of components, products, processes or technologies in the engineering field
2. Analyze the problem requirements and arrive workable design solutions

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Co1	3	3	3	3	3	3	2	2	3	3	3	2	3	3
CO2	3	3	3	3	3	3	2	2	3	3	3	2	3	3

SEMESTER - VI

20AITP601 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

PROBLEM SOLVING SKILLS – PHASE 1

COURSE OBJECTIVE:
- 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 - IaaS –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/
3. https://freevideolectures.com/course/4639/nptel-cloud-computing
4. 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, PSO 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

TEXT BOOKS:
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/organi zationmanagement.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)

CO – PO, PSO 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

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

20AIPJ701 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 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-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. Comprehend an industrial or real life problem and identify right/ real issue with solution.
2. Complete the necessary studies and review the literature, design a setup of equipment and complete the analysis.
3. 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

SEMESTER - VII

20AITP701 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

APTITUDE REFRESHER & APTITUDE COMPANY SPECIFIC TRAINING – PHASE 1

COURSE OBJECTIVE:
- 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. 1.   Demonstrate familiarity with major algorithms and data structures.
2. Apply important algorithmic design paradigms and methods of analysis.
3. Synthesize efficient algorithms in common engineering design situations.
4. Train and run the deep neural networks

CO- PO & PSO MAPPING:

SEMESTER - VIII

20AIPJ801 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. Comprehend an industrial or real life problem and identify right/ real issue with solution.
2. Complete the necessary studies and review the literature, design a setup of equipment and complete the analysis.
3. 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

PROFESSIONAL ELECTIVE - I

20AIPJ801 SDG :9,11	CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the components and their representation of control systems
- To learn various methods for analysing the time response, frequency response and stability of the systems
- To learn the various approaches for the state variable analysis.

UNIT I   SYSTEMS COMPONENTS AND THEIR REPRESENTATION   9

Control System: Terminology and Basic Structure-Feedforward and Feedback control theory- Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchronous -Multivariable control system

UNIT II   TIME RESPONSE ANALYSIS   9

Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control-Analytical design for PD, PI,PID control systems

UNIT III   FREQUENCY RESPONSE AND SYSTEM ANALYSIS   9

Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation

UNIT IV   CONCEPTS OF STABILITY ANALYSIS   9

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.

UNIT V   CONTROL SYSTEM ANALYSIS USING STATE VARIABLE
**   METHODS   9**

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-

Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.

TOTAL: 45 PERIODS

TEXT BOOK:
1. M. Gopal, —Control System – Principles and Design‖, Tata McGraw Hill, 4th Edition, 2012.

REFERENCES:
1. J. Nagrath and M. Gopal, —Control System Engineering‖, New Age International Publishers, 5 th Edition, 2007.
2. K. Ogata, Modern Control Engineering , 5th edition, PHI, 2012.
3. S . K. Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013.
4. Benjamin. C. Kuo, Automatic control systems‖, Prentice Hall of India, 7th Edition,1995.

WEB REFERENCES:
1. https://nptel.ac.in/courses/107106081
2. https://onlinecourses.nptel.ac.in/noc20_ee90/preview

ONLINE RESOURCES:
1. https://freevideolectures.com/course/4456/nptel-control-systems
2. https://mrcet.com/ downloads/ digital_notes/ ECE/II%20Year/ CONTROL%20SYSTEMS.pdf
3. https://www.vidyalankar.org/gate/assets/docs/notes/ec-control.pdf

OUTCOMES:
Upon completion of the course, the student should be able to:
1. Identify the various control system components and their representations. (K1)
2. Analyse the various time domain parameters. (K4)
3. Ability to understand use of PID control systems. (K2)
4. Analysis of the various frequency response plots and its system. (K4)
5. Apply the concepts of various system stability criterions. (K3)
6. Design various transfer functions of digital control systems using state variable models. (K6)

CO- PO, PSO MAPPING :

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

PROFESSIONAL ELECTIVE - I

20AIEL502 SDG :9,11	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the phases in a software project
- To understand fundamental concepts of requirements engineering and Analysis Modeling.
- To understand the various software design methodologies
- To learn various testing and maintenance measures

UNIT I   SOFTWARE PROCESS AND AGILE DEVELOPMENT   9

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile Process-Extreme programming-XP Process.

UNIT II   REQUIREMENTS ANALYSIS AND SPECIFICATION   9

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

UNIT III SOFTWARE DESIGN   9

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design – Architectural styles, Architectural Design, Architectural

Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

UNIT IV   TESTING AND MAINTENANCE   9

Software testing fundamentals-Internal and external views of Testing-white box testing – basis path testing-control structure testing-black box testing-Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging –Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering.

UNIT V   PROJECT MANAGEMENT   9

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection – Risk Management-Risk Identification-RMMM Plan-CASE TOOLS

TOTAL :45 PERIODS

TEXT BOOKS:
1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach" , McGraw Hill International Edition, Seventh Edition, 2009.

REFERENCES:
1. Ian Sommerville, "Software Engineering", Ninth Edition, Pearson Education, 2008.
2. Watts S. Humphrey, "A Discipline for Software Engineering", Pearson Education, 2007.
3. Shari Lawrence Pfleeger, Joanne M. Atlee, "Software Engineering: Theory and Practice", Fourth Edition, Pearson Education, 2010.

WEB REFERENCES:
1. https://swayam.gov.in/nd1_noc19_cs69/preview
2. https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-cs69
3. https://nptel.ac.in/courses/106/105/106105182/

ONLINE RESOURCES:
1. http://www.vssut.ac.in/lecture_notes/lecture1428551142.pdf
2. https://freevideolectures.com/course/2318/software-engineering
3. https://courses.cs.washington.edu/courses/cse403/01au/lectures/

4. https://cosmolearning.org/courses/introduction-to-
softwareengineering/video-lectures/

5. https://www.ece.rutgers.edu/~marsic/books/SE/instructor/slides/

OUTCOMES:

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

1. Identify the key activities in Managing a Software Project and Compare Different Process Models. (K1)
2. Understanding of Requirements Engineering and Analysis Modeling. (K2)
3. Apply Systematic Procedure for Software Design and Deployment. (K3)
4. Compare and Contrast the Various Testing and Maintenance. (K3)
5. Manage Project Schedule, Estimate Project Cost and Effort required. (K5)
6. Estimation of Risk Identification and Risk Management. (K4)

CO- PO, PSO MAPPING :

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

PROFESSIONAL ELECTIVE - I

20AIEL503 SDG :9,11	DISTRIBUTED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

● To understand the foundations of distributed systems.
● To learn issues related to clock Synchronization and the need for global state in distributed systems.
● To learn distributed mutual exclusion and deadlock detection algorithms.

- To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems.
- To learn the characteristics of peer-to-peer and distributed shared memory systems.

UNIT I   INTRODUCTION   9

Introduction: Definition –Relation to computer system components –Motivation –Relation to parallel systems — Message-passing systems versus shared memory systems –Primitives for distributed communication –Synchronous versus asynchronous executions –Design issues and challenges. A model of distributed computations: A distributed program –A model of distributed executions –Models of communication networks –Global state — Cuts –Past and future cones of an event –Models of process communications. Logical Time: A framework for a system of logical clocks –Scalar time –Vector time — Physical clock synchronization: NTP.

UNIT II   MESSAGE ORDERING & SNAPSHOTS   9

Message ordering and group communication: Message ordering paradigms –Asynchronous execution with synchronous communication –Synchronous program order on an asynchronous system –Group communication — Causal order (CO) — Total order. Global state and snapshot recording algorithms: Introduction –System model and definitions –Snapshot algorithms for FIFO channels

UNIT III   DISTRIBUTED MUTEX & DEADLOCK   9

Distributed mutual exclusion algorithms: Introduction — Preliminaries — Lamport's algorithm — Ricart-Agrawala algorithm — Maekawa's algorithm — Suzuki–Kasami's broadcast algorithm. Deadlock detection in distributed systems: Introduction — System model — Preliminaries — Models of deadlocks — Knapp's classification — Algorithms for the single resource model, the AND model and the OR model.

UNIT IV   RECOVERY & CONSENSUS   9

Checkpointing and rollback recovery: Introduction — Background and definitions — Issues in failure recovery — Checkpoint-based recovery — Log-based rollback recovery — Coordinated checkpointing algorithm — Algorithm for asynchronous checkpointing and recovery. Consensus and agreement algorithms: Problem definition — Overview of results — Agreement in a failure — free system — Agreement in synchronous systems with failures.

UNIT V   P2P & DISTRIBUTED SHARED MEMORY   9

Peer-to-peer computing and overlay graphs: Introduction — Data indexing and overlays — Chord — Content addressable networks — Tapestry. Distributed shared memory: Abstraction and advantages — Memory consistency models –Shared memory Mutual Exclusion.

TOTAL :45 PERIODS

TEXT BOOKS:

1. Kshemkalyani, Ajay D., and Mukesh Singhal. Distributed computing: principles, algorithms, and systems. Cambridge University Press, 2011.
2. George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems Concepts and Design, Fifth Edition, Pearson Education, 2012.

REFERENCES:

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. Mukesh Singhal and Niranjan G. Shivaratri. Advanced concepts in operating systems. McGraw-Hill, Inc., 1994.
3. Tanenbaum A.S., Van Steen M., Distributed Systems: Principles and Paradigms, Pearson Education, 2007.
4. Liu M.L., Distributed Computing, Principles and Applications, Pearson Education, 2004.
5. Nancy A Lynch, Distributed Algorithms, Morgan Kaufman Publishers, USA, 2003.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106106168
2. https://onlinecourses.nptel.ac.in/noc21_cs87/preview

ONLINE RESOURCES:

1. https://drive.google.com/file/d/1kmbgQH2jfgB0flPeaK22DBq9xNl9bH0U/view
2. https://drive.google.com/file/d/1s6wsbb8hcFhES3y-Uq5lsXedResVwviP/view

OUTCOMES:

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

1. Elucidate the foundations and issues of distributed systems. (K2)
2. Understand the various synchronization issues and global state for distributed systems. (K2)

3. Understand the Mutual Exclusion and Deadlock detection algorithms in distributed systems. (K2)
4. Describe the agreement protocols and fault tolerance mechanisms in distributed systems. (K2)
5. Describe the features of peer-to-peer and distributed shared memory systems. (K2)
6. Interpret the real-time distributed system applications. (K2)

CO- PO, PSO MAPPING :

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

PROFESSIONAL ELECTIVE - I

20AIEL504 SDG :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

TEXT BOOKS:

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://nptel.ac.in/courses/109106137
2. https://archive.nptel.ac.in/courses/110/105/110105139/

ONLINE RESOURCES:

1. https://freevideolectures.com/course/4478/nptel-intellectual-property
2. https://www.rvskvv.net/images/INTELLECTUAL-PROPERTY-RIGHTS_20.04.2020.pdf
3. https://www.icsi.edu/media/website/IntellectualPropertyRightLaws & Practice.pdf

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, PSO MAPPING :

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

PROFESSIONAL ELECTIVE - I

20AIEL505 SDG :9,11	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

TEXT BOOKS:

1. Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, ―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. https://www.coursera.org/learn/social-network-analysis

ONLINE RESOURCES:

1. https://mylifemynotes.files.wordpress.com/2012/03/handbook-of-social-network-technologies-and-applns-b-furht-springer-2010-bbs.pdf
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 behaviour 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, PSO 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	1	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 ELECTIVE - I

20AIEL506 SDG :9,11	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the Software Project Planning and Evaluation techniques
- To plan and manage projects at each stage of the Software Development Life Cycle (SDLC)
- To learn about the Activity Planning and Risk management principles
- To manage Software Projects and control Software deliverables

UNIT I   PROJECT EVALUATION AND PROJECT PLANNING   9

Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects – Setting Objectives – Management Principles – Management Control – Project Portfolio Management – Cost-Benefit Evaluation Technology – Risk Evaluation – Strategic Program Management – Stepwise Project Planning.

UNIT II   PROJECT LIFE CYCLE AND EFFORT ESTIMATION   9

Software Process and Process Models – Choice of Process Models - Rapid Application Development – Agile Methods – Dynamic System Development Method – Extreme Programming– Managing Interactive Processes – Basics of Software Estimation – Effort and Cost Estimation Techniques – COSMIC Full Function Points - COCOMO II - a Parametric Productivity Model.

UNIT III   ACTIVITY PLANNING AND RISK MANAGEMENT   9

Objectives of Activity Planning – Project Schedules – Activities – Sequencing and Scheduling – Network Planning Models – Formulating Network Model – Forward Pass & Backward Pass Techniques – Critical Path (CPM) Method – Risk Identification – Assessment – Risk Planning –Risk Management – PERT Technique – Monte Carlo Simulation – Resource Allocation – Creation of Critical paths – Cost Schedules.

UNIT IV   PROJECT MANAGEMENT AND CONTROL   9

Framework for Management and Control – Collection of Data – Visualizing Progress – Cost Monitoring – Earned Value Analysis – Prioritizing Monitoring – Project Tracking – Change Control – Software Configuration Management – Managing Contracts – Contract Management.

UNIT V   STAFFING IN SOFTWARE PROJECTS   9

Managing People – Organizational Behavior – Best Methods of Staff Selection – Motivation – The Oldham – Hackman Job Characteristic Model – Stress – Health and Safety – Ethical and Professional Concerns – Working in Teams – Decision Making – Organizational Structures – Dispersed and Virtual Teams – Communications Genres – Communication Plans – Leadership.

TOTAL: 45 PERIODS

TEXT BOOKS:
1.   Bob Hughes, Mike Cotterell and Rajib Mall, "Software Project Management", Tata McGraw Hill, New Delhi, Fifth Edition, 2012.
2.   Robert K. Wysocki, "Effective Software Project Management", Wiley Publication, 2011.

REFERENCES:
1.   Walker Royce,"Software Project Management", Addison-Wesley, 1998.
2.   Gopalaswamy Ramesh, "Managing Global Software Projects", McGraw Hill Education (India), Fourteenth Reprint 2013.

WEB REFERENCES:
1.   https://swayam.gov.in/nd2_cec20_mg07/preview
2.   https://onlinecourses.nptel.ac.in/noc19_cs70/preview

ONLINE RESOURCES:
1.   https://www.edx.org/learn/project-management
2.   https://opentextbc.ca/projectmanagement/ chapter/chapter-16-risk-management-planning-project-management/

OUTCOMES:

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

1. Understand Project Management principles while developing software. (K2)
2. Gain extensive knowledge about the basic project management concepts, framework and the process models. (K3)
3. Obtain adequate knowledge about software process models and software effort estimation techniques. (K3)
4. Estimate the risks involved in various project activities. (K3)
5. Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles(K1)
6. Learn the staff selection process and the issues related to people management and determine an appropriate project management approach through an evaluation of the business context and scope of the project.(K3)

CO- PO, PSO MAPPING :

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

PROFESSIONAL ELECTIVE - I

20AIEL507 SDG :9,11	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

TEXT BOOKS:

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%20 LECTURE%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. K6
2. Demonstrate the software process and design rules. K2
3. Design effective HCI for individuals and persons with disabilities. K6
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. K6

CO- PO, PSO 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 ELECTIVE - I

20AIEL508 SDG :9,11	EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:
- To learn the architecture and programming of ARM processor.
- To become familiar with the embedded computing platform design and analysis.
- To get thorough knowledge in interfacing concepts
- To design an embedded system and to develop programs

UNIT I INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS   9

Complex systems and microprocessors– Embedded system design process –Design example: Model train controller- Instruction sets preliminaries - ARM Processor – CPU: programming input and output- supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption.

UNIT II EMBEDDED COMPUTING PLATFORM DESIGN   9

The CPU Bus-Memory devices and systems–Designing with computing platforms – consumer electronics architecture – platform-level performance analysis - Components for embedded programs- Models of programs-Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

UNIT III SENSOR INTERFACING WITH ARDUINO   9

Basics of hardware design and functions of basic passive components-sensors and actuators- Arduino code - library file for sensor interfacing-construction of basic applications

UNIT IV EMBEDDED FIRMWARE   9

Reset Circuit, Brown-out Protection Circuit-Oscillator Unit - Real Time Clock-Watchdog Timer - Embedded Firmware Design Approaches and Development Languages.

UNIT V EMBEDDED C PROGRAMMING   9

Introduction-Creating _hardware delays using Timer 0 and Timer 1-Reading Switches-Adding Structure to the code-Generating a minimum and maximum delay-Example: Creating a portable hardware delay- Timeout Mechanisms-Creating loop timeouts-Testing loop timeouts- hardware timeouts-Testing a hardware timeout

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Marilyn Wolf, —Computers as Components - Principles of Embedded Computing System Design‖, Third Edition —Morgan Kaufmann Publisher (An imprint from Elsevier), 2012. (Unit I & II)
2. https://www.coursera.org/learn/interface-with-arduino#syllabus (Unit III)
3. Michael J. Pont, —Embedded C‖, 2nd Edition, Pearson Education, 2008. (Unit IV & V)

REFERENCES:

1. Shibu K.V, —Introduction to Embedded Systems‖, McGraw Hill.2014
2. Jonathan W. Valvano, —Embedded Microcomputer Systems Real Time Interfacing‖, Third Edition Cengage Learning, 2012
3. Raj Kamal, —Embedded Systems-Architecture, programming and design‖, 3rd edition, TMH.2015

4. Lyla, —Embedded Systems‖, Pearson, 2013
6. David E. Simon, —An Embedded Software Primer‖, Pearson Education,2000.

WEB REFERENCES:
1. https://nptel.ac.in/courses/108102045

ONLINE RESOURCES:
1. https://freevideolectures.com/course/3624/embedded-systems-programming

OUTCOMES:
Upon completion of the course, the student should be able to:
1. Describe the architecture and programming of the ARM processor. (K2)
2. Explain the concepts of embedded systems. (K2)
3. Understand the Concepts of peripherals and interfacing of sensors. (K2)
4. Analyze the use of system design techniques to develop firmware. (K4)
5. Illustrate the code for constructing a system. (K3)
6. Develop embedded systems using case studies. (K6)

CO- PO, PSO MAPPING :

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

PROFESSIONAL ELECTIVE - I

20AIEL509 SDG :9,11	ETHICS IN DATA SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand Ethics and privacy issues in Data Science
- Relate how Data Science can be used for Social Justice and the Social Good
- To evaluate the relation of ethics with nature

UNIT I   INTRODUCTION   9

Introduction to the class, logistics. Overview of the course-Discussion of reading, introduction to ethical frameworks-Utilitarianism (by action and by rule)- Utilitarianism (continued), social contracts-Rawls and ideas of fairness in society-Kant, deontological ethics and the categorical imperative

UNIT II   VIRTUE ETHICS   9

Virtue Ethics-Data Collection: where do ethical conundrums arise in the process of collecting data-Data as commodity: Data Brokers-Data as (personal) property: De-identification and anonymization-Data as public resource: News and Medicine

UNIT III   ETHICS OF DATA ANALYSIS   9

The Ethics of Data Analysis: Science and Behavior-The Mechanics of Data Analysis: Collection-The Mechanics of Data Analysis: Model building-The Mechanics of Data Analysis: Prediction and Feedback

UNIT IV   DATA VS HUMAN   9

Data is humans: The history of human experimentation-Modern experiments on humans-Auditing black box models-Codes of Conduct

UNIT V   APPLICATIONS   9

Fiduciary Roles-Data Scientists as Security Consultants-Real Life Scenario

TOTAL:45 PERIODS

TEXT BOOKS:

1. Ethics and Data Science, by DJ Patil, Hilary Mason, and Mike Loukides, 25 July 2018
2. "Ethics in Information Technology", 4th Edition, George Reynolds Strayer University, 2012. Reference Books:

3. "Ethics and Technology: Controversies, Questions, and Strategies for Ethical Computing", 3rd Edition, Herman T. Tavani, John Wiley & Sons, 2011.

4. "Information Technology Ethics: Cultural Perspectives", Soraj Hon ladarom, Charles Ess, Idea Group Inc (IGI), 2007

REFERENCES:
1. Paula Boddington, "Towards a Code of Ethics for Artificial Intelligence", Springer, 2017
2. Markus D. Dubber, Frank Pasquale, Sunit Das, "The Oxford Handbook of Ethics of AI", Oxford University Press Edited book, 2020
3. S. Matthew Liao, "Ethics of Artificial Intelligence", Oxford University Press Edited Book, 2020
4. N. Bostrom and E. Yudkowsky. "The ethics of artificial intelligence". In W. M. Ramsey and K. Frankish, editors, The Cambridge Handbook of Artificial Intelligence, pages 316–334. Cambridge University Press, Cambridge, 2014.
5. Wallach, W., & Allen, C, "Moral machines: ceaching robots right from wrong", Oxford University Press, 2008.

WEB REFERENCES:
1. https://nptel.ac.in/courses/109106184
2. https://nptel.ac.in/courses/106102220

ONLINE RESOURCES:
1. https://intelligence.org/files/EthicsofAI.pdf
2. https://www.ibm.com/watson/assets/duo/pdf/everydayethics.pdf

OUTCOMES:
Upon completion of the course, the student should be able to:
1. Understand the quality software development process and Illustrate the key ethical issues of an IT organization (K2)
2. Apply ethics and privacy standards to the Data Science project lifecycle. (K2)
3. Characterize ethics and privacy issues in Big Data, data mining, and social media data analysis (K3)
4. Evaluate data science ethical and privacy standards and codes (K3)
5. Understand copyrights, patents and laws needed in IT organizations (K2)

6. Analyze the impact of IT on productivity and quality of life Understand the concepts on online social networking, its applications and effective usage (K4)

CO- PO, PSO MAPPING :

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

PROFESSIONAL ELECTIVE - I

20AIEL510 SDG :9,11	**PRINCIPLES OF COMPUTER SECURITY**	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand Ethics and privacy issues in Data Science
- Relate how Data Science can be used for Social Justice and the Social Good
- To evaluate the relation of ethics with nature

UNIT 1   INTRODUCTION TO SECURITY TRENDS   9

The Computer Security Problem - Targets and Attacks - Approaches to Computer Security - Ethics - Basic Security Terminology - Security Models

UNIT II   OPERATIONAL AND ORGANIZATIONAL SECURITY   9

Policies, Procedures, Standards, and Guidelines - Security Awareness and Training - Interoperability Agreements - The Security Perimeter - Physical Security - Environmental Issues - Wireless - Electromagnetic Eavesdropping - People—A Security Problem - People as a Security Tool

UNIT III CRYPTOGRAPHY   9

Cryptography in Practice - Historical Perspectives - Algorithms - Hashing Functions - Symmetric Encryption - Asymmetric Encryption - Quantum Cryptography- Cryptography Algorithm Use

UNIT IV AUTHENTICATION AND REMOTE ACCESS   9

User, Group, and Role Management - Password Policies - Single Sign-On - Security Controls and Permissions - Preventing Data Loss or Theft - The Remote Access Process - Remote Access Methods

UNIT V   INTRUSION DETECTION SYSTEMS   9

History of Intrusion Detection Systems - IDS Overview - Network-Based IDSs - Host-Based IDSsIntrusion Prevention Systems - Honeypots and Honeynets - Tools

TOTAL :45 PERIODS

TEXT BOOKS:
1. W.A.Coklin, G.White, Principles of Computer Security: Fourth Edition, McGrawHill, 2016
2. William Stallings, Cryptography and Network Security Principles and Practices, Seventh Edition,Pearson

REFERENCE BOOKS:
1. Achyut S. Godbole, Web Technologies: TCP/IP, Web/Java Programming, and Cloud Computing, Tata McGraw-Hill Education, 2013

E BOOKS:
1. https://www.newhorizons.com/promotions/cybersecurity-ebooks

MOOC:
1. https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks#syllabus

OUTCOMES:
Upon completion of the course, the student should be able to:
1. Understand the broad set of technical, social & political aspects of Computer Security. (K2)
2. Discuss the basic security terminology and security model. (K2)
3. Describe the operational and organizational security Aspects. (K2)
4. Understand the fundamentals of cryptography. (K2)

5. Explain Authentication Methods and remote access. (K2)
6. Understand the purpose of Intrusion detection system. (K2)

CO- PO, PSO MAPPING :

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

PROFESSIONAL ELECTIVE - II

20AIEL601 SDG :9	ETHICAL HACKING AND SYSTEMS DEFENSE	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 hackingFoot 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 do ors-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

TEXT BOOKS:

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

REFERENCE BOOKS:

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. Analyse how to perform TCP/IP and Port scanning. (K2)
4. Identify the desktop and server OS vulnerabilities. (K3)
5. Analyse 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, PSO 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 ELECTIVE - II

20AIEL602 SDG :9	WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about the issues and challenges in the design of wireless sensor networks.
- To Understand the working of MAC and Routing Protocols for ad hoc and sensor networks
- To learn about the Transport Layer protocols and their QoS for ad hoc and sensor networks.
- To understand various platforms & tools in sensor networks and the corresponding solutions.

UNIT I   OVERVIEW OF WIRELESS SENSOR NETWORKS   9

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks.

UNIT II   ARCHITECTURES   9

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT III NETWORKING SENSORS 9

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wake Up Concepts - S-MAC, The Mediation Device Protocol, Wake Up Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols-Energy-Efficient Routing, Geographic Routing.

UNIT IV INFRASTRUCTURE ESTABLISHMENT 9

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS 9

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks - An Information Processing Approach", Elsevier, 2007.

REFERENCES:

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks Technology, Protocols and Applications", John Wiley, 2007.
2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

WEB REFERENCES:

1. https://www.sciencedirect.com/topics/computer-science/wirelesssensor-networks
2. https://www.elprocus.com/architecture-of-wireless-sensor-networkand-applications/

ONLINE RESOURCES:

1. https://www.digimat.in/nptel/courses/video/106105160/L01.html
2. www.tfb.edu.mk › Kniga-w02PDF

OUTCOMES:

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

1. To identify and Understand the Challenges for Wireless Sensor Networks (K2)
2. Explain the architecture and networking scenarios of Sensor Networks (K3)
3. Comprehend the networking Scenarios with the knowledge of routing protocol (K3)
4. Illustrate the infrastructure establishment and network management (K4)
5. Be familiar with the OS used in Wireless Sensor Networks and build basic modules (K4)
6. To apply sensor nodes over various Platforms and tools. (K4)

CO- PO, PSO 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	2	1	-	-	-	-	3	3	2	2
CO3	3	3	2	1	3	1	-	-	-	-	3	3	2	2
CO4	3	3	2	1	3	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 ELECTIVE - II

20AIEL603 SDG :9	INFORMATION RETRIEVAL TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of information retrieval with pertinence to modelling, query operations and indexing
- To get an understanding of machine learning techniques for text classification and clustering.
- To understand the various applications of information retrieval giving emphasis to multimedia IR, web search
- To understand the concepts of digital libraries

UNIT I   INTRODUCTION: MOTIVATION   9

Basic Concepts – Practical Issues - Retrieval Process – Architecture - Boolean Retrieval – Retrieval Evaluation – Open-Source IR Systems–History of Web Search – Web Characteristics– The impact of the web on IR ––IR Versus Web Search–Components of a Search engine

UNIT II   MODELLING   9

Taxonomy and Characterization of IR Models – Boolean Model – Vector Model - Term Weighting – Scoring and Ranking –Language Models – Set Theoretic Models - Probabilistic Models – Algebraic Models – Structured Text Retrieval Models – Models for Browsing

UNIT III INDEXING   9

Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching - Sequential Searching and Pattern Matching. Query Operations -Query Languages – Query Processing - Relevance Feedback and Query Expansion - Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency

UNIT IV   CLASSIFICATION AND CLUSTERING   9

Text Classification and Naïve Bayes – Vector Space Classification – Support vector machines and Machine learning on documents. Flat Clustering – Hierarchical Clustering –Matrix decompositions and latent semantic indexing – Fusion and Meta learning

UNIT V   SEARCHING THE WEB   9

Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking – Web Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR: Models and Languages – Indexing and Searching Parallel and Distributed IR – Digital Libraries

TOTAL: 45 PERIODS

TEXT BOOKS:
1.   Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, —Introduction to Information Retrieval‖, Cambridge University Press, First South Asian Edition, 2008.
2.   Implementing and Evaluating Search Engines‖, The MIT Press, Cambridge, Massachusetts London, England, 2010

REFERENCES:

1. Ricardo Baeza – Yates, Berthier Ribeiro – Neto, ―Modern Information Retrieval: The   concepts and Technology behind Search‖ (ACM Press Books), Second Edition, 2011.
2. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, ―Information Retrieval

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 methods 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, PSO 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 ELECTIVE - II

20AIEL604 SDG :9	FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE FOR ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The primary objective of this course is to provide an introduction to the basic principles, techniques, and applications of Artificial Intelligence.
- The emphasis of the course is on teaching the fundamentals and not on providing a mastery of specific commercially available software tools or programming environments.
- Upon successful completion of the course, students will have an understanding of the basic areas of artificial intelligence search, knowledge representation, learning and their applications in design and implementation of intelligent agents for a variety of tasks in analysis, design, and problem solving.
- Aim of this course is to know about Lisp and Prolog and use of these languages in AI.
- Graduate students are expected to develop some familiarity with current research problems and research methods in AI by working on a research or design project

UNIT I   INTRODUCTION TO AI AND PROBLEM REPRESENTATION   9

Introduction: Artificial Intelligence (AI) and its importance, AI Problems (tic tac toe problem, water jug problems), Application area of AI. Problem Representations: State space representation, problem-reduction representation, production system, production system characteristics and types of production system

UNIT II   HEURISTIC SEARCH TECHNIQUES AND GAME PLAYING   9

Heuristic Search Techniques: AI and search process, brute force search, depth-first search, breadth-first search, time and space complexities, heuristics search, hill climbing, best first search, A* algorithm and beam search, AO search, constraint satisfaction. Game Playing: AI and game playing, plausible move generator, static evaluation move generator, game playing strategies, problems in game playing.

UNIT III LOGIC AND KNOWLEDGE REPRESENTATION   9

Knowledge Representation and Structured Knowledge: Associative networks, frame structures, conceptual dependencies and scripts, ontologies. Logic:

Prepositional logic: syntax and semantics, First Order Predicate Logic (FOPL): Syntax and semantics, conversion to clausal form, inference rules, unification, and the resolution principles.

UNIT IV   KNOWLEDGE ACQUISITION AND EXPERT SYSTEM   9

Knowledge Acquisitions: Type of learning, Knowledge Acquisition, Early work in machine learning, learning by induction. Expert System: Introduction to expert system, Phases of expert system, characteristics of expert system and a case study; Introduction of Executive Support System and Decision Support System.

UNIT V   ROBOTICS AND ITS APPLICATION   9

Robotics and Its applications, DDD concept, Intelligent robots, Robot Anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple Problems-Specifications of Robot-Speed of Robot joints and links-Robot Classifications-Architecture of robotic systems-Robot Drive Systems-Hydraulic, Pneumatic and Electric system.

TOTAL : 45 PERIODS

WEB REFERENCES:
1.   https://nptel.ac.in/courses/112104298

ONLINE RESOURCES:
1.   https://nptel.ac.in/courses/112105249
2.   https://nptel.ac.in/courses/107106090

OUTCOMES:
Upon completion of the course, the student should be able to:
1.   Understand how to solve AI problems by using production rules. (K1)
2.   Analyze the appropriate search algorithms for any AI problem. (K2)
3.   Understand the concepts of heuristic search techniques & logic programming. (K1)
4.   Discuss the various knowledge representation techniques. (K2)
5.   Analyze how to express and reason about some domain of knowledge. (K2)
6.   Interpret with anatomy of industrial robots deals with the assembling of outer components of a robot. (K3)

CO- PO, PSO MAPPING :

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

PROFESSIONAL ELECTIVE - II

20AIEL605 SDG :9	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:
- To understand Cryptography Theories, Algorithms and Systems.
- To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

UNIT I   INTRODUCTION   9

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography). - Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

UNIT II   SYMMETRIC CRYPTOGRAPHY   9

MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures - Modular arithmetic-Euclid's algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution.

UNIT III   PUBLIC KEY CRYPTOGRAPHY   9

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler 's totient function, Fermat 's and Euler 's Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

UNIT IV   MESSAGE AUTHENTICATION AND INTEGRITY   9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509

UNIT V   SECURITY PRACTICE AND SYSTEM SECURITY   9

Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.

TOTAL : 45 PERIODS

TEXT BOOK:
1.   William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006.

REFERENCES:
1.   C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt. Ltd
2.   Behrouz A. Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
3.   Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2

WEB REFERENCES:
1.   https://nptel.ac.in/courses/106105162

ONLINE RESOURCES:
1.   https://nptel.ac.in/courses/106105031

OUTCOMES:

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

1. Understand the concepts of Network Security and Remember the various mathematical techniques applied in Cryptography. (K2)
2. Discuss the mathematical formulas used to implement symmetric key cryptography techniques. (K2)
3. Interpret the mathematical background to implement asymmetric key cryptography techniques. (K2)
4. Apply the Symmetric and Asymmetric Cryptographic methods and design Secure Applications to operate Digital Signature in Real World Situation. (K3)
5. Illustrate the various Message authentication schemes to simulate different applications. (K3)
6. Apply Data authentication mechanisms for a web based and system level application. (K3)

CO- PO, PSO 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	2	1	-	-	-	-	3	3	2	2
CO3	3	3	2	1	3	1	-	-	-	-	3	3	2	2
CO4	3	3	2	1	3	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 ELECTIVE - II

20AIEL606 SDG :9	STATISTICS FOR BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The primary objective of this course is to provide skills and experience in data analysis, economic modeling and interpretation of results.
- Hands-on model building using the open source statistical software - R.
- Emphasis will be laid on the ability to set up the model correctly and interpretation the results of the models.
- Students should also develop the ability to critically evaluate the quality of statistical models used in research

UNIT I   DESCRIBING AND SUMMARIZING DATA   9

Introduction to Economic Questions and Data, Review of Probability, Review of Statistics-Recognize trends in data and detect outliers - Summarize data sets concisely - Analyze relationships between variables- Relationship with Organizational Decision Making-Analytics in Decision Making.

UNIT II   PREDICTIVE ANALYTICS   9

Introduction to Predictive analytics - Logic and Data Driven Models - Predictive Analysis Modeling and procedure - Data Mining for Predictive analytics. Analysis of Predictive analytics

UNIT III HYPOTHESIS TESTING   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   SINGLE VARIABLE LINEAR REGRESSION   9

Linear regression with one regressor-Regression with multiple regressors-Non-linear regression functions- Assessing studies based on linear regression (internal and external validity)

UNIT V   MULTIPLE REGRESSION   9

Regression with a binary dependent variable, Panel Data Regression, Introduction to Time-series regression and forecasting- Estimation of Dynamic Causal Effects, VAR, ARCH and GARCH models.

TOTAL : 45 PERIODS

TEXT BOOKS:
1. Introduction to Econometrics by James H. Stock and Mark W. Watson (Addison-Wesley, 3rd Edition)
2. Marc J. Schniederjans, Dara G. Schniederjans and Christopher M. Starkey, " Business Analytics Principles, Concepts, and Applications - What, Why, and How" , Pearson Ed, 2014 3.Christian Albright S and Wayne L. Winston, "Business Analytics - Data Analysis and Decision Making", Fifth edition, Cengage Learning, 2015.

REFERENCE BOOKS/RESOURCES:
1. Introductory Econometrics: A Modern Approach, by Jeffrey M. Wooldridge (South-Western Cengage Publishers, 4th Ed.)
2. R resources: http://www.r-tutor.com/r-introduction, http://www.statmethods.net/
3. James R. Evans, "Business Analytics - Methods, Models and Decisions", Pearson Ed, 2012.

WEB REFERENCES:
1. https://onlinecourses.nptel.ac.in/noc20_mg11/preview
2. https://archive.nptel.ac.in/courses/110/107/110107092/

ONLINE RESOURCES:
1. https://nptel.ac.in/courses/110105089
2. https://www.coursera.org/specializations/business-analytics

OUTCOMES:
Upon completion of the course, the student should be able to:
1. Understand The Role Of Business Analytics In Decision Making. (K1)
2. Identify The Appropriate Tool For The Analytics Scenario. (K2)
3. Quantify the evidence in favor of or against your hypothesis in order to make managerial decisions. (K2)
4. Analyze the relationship between two variables and develop forecasts for values outside the data set. (K3)
5. Apply the tools and generate solutions. (K2)

CO- PO, PSO 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

PROFESSIONAL ELECTIVE - II

20AIEL607 SDG :9	FUZZY CONTROL 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   Λ 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

TEXT BOOKS:
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. REFERENCE BOOK(s): 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

ONLINE RESOURCES:
1. https://nptel.ac.in/courses/127105006
2. 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. (K4)
2. Understand the basic features of membership functions, fuzzification process and defuzzification process. (K2)
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. (K4)
6. Analyze various Fuzzy classification Techniques. (K4)

CO- PO, PSO 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	2	1	-	-	-	-	3	3	2	2
CO3	3	3	2	1	3	1	-	-	-	-	3	3	2	2
CO4	3	3	2	1	3	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 ELECTIVE - II

20AIEL608 SDG :9	AGENT BASED INTELLIGENT SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The concepts of IA Implementation.
- The concepts of manufacturing execution and decision-making in industry.
- Process monitoring, process performance prediction and operation suggestion.
- A mathematical function of an IA which maps all the possible sequences of perceptions in every action.

UNIT I   INTRODUCTION   9

Definitions – Foundations – History – Intelligent Agents-Problem Solving-Searching–Heuristics -Constraint Satisfaction Problems – Game playing.

UNIT II   KNOWLEDGE REPRESENTATION AND REASONING   9

Logical Agents-First order logic-First Order Inference-Unification-Chaining-Resolution Strategies-Knowledge Representation-Objects-Actions-Events.

UNIT III PLANNING AGENTS   9

Planning Problem-State Space Search-Partial Order Planning-Graphs-Nondeterministic Domains-Conditional Planning-Continuous Planning-MultiAgent Planning.

UNIT IV AGENTS AND UNCERTAINITY   9

Acting under uncertainty – Probability Notation-Bayes Rule and use – Bayesian Networks-Other Approaches-Time and Uncertainty-Temporal Models- Utility Theory–Decision Network – Complex Decisions.

UNIT V HIGHER LEVEL AGENTS   9

Knowledge in Learning-Relevance Information-Statistical Learning Methods-Reinforcement Learning-Communication-Formal Grammar-Augmented Grammars-Future of AI.

TOTAL: 45 PERIODS

TEXT BOOK:
1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", 2nd Edition, Prentice Hall, 2002

REFERENCES:
1. Michael Wooldridge, "An Introduction to Multi Agent System", John Wiley, 2002.
2. Patrick Henry Winston, Artificial Intelligence, 3rd Edition, AW, 1999.
3. Nils.J.Nilsson, Principles of Artificial Intelligence, Narosa Publishing House, 1992

WEB REFERENCES:
1. https://ieeexplore.ieee.org/document/9222332https://www.researchgate.net/publication/3331036606_An_Overview_of_Agent_Based_Intelligent_Systems_and_its_Tools
2. https://www.coursera.org/lecture/modeling-simulation-natural-processes/agents-0qKgg

ONLINE RESOURCES:
1. https://www.coursehero.com/file/59866622/33-BayesianNetworkspptx/
2. https://nptel.ac.in/courses/112104251

OUTCOMES:
Upon completion of the course, the student should be able to:
1. Understand the fundamental concepts in the study intelligent agents. (K1)
2. Interpreting the knowledge to design solutions to different problems. (K2)
3. Discuss the components and functions of planning agents. (K3)
4. Understand the relationship between bayes rule and Bayesian networks. (K3)
5. Identify the current trends in intelligent agents and their manifestation in business and industry. (K2)
6. Determine type of higher level agent methodology would be suitable for a given type of application problem. (K3)

CO- PO, PSO MAPPING :

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

PROFESSIONAL ELECTIVE - II

20AIEL609 SDG :9	BIOMEDICAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Introduce Fundamentals of Biomedical Engineering
- To study the communication mechanics in a biomedical system with few example
- To study measurement of certain important electrical and non-electrical parameters
- To understand the basic principles in imaging techniques
- To have a basic knowledge in life assisting and therapeutic devices

UNIT I   INTRODUCTION   9

Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals - Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow - Biomechanics of bone - Biomechanics of soft tissues -Physiological signals and transducers - Transducers – selection criteria – Piezoelectric, ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors

UNIT II   NON-ELECTRICAL PARAMETERS MEASUREMENT AND
**   DIAGNOSTIC PROCEDURES   9**

Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Photo Plethysmography,

Body Plethysmography – Blood Gas analysers, pH of blood –measurement of blood pCO2, pO2, finger-tip oximeter - ESR, GSR measurements.

UNIT III ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS   9

Electrodes – Limb electrodes –floating electrodes – pregelled disposable electrodes - Micro, needle and surface electrodes – Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current- Instruments for checking safety parameters of biomedical equipment.

UNIT IV IMAGING MODALITIES AND ANALYSIS   9

Radiographic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography –Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems.

UNIT V   LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES   9

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy - ICCU patient monitoring system - Nano Robots - Robotic surgery –Orthopaedic prostheses fixation.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007.
2. Khandpur R.S, Handbook of Biomedical Instrumentation, Tata McGraw-Hill, New Delhi,2nd edition, 2003
3. Joseph J Carr and John M. Brown, Introduction to Biomedical Equipment Technology, John Wiley and sons, New York, 4th edition, 2012

REFERENCES

1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 1998.
2. Duane Knudson, Fundamentals of Biomechanics, Springer, 2nd Edition, 2007.
3. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.

4. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.
5. M. Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.

WEB RESOURCES:
1. https://nptel.ac.in/courses/102105090

Online Resources:
1. https://nptel.ac.in/courses/127106134

OUTCOMES:
Upon completion of the course, the student should be able to:
1. Understand the philosophy of the heart, lung, blood circulation (K2)
2. Provide latest ideas on devices of non-electrical devices respiration systems (K1)
3. Gain knowledge on various sensing and measurement devices of electrical origin (K1)
4. Understand the analysis systems of various organ types (K2)
5. Bring out the important and modern methods of imaging techniques and their analysis (K3)
6. Explain the medical assistance/techniques, robotic and therapeutic equipment (K2)

CO- PO, PSO 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	2	1	-	-	-	-	3	3	2	2
CO3	3	3	2	1	3	1	-	-	-	-	3	3	2	2
CO4	3	3	2	1	3	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 ELECTIVE - II

20AIEL610 SDG :9	ROBOTIC SENSORS	L	T	P	C
		3	0	0	3

OBJECTIVES:
- The basics and the latest technology of sensors used in robotics.
- The different sensing variables
- Robot vision system
- Robot programming

UNIT I   INTRODUCTION   9
An Introduction to sensors and Transducers, History and definitions, Smart Sensing, AI sensing, Need of sensors in Robotics.

UNIT II   SENSORS IN ROBOTICS   9
Position sensors – optical, non-optical, Velocity sensors, Accelerometers, Proximity Sensors – Contact, non-contact, Range Sensing, touch and Slip Sensors, Force and Torque Sensors.

UNIT III MISCELLANEOUS SENSORS IN ROBOTICS   9
Different sensing variables – smell, Heat or Temperature, Humidity, Light, Speech or Voice recognition Systems, Telepresence and related technologies.

UNIT IV   VISION SENSORS IN ROBOTICS   9
Robot Control through Vision sensors, Robot vision locating position, Robot guidance with vision system, End effector camera Sensor.

UNIT V   MULTI SENSOR CONTROLLED ROBOT ASSEMBLY   9
Control Computer, Vision Sensor modules, Software Structure, Vision Sensor software, Robot programming, Handling, Gripper and Gripping methods, accuracy – A Case study.

TOTAL : 45 PERIODS

TEXT BOOK:
1. Paul W Chapman, "Smart Sensors", an Independent Learning Module Series, 1996.

2. Richard D. Klafter, Thomas. A, Chri Elewski, Michael Negin, "Robotics Engineering an Integrated Approach", Phi Learning., 2009.
3. John Iovice, "Robots, Androids and Animations", Mc Graw Hill, 2003.

REFERENCES :
1. Gonzalez Fu.K.S, R.C, Lee.C.S.G, "Robotics – Control Sensing, Vision and Intelligence", Tata McGraw-Hill Education, 2008.
2. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, "Industrial Robotics, Technology Programming and Applications", Tata McGraw-Hill Education, 2012.
3. Sabrie Soloman, "Sensors and Control Systems in Manufacturing", McGraw-Hill Professional Publishing, 2nd Edition, 2009.
4. Julian W Gardner, "Micro Sensor MEMS and Smart Devices", John Wiley & Sons, 2001.

WEB REFERENCES:
1. https://nptel.ac.in/courses/112101098
2. https://archive.nptel.ac.in/courses/112/105/112105249/

ONLINE RESOURCES:
1. https://nptel.ac.in/courses/112108093
2. https://nptel.ac.in/courses/112107289

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 countermeasures. (K2)

CO- PO, PSO MAPPING :

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

Imagine the Future and
Make it happen!

1 NO POVERTY

2 ZERO HUNGER

3 GOOD HEALTH AND WELL-BEING

4 QUALITY EDUCATION

5 GENDER EQUALITY

6 CLEAN WATER AND SANITATION

7 AFFORDABLE AND CLEAN ENERGY

8 DECENT WORK AND ECONOMIC GROWTH

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

10 REDUCED INEQUALITIES

11 SUSTAINABLE CITIES AND COMMUNITIES

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

14 LIFE BELOW WATER

15 LIFE ON LAND

16 PEACE, JUSTICE AND STRONG INSTITUTIONS

17 PARTNERSHIPS FOR THE GOALS

Sairam SDG ACTION PROGRAM

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

Chairam & CEO – Sairam Institutions