Sri

SAI RAM ENGINEERING COLLEGE

An Autonomous Institution

West Tambaram, Chennai - 44

www.sairam.edu.in

Approved by AICTE, New Delhi
Affiliated to Anna University

B.E. COMPUTER SCIENCE & ENGINEERING
INTERNET OF THINGS (IoT)

REGULATIONS
2020

Academic Year 2021-22 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 COMPUTER SCIENCE & ENGINEERING INTERNET OF THINGS (IoT)

VISION

To develop technical professionals into entrepreneurs and IoT experts and to provide students with the skill sets and subject knowledge that they need to succeed in the Internet of Things world.

MISSION

Computer Science and Engineering (Internet of Things), Sri Sai Ram Engineering College is committed to:

M1: To provide good infrastructure and teaching learning ambience
M2: Connect geographically dispersed devices with a variety of capabilities.
M3: Utilize Computers and peripherals to build IoT hardware.
M4: Facilitate Industry Academia interface to update the recent trends in IoT.

AUTONOMOUS CURRICULA 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
PRACTICALS							
7	20BSPL101	Physics and Chemistry Laboratory	0	0	3	3	1.5
8	20ESPL101	Programming in C Laboratory	0	0	3	3	1.5
VALUE ADDITIONS - I							
9	20TPHS101	Skill Enhancement	0	0	2	2	1
10	20HSMG101	Personal Values	2	0	0	2	0
11	20HSTA101	Heritage of Tamils	1	0	0	1	1
TOTAL						**30**	**24**

SEMESTER II

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20BSMA204	Discrete Structures	3	1	0	4	4
2	20HSEN201	Technical English – II	3	0	0	3	3
3	20BSPH203	Physics for Information Science	3	0	0	3	3
4	20BSCY201	Environmental Science and Engineering	3	0	0	3	3
5	20ESIT202	Python Programming	3	0	0	3	3
6	20ESIT203	Digital Principles and System Design	2	1	0	3	3
PRACTICALS							
7	20ESPL201	Python Programming Laboratory	0	0	3	3	1.5
8	20ESPL202	Digital Laboratory	0	0	3	3	1.5
9	20ESGE201	Engineering Practices Laboratory	0	0	3	3	1.5
VALUE ADDITIONS - II							
10	20TPHS201	Skill Enhancement	0	0	1	1	0
11	20HSMG201	Interpersonal Values	2	0	0	2	0
12	20HSTA201	Tamils And Technology	1	0	0	1	1
TOTAL						**32**	**24.5**

SEMESTER III

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20BSMA302	Probability and Statistical Modelling	3	1	0	4	4
2	20CSPC301	Object Oriented Programming	2	1	0	3	3
3	20ITPC301	Data Structures	3	0	0	3	3
4	20ESCI301	Basic Electronics and Communication Engineering	3	0	0	3	3
5	20CIPC301	Computer Architecture and Microcontrollers	3	0	0	3	3
6	20CIPC302	Introduction to Internet of Things	3	0	0	3	3
PRACTICALS							
6	20ITPL301	Data Structures Laboratory	0	0	3	3	1.5
7	20CIPL301	Internet of Things Laboratory	0	0	3	3	1.5
8	20CITE301	Live-in-Lab-I	0	0	2	2	1
VALUE ADDITIONS - III							
9	20CITP301	Skill Enhancement	0	0	1	1	0
TOTAL						**29**	**24**

SEMESTER IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20CIPW401	Communication and Networking Technologies for IoT with Lab	3	0	2	5	4
2	20CSPC401	Operating Systems	3	0	0	3	3
3	20ITPC401	Design and Analysis of Algorithms	3	0	0	3	3
4	20CIPC401	Agile Software Engineering	3	0	0	3	3
5	20CSPC402	Database management systems	3	0	0	3	3
PRACTICALS							
7	20CSPL401	Operating Systems Laboratory	0	0	3	3	1.5
8	20CSPL402	Database Management Systems Laboratory	0	0	3	3	1.5
9	20CITE401	Live-in-Lab-II	0	0	2	2	1
VALUE ADDITIONS - IV							
10	20CITP401	Skill Enhancement	0	0	2	2	1
11	20MGMC301	Constitution of India	2	0	0	2	0
TOTAL						**29**	**21**

SEMESTER V

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20CSPC501	Internet Programming	3	0	0	3	3
2	20CSPC502	Theory of Computation	2	1	0	3	3
3	20CIPC501	IoT architecture and programming in IoT	3	0	0	3	3
4	20CSPC503	Mobile Computing	3	0	0	3	3
5	20XXELXXX	Professional Elective–I	3	0	0	3	3
6	20XXOEXXX	OpenElective-I	3	0	0	3	3
PRACTICALS							
7	20CSPL501	Internet Programming Laboratory	0	0	4	4	2
8	20CIPL501	IoT architecture and programming in IoT Lab	0	0	3	3	1.5
9	20CITE501	Live in Lab-III	0	0	2	2	1
VALUE ADDITIONS - V							
10	20CITP501	Skill Enhancement	0	0	2	2	1
TOTAL						**29**	**23.5**

SEMESTER VI

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20CSPC601	Artificial Intelligence	3	0	0	3	3
2	20CSPC602	Compiler Design	3	0	0	3	3
3	20CIPC603	Cloud Computing and Fog Computing	3	0	0	3	3
4	20XXELXXX	Professional Elective–II	3	0	0	3	3
5	20HSMG601	Principles of Engineering Management	3	0	0	3	3
PRACTICALS							
6	20CSPL601	Artificial Intelligence Laboratory	0	0	3	3	1.5
7	20CSPL602	Cloud Computing Laboratory	0	0	3	3	1.5
8	20HSPL501	Communication and Soft Skills Laboratory	0	0	2	2	1
9	20CIPJ601	Innovative Design Project	0	0	2	2	1
VALUE ADDITIONS - VI							
10	20CITP601	Skill Enhancement	0	0	2	2	1
TOTAL						**27**	**21**

SEMESTER VII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20CSPC701	Big Data Analytics	3	0	0	3	3
2	20CSPC702	Machine Learning Techniques	3	0	0	3	3
3	20CIPW701	Sensors and Embedded Systems with Lab	3	0	2	5	4
4	20XXELXXX	Professional Elective-III	3	0	0	3	3
5	20XXOEXXX	Open Elective–II	3	0	0	3	3
PRACTICALS							
6	20CSPL701	Big Data Analytics Laboratory	0	0	3	3	1.5
7	20AIPL702	Machine Learning Laboratory	0	0	3	3	1.5
8	20CIPJ701	Project Phase-I	0	0	4	4	2
VALUE ADDITIONS - VII							
9	20CITP701	Skill Enhancement	0	0	2	2	1
TOTAL						**29**	**22**

SEMESTER VIII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20XXELXXX	Professional Elective-IV	3	0	0	3	3
PRACTICAL							
2	20CIPJ801	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	25.5	21	10	12	66.5	08	06	03	7	7	3	Y	**169**
Percentage	15	12.4	5.9	7.1	39.3	4.7	3.5	1.8	4.1	4.1	1.8	-	

*IS-Internship

PROFESSIONAL ELECTIVES - I

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1.	20CSEL501	Data Warehousing and DataMining	3	0	0	3	3	Artificial Intelligence
2.	20CIEL501	Introduction to Cyber Security	3	0	0	3	3	Cyber Security
3.	20CIEL502	Sensors, Actuators and Signal Processing	3	0	0	3	3	IoT
4.	20CIEL503	Dynamic Paradigm in IoT	3	0	0	3	3	IoT
5.	20CIEL504	Introduction To Industry 4.0 and Technologies	3	0	0	3	3	IoT
6.	20CIEL505	Data Preprocessing	3	0	0	3	3	Artificial Intelligence
7.	20CIEL506	Quantum Computing	3	0	0	3	3	Computing & Information Systems
8.	20ITEL601	SoftwareTesting	3	0	0	3	3	Computing & Information Systems
9.	20ITEL706	Computer Graphics and Multimedia	3	0	0	3	3	Computing & Information Systems
10.	20MGEL501	Intellectual Property Rights	3	0	0	3	3	Management

PROFESSIONAL ELECTIVES - II

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20CSEL705	Ethical Hacking	3	0	0	3	3	Cloud Computing & Security
2	20CSEL605	Predictive Modeling	3	0	0	3	3	Data Science
3	20CIEL601	IoT Device Programming	3	0	0	3	3	IoT
4	20CIEL602	Web of Things	3	0	0	3	3	IoT
5	20CIEL603	Data Science for Internet of Things	3	0	0	3	3	IoT
6	20CIEL604	Descriptive Analytics for IoT	3	0	0	3	3	IoT
7	20CSEL601	Software Project Management	3	0	0	3	3	Software Engg. & Computing
8	20CSEL602	Digital Forensics	3	0	0	3	3	Cloud Computing & Security
9	20CSEL603	Virtualization Technologies	3	0	0	3	3	Cloud Computing & Security
10	20CSEL604	BioInformatics	3	0	0	3	3	Data Science

PROFESSIONAL ELECTIVES - III

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1.	20ITEL802	Virtual Reality and Augmented Reality	3	0	0	3	3	IoT
2.	20MEPC702	Robotics and Applications	3	0	0	3	3	IoT
3.	20CSEL809	Game Programming	3	0	0	3	3	Software Engg. & Computing
4.	20CIEL701	Artificial IoT	3	0	0	3	3	IoT
5.	20CSEL701	Social Network Analysis	3	0	0	3	3	Data Science
6.	20CIEL702	Software Defined Networks	3	0	0	3	3	IoT
7.	20CSEL703	Information Retrieval Techniques	3	0	0	3	3	Artificial Intelligence
8.	20CSEL704	Natural Language Processing	3	0	0	3	3	Artificial Intelligence
9.	20CSEL707	Web Analytics	3	0	0	3	3	Data Science
10.	20CSEL708	IT Security Compliance and Forensics	3	0	0	3	3	Software Engg. & Computing

PROFESSIONAL ELECTIVES - IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20CSEL801	Green Computing	3	0	0	3	3	Cloud Computing & Security
2	20CSEL802	Deep Learning Principles and Practices	3	0	0	3	3	Data Science
3	20CSEL803	Block Chain and Crypto Currency Technologies	3	0	0	3	3	Cloud Computing & Security
4	20CSEL804	Software Quality Assurance	3	0	0	3	3	Cloud Computing & Security
5	20CSEL805	Speech Processing	3	0	0	3	3	Artificial Intelligence
6	20CSEL806	Cognitive Science	3	0	0	3	3	Cloud Computing & Security
7	20CSEL807	Computer Vision	3	0	0	3	3	Software Engg & Computing
8	20CSEL808	Scientific Visualization Techniques	3	0	0	3	3	Data Science
9	20CIEL801	Open Source Intelligence (OSINT)	3	0	0	3	3	IoT
10	20CIEL802	Digital Twin Technology	3	0	0	3	3	IoT

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1 Graduates will have a sound understanding of fundamental concepts of IoT.

PEO 2 Graduates will be trained to gain domain expertise by applying the theory basics into practical situation through simulation and modeling techniques.

PEO 3 Graduates will enhance the capability through skill development and make them Industry ready by inculcating leadership and multitasking abilities.

PEO 4 Graduates will apply their expertise of the Internet of Things to research and Development and create novel products that benefit society.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1 The graduates will be able to develop and test integrated solutions for Internet of Things project development.

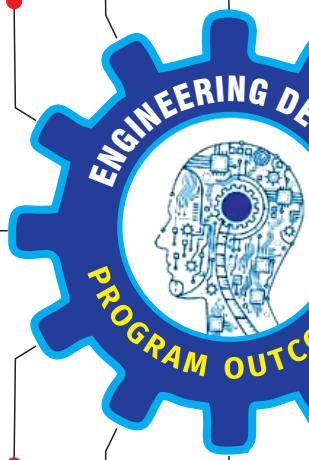
PSO 2 The graduates will be empowered with the skills and expertise required delivering industry and societal solutions in the area of Internet of Things.

COMPONENTS OF THE CURRICULUM (COC)

Course Component	Curriculum Content (% of total number of credits of the program)	Total number of contact hours	Total Number of credits
Basic Sciences(BS)	15	27	25.5
Engineering Sciences(ES)	12.4	27	21
Humanities and Social Sciences (HS)	5.9	15	10
Professional Electives(EL)	7.1	12	12
Program Core+Program Lab (PC+PL)	39.3	82	66.5
Program theory with Lab (PW)	4.7	10	8
Open Electives (OE)	3.5	06	06
Talent Enhancement (TE)	1.7	06	03
Project (PJ)	4.1	14	07
Training & Placement (TP)	4.1	14	07
Internships/Seminars (IS)	1.7	-	03
Mandatory Courses (MC)	NA	02	NA
Total number of Credits		215	169

PROGRAMME OUTCOMES(POs)

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



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

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

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

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

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

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

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

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

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

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

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

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

SEMESTER - I

20BSMA101 SDG NO. 4	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 SDG NO. 4&9	PROBLEM SOLVING AND PROGRAMMING IN C	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand about the programming language
- To develop C Programs using basic Programming Constructs, Loops Arrays and Strings
- To develop applications in C using Functions , Pointers and Structures
- To perform I/O operations and File Handling in C

UNIT I INTRODUCTION TO PROGRAMMING AND ALGORITHMS FOR PROBLEM SOLVING 10

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

UNIT II BASICS OF C PROGRAMMING 8

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

UNIT III ARRAYS AND STRINGS 9

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

UNIT IV FUNCTIONS AND POINTERS 9

Introduction to Functions: Function Prototype, Function Definition, Function Call, Built-in Functions (String Functions, Math Functions) – Recursion – Example Program: Computation of Sine Series - Scientific Calculator using Built-in Functions - Binary Search using Recursive Functions – Pointers – Pointer Operators – Pointer Arithmetic – Arrays and Pointers –

Array of Pointers – Example Program: Sorting of Names – Parameter Passing: Pass by Value - Pass by Reference – Example Program: Swapping of Two Numbers using Pass by Reference.

UNIT V STRUCTURES and FILE PROCESSING 9

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

Files – Types of File Processing: Sequential Access, Random Access – Sequential Access File - Example Program: Finding Average of Numbers stored in Sequential Access File - Random Access File - Example Program: Transaction Processing Using Random Access Files – Command Line Arguments.

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

1. Paul Deitel and Harvey Deitel, "C How to Program", Seventh edition, Pearson Publication, 2015.
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. Understand the concepts of algorithms for solving a problem. (K2)
2. Illustrate the various constructs in C to develop simple applications. (K3)
3. Understand the concepts of Array & Strings. (K2)
4. Demonstrate the usage of Functions and Pointers. (K3)
5. Explain the Structure and union concepts. (K2)
6. Describe the file manipulation and its organisation.(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	1	1	-	2	2	-	3	2	3
CO2	3	3	3	3	2	-	1	1	2	2	3	3	2	3
CO3	3	3	3	3	2	1	1	1	2	-	3	-	3	2
CO4	3	3	3	3	2	1	-	1	2	2	3	3	1	2
CO5	3	3	3	3	2	1	1	1	2	2	3	3	2	1
CO6	3	3	3	3	2	1	1	1	2	2	3	3	3	2

SEMESTER - I

20ESGE101 SDG NO. 4,6,7, 9, 12,14 &15	ENGINEERING GRAPHICS	L	T	P	C
		1	2	0	3

OBJECTIVES:

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

CONCEPTS AND CONVENTIONS (Not for Examination) 3

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

UNIT I PLANE CURVES AND FREEHAND SKETCHING 6+9

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

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

UNIT II PROJECTION OF LINES AND PLANE SURFACE 6+9

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

UNIT III PROJECTION OF SOLIDS 6+9

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

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

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

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+9

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

TOTAL: 78 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

WEB REFERENCES:

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

ONLINE RESOURCES:

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

PUBLICATION OF BUREAU OF INDIAN STANDARDS:

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

OUTCOMES:

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

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

CO - PO , PSO MAPPING:

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

SEMESTER - I

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

PHYSICS LABORATORY

OBJECTIVES:

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

LIST OF EXPERIMENTS (Any 5 Experiments)

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

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

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

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

TEXTBOOKS:

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

CHEMISTRY LABORATORY

(Any five experiments to be conducted)

OBJECTIVES:

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

LIST OF EXPERIMENTS (Any five experiments to be conducted)

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

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

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

TOTAL: 30 PERIODS

TEXT BOOKS:

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

OUTCOMES:

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

1. Apply the principles of thermal physics and properties of matter to evaluate the properties of materials and to determine the physical properties of liquid using ultrasonic interferometer. (K1)
2. Understand measurement technique and usage of new instruments in optics for real time application in engineering. (K2)
3. Apply the knowledge of semiconductor materials to evaluate the band gap and Hall coefficient of materials and to study the characteristics of solar cell for engineering solutions. (K3)
4. 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 tocheck whether a given number is odd or even?
7. Write a program to find the factorial of a given number.
8. Write a program to find out the average of 4 integers.
9. Write a program to display array elements using two dimensional arrays.
10. Write a program to perform swapping using function.
11. Write a program to display all prime numbers between two intervals using functions.
12. Write a program to reverse a sentence using recursion.
13. Write a program to get the largest element of an array using the function.
14. Write a program to concatenate two string.
15. Write a program to find the length of String.
16. Write a program to find the frequency of a character in a string.
17. Write a program to store Student Information in Structure and Display it.
18. The annual examination is conducted for 10 students for five subjects. Write a program to read the data and determine the following:
    (a) Total marks obtained by each student.
    (b) The highest marks in each subject and the marks of the student who secured it.
    (c) The student who obtained the highest total marks.
19. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.
20. Count the number of account holders whose balance is less than the minimum balance using sequential access file.

TOTAL: 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C compiler 30 Nos.

(or)

Server with C compiler supporting 30 terminals or more.

OUTCOMES:

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

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

5. Demonstrate C programs involving pointers, and structures. (K3)
6. Interpret applications using sequential and random access file. (K3)

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	1	1

OBJECTIVES:

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

UNIT I SOCIAL NETWORK ETIQUETTES **6**

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

UNIT II BROWSING CULTURE **6**

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

UNIT III NETWORKING **6**

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

UNIT IV PROFESSIONALISM **6**

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

UNIT V DIGITAL IDENTIFICATION **6**

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

TOTAL : 30 PERIODS

WEB REFERENCES :

Unit I: Social Network Etiquettes:

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

Unit II: Browsing Culture:

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

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

Unit III:Networking

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

Unit IV : Professionalism

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

Unit V: Digital Identification

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

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

OUTCOMES:

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

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

CO- PO MAPPING :

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

SEMESTER - I

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

OBJECTIVES:

- Values through Practical activities

UNIT I SELF CONCEPT **6**

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

UNIT II INDIVIDUAL VALUES **6**

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

UNIT III MORAL VALUES **6**

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

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

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

UNIT V DECISION MAKING **6**

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

TOTAL: 30 PERIODS

Note:

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

REFERENCE BOOKS:

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

OUTCOMES:

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

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

CO – PO MAPPING:

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

SEMESTER - I

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

UNIT I LANGUAGE AND LITERATURE 3

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

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

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

UNIT III FOLK AND MARTIAL ARTS 3

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

UNIT IV THINAI CONCEPT OF TAMILS 3

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

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

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

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

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

தமிழர் மரபு

அலகு I மொழி மற்றும் இலக்கியம்: **3**

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

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

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

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: 3

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

அலகு IV தமிழர்களின் திறைக் கோட்பாடுகள்: 3

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

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

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

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

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

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

SEMESTER - II

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

OBJECTIVES:

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

UNIT I RELATION AND FUNCTION 12

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

UNIT II COMBINATORICS 12

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

UNIT III LOGICS AND PROOFS 12

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

UNIT IV ALGEBRAIC STRUCTURES 12

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

UNIT V GRAPHS AND TREES 12

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

TOTAL: 60 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

WEB REFERENCES :

1. https://web.stanford.edu/class/cs103x/cs103x-notes.pdf
2. https://www.cs.cornell.edu/~rafael/discmath.pdf
3. http://home.iitk.ac.in/~arlal/book/mth202.pdf

ONLINE RESOURCES:

1 https://www.youtube.com/watch?v=h_9WjWENWV8&list=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 SDG NO. 4,17	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

UNIT I ENVIRONMENT, 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 SDG NO. 4&9	PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

UNIT I BASICS OF PYTHON PROGRAMMING 9

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

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

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

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

UNIT III FUNCTIONS, MODULES, PACKAGES 9

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

UNIT IV FILES, EXCEPTIONS, CLASSES AND OBJECTS 9

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

UNIT V NUMPY, PANDAS, MATPLOTLIB 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Second edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2", Network Theory Ltd., 2011.
3. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013
4. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.

5. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
6. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
7. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus", Wiley India Edition, 2013.
8. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.

WEB REFERENCES:

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

OUTCOMES:

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

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

CO- PO, PSO MAPPING:

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

SEMESTER - II

20ESIT203 SDG NO. 4 & 9	DIGITAL PRINCIPLES AND SYSTEM DESIGN	L	T	P	C
		2	1	0	3

OBJECTIVES:

- To analyze and design combinational circuits
- To analyze and design synchronous and asynchronous sequential circuits
- To understand Programmable Logic Devices
- To write HDL code for combinational and sequential circuits

UNIT I BOOLEAN ALGEBRA AND LOGIC GATES **9**

Number Systems – Arithmetic Operations – Binary Codes- Boolean Algebra and Logic Gates – Theorems and Properties of Boolean Algebra – Boolean Functions – Canonical and Standard Forms – Simplification of Boolean Functions using Karnaugh Map – Logic Gates – NAND and NOR Implementations.

UNIT II COMBINATIONAL LOGIC **9**

Combinational Circuits – Analysis and Design Procedures – Binary Adder-Subtractor – Decimal Adder – Binary Multiplier – Magnitude Comparator – Decoders – Encoders – Multiplexers – Introduction to HDL – HDL Models of Combinational circuits.

UNIT III SYNCHRONOUS SEQUENTIAL LOGIC **9**

Sequential Circuits – Storage Elements: Latches , Flip-Flops – Analysis of Clocked Sequential Circuits – State Reduction and Assignment – Design Procedure – Registers and Counters – HDL Models of Sequential Circuits.

UNIT IV ASYNCHRONOUS SEQUENTIAL LOGIC **9**

Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards.

UNIT V MEMORY AND PROGRAMMABLE LOGIC **9**

RAM – Memory Decoding – Error Detection and Correction – ROM – Programmable Logic Array – Programmable Array Logic – Sequential Programmable Devices.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. M. Morris R. Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog", 6th Edition, Pearson Education, 2017.

REFERENCES:

1. G. K. Kharate, "Digital Electronics", Oxford University Press, 2010
2. John F. Wakerly, "Digital Design Principles and Practices", Fifth Edition, Pearson Education, 2017.
3. Charles H. Roth Jr, Larry L. Kinney, "Fundamentals of Logic Design", Sixth Edition, CENGAGE Learning, 2013
4. Donald D. Givone, "Digital Principles and Design", Tata Mc Graw Hill, 2003.

ONLINE RESOURCES:

1. https://ocw.mit.edu/courses/online-textbooks/
2. https://nptel.ac.in/courses/117105080/

OUTCOMES:

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

1. Understanding Boolean algebra, number systems and simplify Boolean functions using Kmap. (K2)
2. Understand the Combinational and sequential Circuits. (K2)
3. Demonstrate the use of Combinational Circuits and Sequential circuits (K3)
4. Interpret the designs using Programmable Logic Devices. (K3)
5. Apply HDL code for combinational and Sequential Circuits. (K3)
6. Interpret and troubleshoot logic circuits. (K3)

CO – PO, PSO MAPPING:

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

SEMESTER - II

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

OBJECTIVES:

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

LIST OF EXPERIMENTS :

1 Compute the GCD of two numbers
2 Find the maximum and minimum of a list of numbers
3 Linear search and Binary search
4 Selection sort, Insertion sort
5 Merge sort, Quick Sort
6 First n prime numbers
7 Multiply matrices
8 Programs that take command line arguments (word count)
9 Find the most frequent words in a text read from a file
10 Exception Handling – License Process
11 Classes and Objects – Student class
12 Solving Linear System of Equations
13 Using Pandas to Open csv files
14 Creating a Single plot
15 Creating Scatter plot, Histogram

TOTAL: 45 PERIODS

LAB REQUIREMENTS

Python 3

OUTCOMES

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

1. Illustrate simple programs for describing the syntax, semantics and control flow statements. [K3]
2. Describe the core data structures like String, lists, dictionaries, tuples and sets in Python to store, process and sort the data. [K2]
3. Interpret the concepts of functions, modules and packages in Python. [K3]
4. Illustrate the applications of python libraries. [K3]

5. Describe the file manipulation and its operations. [K2]
6. Demonstrate exceptions and classes and objects for any real time applications. [K3]

CO- PO, PSO MAPPING:

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

SEMESTER - II

20ESPL202 SDG NO. 4 & 9	DIGITAL LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To design and implement the various combinational circuits
- To design and implement combinational circuits using MSI devices
- To design and implement sequential circuits
- To understand and code with HDL programming

LIST OF EXPERIMENTS

1. Verification of Boolean Theorems using basic gates
2. Design and implementation of combinational circuits using basic gates for arbitrary functions, code converters
3. Design and implement Half/Full Adder and Subtractor
4. Design and implement combinational circuits using MSI devices:
   a) 4 bit binary adder/subractor
   b) Parity generator/checker
   c) Magnitude comparator
5. Application using multiplexers

6. Design and implement shift-registers
7. Design and implement synchronous counters
8. Design and implement asynchronous counter
9. Coding combinational circuits using HDL
10. Coding sequential circuits using HDL
11. Design and implementation of a simple digital system (Mini Project)

LAB REQUIREMENTS:

HARDWARE:

DIGITAL TRAINER KITS

DIGITAL IC's required for the experiments in sufficient numbers

SOFTWARE:

HDL, Verilog simulator

TOTAL: 45 PERIODS

OUTCOMES

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

1. Implement simplified combinational circuits using basic logic gates. (K6)
2. Implement combinational circuits using MSI devices. (K6)
3. Implement sequential circuits like registers and counters.(K6)
4. Simulate combinational and sequential circuits using HDL.(K4)
5. Implement designs using Programmable Logic Devices. (K6)
6. Design and implementation of a simple digital system.(K6)

CO- PO, PSO MAPPING:

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

SEMESTER - II

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

OBJECTIVES:

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

ELECTRICAL ENGINEERING PRACTICE

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

ELECTRONICS ENGINEERING PRACTICE

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

CIVIL ENGINEERING PRACTICE

Buildings:

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

Plumbing Works:

1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.

2. Study of pipe connections requirements for pumps and turbines.
3. Preparation of plumbing line sketches for water supply and sewage works.
4. Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
5. Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

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

MECHANICAL ENGINEERING PRACTICE

Welding:

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

Basic Machining:

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

Sheet Metal Work:

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

Machine assembly practice:

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

Demonstration on:

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

Total : 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

1. Electrical

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

2. Electronics

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

3. Civil

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

4. Mechanical

1	Arc welding transformer with cables and holders	5 Nos
2	Welding booth with exhaust facility	5 Nos
3	Welding accessories like welding shield, chipping hammer, wire brush, etc	5 Sets
4	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos
5	Centre lathe	2 Nos

6	Hearth furnace, anvil and smithy tools	2 Sets
7	Moulding table, foundry tools	2 Sets
8	Power Tool: Angle Grinder	2 Nos
9	Study-purpose items: centrifugal pump, air-conditioner	1 each

OUTCOMES:

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

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

CO - PO MAPPING:

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

SEMESTER - II

20TPHS201 SDG NO. 4&5	SKILL ENHANCEMENT	L	T	P	C
		0	0	1	0

OBJECTIVES:

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

UNIT I RESUME BUILDING **6**

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

UNIT II VIRTUAL MEETINGS **6**

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

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

UNIT III ONLINE LEARNING **6**

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

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

UNIT IV GOOGLE SUITE **8**

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

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

UNIT V PRESENTATION SKILLS **4**

Email Writing – Group Discussion - Power Point Presentation

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

TOTAL : 30 PERIODS

WEB REFERENCES :

Unit I: Resume Building:

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

Unit – II:Virtual Meetings

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

Unit – III:Online Learning

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

Unit IV: Google Suite

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

Unit V: Presentation Skills

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

OUTCOMES:

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

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

CO – PO MAPPING

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

SEMESTER - II

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

OBJECTIVES:

- Values through Practical activities

UNIT I INTERPERSONAL VALUES **6**

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

UNIT II EFFECTIVE COMMUNICATION **6**

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

UNIT III GROUP DYNAMICS **6**

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

UNIT IV MUTUAL RELATIONSHIP **6**

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

UNIT V POSITIVE ATTITUDE **6**

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

TOTAL: 30 PERIODS

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

REFERENCE BOOKS:

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

OUTCOMES:

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

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

CO – PO MAPPING :

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

SEMESTER - II

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

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3

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

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3

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

UNIT III MANUFACTURING TECHNOLOGY 3

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

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

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

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

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

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

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

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

தமிழர் மரபு

அலகு I நெசவு மற்றும் பானைத் தொழில்நுட்பம்: 3

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

அலகு II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: 3

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

அலகு III உற்பத்தித் தொழில் நுட்பம்: 3

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

அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: 3

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

அலகு V அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: 3

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

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

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

SEMESTER - III

20BSMA302 SDG NO. 4	PROBABILITY AND STATISTICAL MODELLING	L	T	P	C
		3	1	0	4

OBJECTIVES:

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

UNIT I PROBABILITY AND RANDOM VARIABLES 12

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

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 12

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

UNIT III LINEAR STATISTICAL MODELS AND TESTING OF HYPOTHESIS12

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

20CSPC301 SDG NO. 4 & 9	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		2	1	0	3

OBJECTIVES:

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

UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 10

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

UNIT II INHERITANCE AND INTERFACES 9

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

UNIT III EXCEPTION HANDLING AND I/O 9

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

UNIT IV MULTI-THREADING AND GENERIC PROGRAMMING 8

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

UNIT V LAMBDAS STREAMS AND REACTIVE PROGRAMMING 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

1. Paul Deitel, Harvey Deitel, “Java SE 8 for Programmers”, 3rd Edition, Pearson, 2015.
2. Steven Holzner, “Java 2 Black book”, Dream Tech Press, 2011.
3. Timothy Budd, “Understanding Object-Oriented Programming with Java”, Updated Edition, Pearson Education, 2000.
4. Kathy Sierra, Bert Bates, Trisha Gee, "Head First Java", 3rd Edition, O'Reilly, 2022.
5. Joshua Bloch, " Effective Java", Third Edition, Addison Wesley, 2018.

WEB REFERENCES:

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

ONLINE RESOURCES :

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

OUTCOMES:

Upon completion of the course, students should be able to

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

CO – PO, PSO MAPPING:

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

SEMESTER - III

20ITPC301 SDG NO. 4	DATA STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts of ADT's
- To learn Linear Data Structures – Lists, Stacks, and Queues
- To understand Sorting, Searching and Hashing Algorithms
- To learn Dynamic Data Structures - Tree and Graph

UNIT I LINEAR DATA STRUCTURES – I 9

Stacks and Queues : Abstract Data Types (ADTs) – Stack ADT – Operations – Applications - Evaluating arithmetic expressions- Conversion of Infix to Postfix expression - Queue ADT – Operations - Circular Queue – Priority Queue –Dequeue – Applications of Queues.

UNIT II LINEAR DATA STRUCTURES – II 9

Linked List: List ADT – Array-Based Implementation – Linked List Implementation –– Singly Linked Lists- Circularly Linked Lists- Doubly-Linked Lists – Applications of Lists –Polynomial Manipulation – All Operations (Insertion, Deletion, Merge, Traversal).

UNIT III NON LINEAR DATA STRUCTURES – I 9

Trees : Tree ADT – Tree Traversals - Binary Tree ADT – Expression Trees – Applications of Trees – Binary Search Tree ADT –Threaded Binary Trees- AVL Trees – B-Tree - B+ Tree -Heap – Applications of Heap.

UNIT IV NON LINEAR DATA STRUCTURES – II 9

Graphs : Definition – Representation of Graph – Types of Graph – Breadth First Traversal –Depth First Traversal – Topological Sort – Bi-Connectivity – Cut Vertex – Euler Circuits – Dijkstra‟s algorithm – Bellman-Ford algorithm – Floyd's Algorithm - minimum spanning tree – Prim's and Kruskal's algorithms – Applications of Graphs.

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES 9

Searching- Linear Search - Binary Search - Sorting - Bubble Sort - Selection Sort-Insertion Sort - Shell Sort – Radix Sort – Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. M. A. Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education Asia, 2002.
2. Reema Thareja, "Data Structures Using C", Second Edition, Oxford University Press, 2011.

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.
2. Stephen G. Kochan, "Programming in C", 3rd edition, Pearson Education.
3. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education, 1983.
4. Ellis Horowitz, SartajSahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008.

WEB REFERENCES :

1. https://www.programiz.com/dsa
2. http://masterraghu.com/subjects/Datastructures/ebooks/remathareja.pdf

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 and searching algorithms. (K3)
5. Solve Problem involving Graph, Trees and Heap. (K3)
6. Choose appropriate data structures to solve real world problems efficiently.(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	1	1
CO2	2	2	1	2	1	1	1	0	2	2	3	3	1	1
CO3	3	3	2	3	3	1	1	1	2	2	3	3	1	1
CO4	2	2	1	2	3	2	1	0	1	1	2	1	1	2
CO5	2	2	1	2	3	0	0	1	2	1	2	2	1	2
CO6	3	3	3	3	1	0	0	0	1	1	2	1	2	2

SEMESTER - III

20ESCI301 SDG NO. 4	BASIC ELECTRONICS AND COMMUNICATION ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand Electric circuit laws
- To understand the working principle of various electronic devices
- To deal with Information theory and channel capacity
- To acquire knowledge about analog communication technique
- To gain knowledge about digital communication technique.

UNIT I ELECTRICAL CIRCUIT ANALYSIS **9**

Ohms Law, Kirchhoff's Law-Instantaneous power- series and parallel circuit analysis with resistive, capacitive and inductive network - nodal analysis, mesh analysis- network theorems – Thevenin's theorem, Norton theorem, maximum power transfer theorem and superposition theorem.

UNIT II ELECTRONIC CIRCUITS **9**

PN Junction-VI Characteristics of Diode, Zener diode, Transistors configurations - amplifiers. Basic information about op-amps-Ideal Operational Amplifier-General operational amplifier stages-internal circuit diagrams of IC 741- rectifiers.

UNIT III INFORMATION THEORY **9**

Concept of amount of information, information units Entropy: marginal, conditional, joint and relative entropies, relation among entropies Mutual information, information rate, channel capacity.

UNIT IV ANALOG COMMUNICATION **9**

Analog Communication–Types of modulation–AM–FM–Phase Modulation–Pulse Modulation–PAM– PWM–PPM–PCM–Concept of Radio wave propagation

UNIT V DIGITAL COMMUNICATION **9**

Concepts of Sampling theorem – Nyquist rate–Digital Modulation Schemes–ASK–FSK– PSK–Radio signal transmission – Multiple access techniques –Cellular Wireless Networks

TOTAL: 45 PERIODS

TEXT BOOKS:

1. D P Kothari and I.J Nagarath, "Electrical Machines "Basic Electrical and Electronics Engineering", McGraw Hill Education(India) Private Limited, 4th Edition, April 12, 2019.
2. Thereja .B.L., "Fundamentals of Electrical Engineering and Electronics", S. Chand & Co. Ltd., 2008
3. Wayne Tomasi, "Advanced Electronic Communication Systems", 6th Edition, Pearson Education, 2009

REFERENCES:

1. Blake, "Electronic Communication Systems", Thomson Delmar Publications, 2002.
2. S L Kakani and Priyanka Punglia, 'Communication Systems', New Age International Publisher,2017

WEB REFERENCES :

1. https://drive.google.com/drive/folders/1aTCPv2Bf5M-k40IAYfE0cgZwBjcpAZcR?usp=sharing
2. Analog Communication-Course(nptel.ac.in)https://onlinecourses.nptel.ac.in/noc21_ee74
3. https://nptel.ac.in/courses/108/105/108105153/

OUTCOMES:

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

1. Describe the principles of electric circuit laws(K2)
2. Explain the working concepts of various electronic devices(K2)
3. Illustrate the measurement of Information theory and coding(K2)
4. Discuss the various modulation schemes such as AM,FM and Phase modulation (K2)

5. Elaborate Sampling theorem, Nyquist rate and PCM(K2)
6. Describe various the digital modulation schemes, multiple access Techniques and cellular wireless networks(K2)

CO – PO, PSO MAPPING:

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

SEMESTER - III

20CIPC301 SDG NO. 4 & 9	COMPUTER ARCHITECTURE AND MICROCONTROLLERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the basic structure and operations of a computer
- To learn the arithmetic and logic unit and implementation of fixed-point and floating point arithmetic unit
- To learn the basics of pipelined execution
- To program the internal resources of 8051 microcontroller

UNIT I BASIC STRUCTURE OF A COMPUTER SYSTEM 9

Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing.

UNIT II ARITHMETIC FOR COMPUTERS 9

Addition and Subtraction – Multiplication – Division – Floating Point Representation – Floating Point Operations – Subword Parallelism.

UNIT III PROCESSOR AND CONTROL UNIT 9

A Basic MIPS implementation – Building a datapath – Control Implementation Scheme – Pipelining – Pipelined datapath and control – Handling Data Hazards & Control Hazards – Exceptions.

UNIT IV 8051 MICROCONTROLLER 9

8051 Microcontroller Architecture – Programming model - Addressing modes - Instruction set - Assembly language programming – Memory Organization.

UNIT V 8051 MICROCONTROLLER INTERFACING 9

I/O Ports – Timer port architecture and programming - Serial port architecture and programming - Interrupts Handling - LCD & Keyboard Interfacing

TOTAL: 45 PERIODS

TEXT BOOKS:

1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Morgan Kaufmann / Elsevier, Fifth Edition, 2014.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Tata McGraw Hill, Sixth Edition, 2012.
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin McKinlay, The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Pearson education, Second Edition, 2013.

REFERENCE BOOKS:

1. William Stallings, Computer Organization and Architecture – Designing for Performance, Pearson Education, Eighth Edition, 2010.
2. John P. Hayes, Computer Architecture and Organization, Tata McGraw Hill, Third Edition, 2012.
3. John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative Approach, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.

OUTCOMES

On successful completion of this course, the student will be able to

1. Comprehend the basics structure of computers, operations and instructions.(K2)
2. Carry out different algorithms to design arithmetic and logic unit.(K2)
3. Infer pipelined execution and design control unit.(K2)

4. Acquire knowledge on 8051 microcontroller, instruction set and assembly language programming. (K2)
5. Describe the I/O ports and its programming K2)
6. Categorize the various interrupt handling techniques used and interfacing.(K2)

CO – PO, PSO MAPPING:

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

SEMESTER - III

20CIPC302 SDG NO. 4	INTRODUCTION TO INTERNET OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamentals of Internet of Things
- To understand IoT Reference Architecture
- To learn about the basics of IoT protocols
- To understand the basics of python with IoT.
- To build a small low cost IoT system and to apply the concept of Internet of Things in the real world scenario

UNIT I INTRODUCTION AND APPLICATIONS **9**

Introduction to IoT–Definition, Characteristics, functional requirements, motivation, Physical design-things in IoT, IoT protocols, Logical Design-functional blocks, communication models, Communication APIs, Applications–Home Automation, Cities, Environment, Energy, Agriculture, Health, Industry.

UNIT II M2M AND SYSTEM MANAGEMENT 9

Introduction-M2M, Difference between M2M and IoT, SDN and NFV for IoT, System Management–need, SNMP, NETCONF, YANG.

UNIT III DEVELOPING INTERNET OF THINGS 9

IoT Methodology-Purpose & Requirements specification, process specification, domain model specification, information model specification, service specification, IoT level specifications.

UNIT IV USAGE OF PYTHON 9

IoT systems logical design using python-python data types & data structures, control flow, functions or modules, remote access enablement using cloud.

UNIT V CASE STUDY ON IoT SYSTEM 9

Case study for weather monitoring system-modules & package of python, python packages of interest for IoT-JSON, XML, HTTP & URLLib, SMTPLib. Exemplary device-Rasberry pi, Linux on Raspberry pi.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Dr. Ovidiu Vermesan and Dr. Peter Friess, Internet of Things: From research and innovation to market deployment, River Publishers 2014.
2. Honbo Zhou,"The Internet of Things in the Cloud: A Middleware Perspective" - CRC Press 2012.
3. Arshdeep Bahga and Vijay Madisetti, Internet of Things A Hand-on Approach, Universities press, 2015

REFERENCES:

1. Dieter Uckelmann et.al, Architecting the Internet of Things, Springer, 2011
2. Pethuru Raj and Anupama C.Raman, "The Internet of Things: Enabling Technologies and Use Cases, CRC Press

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc19_cs65
2. The Internet of Things in the Cloud | A Middleware Perspective | Honbo (taylorfrancis.com)

OUTCOMES:

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

1. Explain the fundamentals of Iot and its applications. (K2)

2. Illustrate applications of IoT in real time scenario. (K2)
3. Interpret M2M and IoT system management (K2)
4. Discuss IoT System design methodology (K2)
5. Demonstrate IoT device programming (K2)
6. Implement IoT in real time scenario. (K3)

CO – PO, PSO MAPPING:

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

SEMESTER - III

20ITPL301 SDG NO. 4	DATA STRUCTURES LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To implement Linear and Non-linear Data Structures
- To understand the different operations of Search Trees
- To implement Graph Traversal algorithms
- To get familiarized to Sorting and Searching algorithm

LIST OF EXPERIMENTS:

1. Array implementation of Stack and Queue ADTs
2. Array implementation of List ADT
3. Linked list implementation of List, Stack and Queue ADTs
4. Applications of List, Stack and Queue ADTs
5. Implementation of Binary Trees and operations of Binary Trees
6. Implementation of Binary Search Trees
7. Implementation of AVL Trees

8. Implementation of Heaps using Priority Queues
9. Graph representation and Traversal algorithms
10. Applications of Graphs- Implementation of searching and sorting algorithms
11. Implementation of any two Collision Techniques in Hashing

TOTAL: 45 PERIODS

LAB REQUIREMENTS :

Turbo C/Dev C++, Borland C

OUTCOMES:

Upon completion of the course, students should be able to

1. Write functions to implement linear and non-linear data structure operations. [K1]
2. Suggest appropriate linear / non-linear data structure operations for solving a given problem. [K2]
3. Design and analyze the time and space efficiency of data structure.[K2]
4. Apply sorting and searching techniques. [K3]
5. Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval. [K3]
6. Choose and implement efficient data structures and apply them to solve problems. [K3]

CO – PO, PSO MAPPING:

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

SEMESTER - III

20CIPL301 SDG NO. 4	INTERNET OF THINGS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To implement Embedded Programming
- To understand the different communications like point to point and multi point to single point.
- To implement the interfacing with UbiSense technology
- To get familiarized to transforming the measured physical value from the Ubisense over the Air.

LIST OF EXPERIMENTS :

1. Embedded Programming

a) Toggling LEDs
b) Transmitting a string through UART
c) Controlling LEDs blinking pattern through UART
d) Echo each character typed on serial terminal.
e) Digital IO configuration.
f) Timer based LED Toggle.
g) On-chip Temperature measurement through ADC.

2. RF experiments

a) Point to point communication of two Ubimotes over the radio frequency.
b) Multi-point to single point communication of
c) Ubimotes over the radio frequency.

3. Interfacing with UbiSense

a) I2C protocol study
b) Reading Temperature and Relative Humidity value from the sensor.
c) Reading Light intensity value from light sensor.
d) Reading of atmospheric pressure value from pressure sensor.
e) Proximity detection with IR LED.
f) Generation of alarm through Buzzer.
g) Transmitting the measured physical value from the
h) UbiSense over the Air.

4. Arduino and Raspberry Pi

a) Introduction to Arduino platform and programming
b) Introduction to Raspberry PI platform and Python Programming

TOTAL: 45 PERIODS

LAB REQUIREMENTS :

Ubimote/ BLE Mote/ UbiSense/ Systems with Linux Operating System

OUTCOMES:

Upon completion of the course, students should be able to

1. Write functions to implement toggling and controlling LED. [K1]
2. Suggest appropriate point to point / multi point to single point communications using Ubimote. [K2]
3. Read the temperature and humidity value from the sensor.[K2]
4. Read the light intensity from the light sensor. [K3]
5. Read the atmospheric pressure from the pressure sensor. [K3]
6. Generate alarm and transmit measured physical value from the UbiSense over the Air. [K3]

CO – PO, PSO MAPPING:

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

SEMESTER - III

20CITE301 SDG NO. 4, 11 & 15	LIVE-IN-LAB-I	L	T	P	C
		0	0	2	1

OBJECTIVES:

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

COURSEPLAN:

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

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

20CITP301 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	1	1

APTITUDE & COGNITIVE SKILLS–PHASE1

OBJECTIVES:

- To educate and enrich the students on quantitative ability, reasoning ability, and verbal ability.
- Improve their quantitative ability.
- Improve the ability of arithmetic reasoning
- Enhance their verbal ability through vocabulary building and grammar
- Equip with creative thinking and problem solving skills

UNIT I QUANTITATIVE ABILITY–I **10**

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

UNIT II QUANTITATIVE ABILITY–II **10**

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

UNIT III REASONING ABILITY–I **8**

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

UNIT IV VERBAL ABILITY–I **10**

Idioms & Phrases-Synonyms-Antonyms-Classification

UNIT V CREATIVITY ABILITY–I **7**

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

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

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 9

Introduction to Programming, Programming Domain: Scientific Application, Business Applications, Artificial Intelligence, Systems Programming , Web Software Categories of Programming Languages: Machine Level Languages, Assembly Level Languages, High Level Languages Programming Design Methodologies :Top Down and Bottom UP Program Development Cycle with case study, Program Execution and Translation Process, Problem solving using Algorithms and Flowcharts, Performance Analysis and Measurements: Time and Space complexity.

UNIT II INTRODUCTION TO C PROGRAMMING 9

Features of C and its Basic Structure, Simple C programs, Constants, Integer Constants, Real Constants, Character Constants, String Constants, Backslash Character Constants, Concept of an Integer and Variable, Rules for naming Variables and assigning values to variables, Floating-point Numbers, Converting Integers to Floating-point and vice-versa, Mixed-mode Expressions, The type cast Operator, The type char, Keywords, Character Input and Output, Formatted input and output, The gets() and puts() functions, Interactive Programming.

UNIT III OPERATORS, EXPRESSIONS AND CONTROL STATEMENTS 9

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 off or loops, The break statement and continue statement.

UNIT IV ARRAYS, STRINGS AND POINTERS 9

One Dimensional Arrays, Passing Arrays to Functions, Multidimensional Arrays, Strings, Basics of Pointers, Pointers and One-dimensional Arrays, Pointer Arithmetic, Pointer Subtraction and Comparison, Similarities between Pointers and One-dimensional Arrays, Null pointers, Pointers and Strings, Pointers and two-dimensional arrays, Arrays of Pointers.

UNIT V STRUCTURES, UNIONS AND FUNCTIONS 9

Basics of Structures, Arrays of Structures, Pointers to Structures, Self-referential Structures, Unions, Function Philosophy, Function Basics, Function Prototypes, and Passing Parameters: Passing Parameter by value and Passing Parameter by reference, passing string to function, Passing array t o function, Structures and Functions Recursion.

TOTAL: 45 PERIODS

REFERENCES:

1. Programming in ANSIC-Balagurusamy-TataMcGraw-HillEducation,2008
2. Programming in C(3rdEdition),byStephenG.Kochan,Sams,2004
3. Programming in C-Stephen G. Kochan, III Edition, Pearson Education.

OUTCOMES:

Upon completion of the course, 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 analyze 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

20CIPW401 SDG NO. 4 & 9	COMMUNICATION AND NETWORKING TECHNOLOGIES FOR IOT WITH LAB	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To understand the protocol layering and physical level communication.
- To learn how to assess, select and customize communication.
- To understand networking technologies and standards.
- To control the networks virus and provide security.
- To know how to apply various communication networks and develop an application.

UNIT I INTRODUCTION TO NETWORKING & NETWORK MODELS 9

Networks–Types–OSI Model-Layers in OSI Model- TCP/ IP Protocol suite–Addressing- Performance – Transmission media – Switching – Circuit-switched Networks–PacketSwitching-CommunicationModels-Client-Server-PublisherSubscriber-P2P.

UNIT II ARCHITECTURE & PROTOCOLS 9

AdHoc- WSN-MANET-VANET--Routing-Unicast, Multicast-IPV4&IPV6-MAC.

UNIT III COMMON NETWORK STANDARDS 9

802.11 & variants-Bluetooth & variants-802.15.4 & variants-Other Standards -NFC -LORA -DSRC, WAVE –Industrial & Automotive Networks –Vehicular networks (CAN, Modbus, Ethernet /Industrial Protocol ,MQTT,TTP/C, Flexray)

UNIT IV NETWORK SECURITY & PRIVACY 9

Issues & Challenges - Security attacks - Security solutions- Electronic MailSecurity–PGP-S/MIME–IPSecurity–WebSecurity–SystemSecurity-Intruders-Malicious Software - Cloud Security – Transport Level Security –

UNIT V CASE STUDY & TOOLS 9

Asset Management, Industrial Automation, Smart Grid, Commercial Building Automation, Smart Cities.

LIST OF EXPERIMENTS 15

1. Simple Client Server Program
2. Implementation of IP address configuration.

3. To create scenario and study the performance of network with CSMA/CA protocol and compare with CSMA/CD protocols.
4. Implementation of distance vector routing algorithm.
5. Design and test Network Topology-Star, Bus, and Ring.
6. Study of Network simulator and simulation of Congestion Control Algorithm using NS.

60 PERIODS

TEXT BOOKS:

1. LarryL.Peterson,BruceS.Davie,"ComputerNetworks:ASystems Approach", Fifth Edition,MorganKaufmannPublishersInc.,2012.
2. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6:TheEvolvingWorldofM2MCommunications", ISBN:978-1-118-47347-4,WillyPublications,2016.
3. Behrouz A. Forouzan, "Data communication and Networking", Fifth Edition, Tata McGraw Hill, 2013.
4. Jan Holler, "From Machine to Machine to the Internet of Things", first edition academic Press,2014

REFERENCES:

1. William Stallings, "Data and Computer Communications", Tenth Edition,PearsonEducation, 2014.
2. Nader F. Mir, "Computer and Communication Networks", Second EditionPrenticeHall, 2014.

WEB REFERENCES

1. https://onlinecourses.nptel.ac.in/noc22_cs53/preview
2. https://onlinecourses.nptel.ac.in/noc20_cs69/preview
3. https://onlinecourses.nptel.ac.in/noc22_cs19/preview
4. https://onlinecourses.swayam2.ac.in/cec21_cs04/preview

ONLINE REFERENCES

1. https://docs.google.com/file/d/0B2xtAGmXggYSeUw3RHhRUko0Y00/preview?resourcekey=0-J-Zn5LHfvKHNp3tK33AwZw
2. https://www.tutorialspoint.com/data_communication_computer_network/data_communication_computer_network_tutorial.pdf
3. https://www.khanacademy.org/computing/computers-and-internet/xcae6f4a7ff015e7d:the-internet/xcae6f4a7ff015e7d:connecting-networks/a/computer-networks-overview
4. https://csc-knu.github.io/sys-prog/books/Andrew%20S.%20Tanenbaum%20-%20Computer%20Networks.pdf

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. Compare different network models and communication.(K2)
3. Access different network techniques and standards in IoT systems.(K2)
4. Identify security threats in networks privacy.(K2)
5. Case Study/simple Program to Understand IoT/ network applications(K3)
6. Design simple experiments using simulation tools. (K3)

CO – PO, PSO MAPPING:

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

SEMESTER - IV

20CSPC401 SDG NO. 4 & 9	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic concepts, functions of Operating Systems, Processes and Threads
- To analyze Scheduling algorithm and understand the concept of Deadlock
- To analyse various Memory Management schemes and 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 Multicore Organization - Operating System Overview- Objectives and Functions - Evolution of Operating System - Computer System Organization Operating System Structure and Operations - System Calls - System Programs - OS Generation and System Boot.

UNIT II PROCESS MANAGEMENT **11**

Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication - CPU Scheduling - Scheduling Criteria - Scheduling Algorithms- Multiple - Processor Scheduling - Real Time Scheduling - Threads - Overview - Multithreading Models - Threading Issues - Process Synchronization - The Critical - Section Problem - Synchronization Hardware - Mutex Locks - Semaphores - Classic Problems of Synchronization - Critical Regions - Monitors - Deadlock – System Model - Deadlock Characterization - Methods for Handling Deadlocks - Deadlock Prevention - Deadlock Avoidance - Deadlock Detection - Recovery from Deadlock.

UNIT III STORAGE MANAGEMENT **9**

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

UNIT IV FILE SYSTEMS AND I/O SYSTEMS **9**

Mass Storage System – Overview of Mass Storage Structure - Disk Structure - Disk Scheduling and Management - Swap Space Management - File-System Interface - File Concept - Access Methods - Directory Structure - Directory Organization - File System Mounting - File Sharing and Protection - File System Implementation- File System Structure - Directory Implementation - Allocation Methods - Free Space Management - Efficiency and Performance - Recovery - I/O Systems – I/O Hardware - Application I/O Interface - Kernel I/O Subsystem - Streams - Performance.

UNIT V CASE STUDY **9**

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

2. William Stallings, "Operating Systems – Internals and Design Principles",7th Edition, Prentice Hall, 2011.

REFERENCES :

1. Ramez Elmasri, A. Gil Carrick, David Levine, "Operating Systems – A Spiral Approach", Tata McGraw Hill Edition, 2010.
2. AchyutS.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.

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 RESOURCES:

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

OUTCOMES:

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

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

CO – PO, PSO MAPPING:

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

SEMESTER - IV

20ITPC401 SDG NO. 4	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		2	1	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 TECHNIQUES9

Dynamic programming – Principle of optimality - Coin Changing Problem - Computing a Binomial Coefficient – Floyd's Algorithm – Multi Stage Graph -

Optimal Binary Search Trees – Knapsack Problem and Memory functions - Greedy Technique – Container Loading Problem - Prim's Algorithm and Kruskal's Algorithm – 0/1 Knapsack Problem - Optimal Merge pattern - Huffman Trees.

UNIT IV ITERATIVE IMPROVEMENT 8

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

UNIT V COPING WITH THE LIMITATIONS OF ALGORITHM POWER 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Anany Levitin, "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/CoursePage.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	PSO1	PSO2
CO1	3	3	1	0	0	0	0	0	0	0	0	0	0	1
CO2	3	3	1	0	0	0	0	0	0	0	0	0	0	1
CO3	2	3	0	1	0	0	0	0	0	0	0	0	0	1
CO4	2	3	0	2	0	0	0	0	0	0	0	0	0	1
CO5	1	2	0	1	0	0	0	0	0	0	0	0	0	1
CO6	1	2	1	2	0	0	0	0	0	0	0	0	0	1

SEMESTER - IV

20CIPC401 SDG NO. 4 & 16	AGILE SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software
- To provide a good understanding of software design and a set of software technologies and APIs
- To do a detailed examination and demonstration of Agile development and testing techniques
- To understand Agile management and quality assurance.

UNIT I AGILE METHODOLOGY **9**

Theories for Agile Management – Agile Software Development – Traditional Model Vs Agile Model – Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams – Agility in Design - Testing – Agile Documentations – Agile Drivers - Capabilities and Values.

UNIT II AGILE PROCESSES **9**

Lean Production – SCRUM, Crystal - Feature Driven Development - Adaptive Software Development – Extreme Programming - Method Overview – Lifecycle – Work Products - Roles and Practices.

UNIT III AGILITY AND KNOWLEDGE MANAGEMENT **9**

Agile Information Systems – Agile Decision Making – Earl's Schools of KM – Institutional Knowledge Evolution Cycle – Development - Acquisition - Refinement - Distribution - Deployment - Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story Cards – Story-Card Maturity Model (SMM).

UNIT IV AGILITY AND REQUIREMENTS ENGINEERING **9**

Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment - Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.

UNIT V AGILITY AND QUALITY ASSURANCE **9**

Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance – Test Driven Development – Agile Approach in Global Software Development.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. David J. Anderson and Eli Schragenheim, "Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results", Prentice Hall, 2003.
2. Hazza and Dubinsky, "Agile Software Engineering, Series: Undergraduate Topics in Computer Science", Springer, 2009.

REFERENCES:

1. Craig Larman, "Agile and Iterative Development: A Manager's Guide", Addison-Wesley, 2004.
2. Kevin C. Desouza, "Agile Information Systems: Conceptualization, Construction, and Management", Butterworth- Heinemann, 2007.
3. Jorgen Hesselberg, "Unlocking Agility: An Insider's Guide to Agile Enterprise Transformation", Addison – Wesley Signature Series, First Edition, 2018.
4. Mike Cohn, "Agile Estimating & Planning ", Pearson Education India, First Edition, 2006.
5. Roman Pichler, "Agile Product Management with Scrum", Pearson Education India, 2011

WEB REFERENCES:

1. http://www.umsl.edu/~sauterv/analysis/6840_f09_papers/Nat/Agile.html
2. https://www.classcentral.com/help/section/edx
3. https://nptel.ac.in/courses/110/104/110104073/
4. https://www.coursera.org/learn/software-processes-and-agilepractices

ONLINE RESOURCES:

1. https://www.udacity.com/course/software-development-process--ud805
2. https://www.edx.org/course/agile-software-development

OUTCOMES:

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

1. Realize the importance of interacting with business stakeholders in determining the requirements for a software system.(K3)

2. Perform iterative software development processes.(K2)
3. Point out the impact of social aspects on software development success.(K2)
4. Develop techniques and tools for improving team collaboration and software quality.(K3)
5. Perform Software process improvement as an ongoing task for development teams.(K3)
6. Show how agile approaches can be scaled up to the enterprise level.(K2)

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

SEMESTER - IV

20CSPC402 SDG NO. 4 & 9	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/Codd Normal 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. Ramez Elmasri, 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 reine the database system. (K1)
3. Demonstrate various SQL queries for the Transaction Processing & Locking using concept of Concurrency control. (K2)
4. Build the query processing techniques for the optimization of SQL queries. (K3)
5. Implement the indexing and hashing techniques for the organization of database records. (K3)
6. Illustrate how the advanced databases differ from the traditional databases. (K2)

CO – PO, PSO MAPPING:

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

SEMESTER - IV

20CSPL401 SDG NO. 4 & 9	OPERATING SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To learn Unix commands and Shell programming
- To implement various CPU scheduling algorithm, Process Creation and Inter process Communication
- To implement Deadlock avoidance and Deadlock Detection algorithms
- To implement Page Replacement algorithms and File strategies

LIST OF EXPERIMENTS:

1. Basics of UNIX commands & Administrator commands (man, uptime, users, service, pkill, pmap, wget, free, Shutdown commands, ping, su, who, env).
2. Write programs using the following system calls of UNIX operating system fork, exec, get pid, exit, wait, close, stat, opendir, readdir.
3. Write programs to simulate UNIX commands like cp, ls, grep, etc.
4. Shell Programming.
5. Write programs to implement the various CPU Scheduling Algorithms.
6. Implementation of Semaphores.
7. Implementation of Shared memory and IPC.
8. Implementation of Bankers Algorithm for Deadlock Avoidance.
9. Implementation of Deadlock Detection Algorithm.
10. Write program to implement Threading & Synchronization Applications.
11. Implementation of the following Memory Allocation Methods for fixed partition
    a) First Fit b) Worst Fit c) Best Fit
12. Implementation of Paging Technique of Memory Management.
13. Implementation of the following Page Replacement Algorithms
    a) FIFO b) LRU c) LFU
14. Implementation of the various File Organization Techniques.
15. Implementation of the following File Allocation Strategies
    a) Sequential b) Indexed c) Linked

TOTAL: 45 PERIODS

LAB REQUIREMENTS

1. Standalone desktops with C / C++ / Java / Equivalent compiler 30 Nos. with Linux OS

OUTCOMES:

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

1. Compare the performance of various CPU Scheduling Algorithms (K4)
2. Implement Deadlock avoidance and Detection Algorithms (K2)
3. Implement Semaphores. Create processes and implement IPC (K2)
4. Analyze the performance of the various Page Replacement Algorithms (K4)
5. Implement File Organization and File Allocation Strategies (K2)
6. Implement File Allocation Strategies (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	2	2
CO2	3	3	3	2	1	1	1	2	2	2	1	2	2	2
CO3	3	3	3	3	1	2	1	2	2	2	2	2	2	2
CO4	3	3	3	2	1	-	-	1	1	1	1	2	2	2
CO5	3	3	3	2	1	-	-	1	1	1	1	1	2	2
CO6	3	3	2	2	1	-	-	1	1	1	1	1	2	2

SEMESTER - IV

20CSPL402 SDG NO. 4 & 9	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

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

LIST OF EXPERIMENTS:

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

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

TOTAL: 45 PERIODS

LAB REQUIREMENTS

1. Front end: VB/VC ++/JAVA or Equivalent
2. Back end: Oracle / SQL / MySQL/ Postgres / DB2 or Equivalent

OUTCOMES:

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

1. 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 - IV

20CITE401 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 3students. 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):20marks
2. Second evaluation(Immediately after second internal examination): 30marks
3. Final evaluation(Last week of the semester):50marks

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

TOTAL: 45 PERIODS

OUTCOMES:

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

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

CO – PO, PSO MAPPING:

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

20CITP401 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

APTITUDE AND COGNITIVE 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 **10**

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

UNIT II QUANTITATIVE ABILITY–IV **10**

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

UNIT III REASONING ABILITY–II **8**

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 **10**

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

UNIT V CREATIVITY ABILITY–II **7**

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

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

ADVANCED C PROGRAMMING-PHASE 2

OBJECTIVES:

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

UNIT I INTRODUCTION TO RECURSION **9**

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 **9**

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 PRE PROCESSOR AND DYNAMIC MEMORY ALLOCATION 9

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 FILE MANAGEMENT 9

Defining and Opening a file, Closing Files, Input/output Operations on Files, Pre defined Streams, Error Handling during I/O Operations, Random Access to Files, Command Line Arguments.

UNIT V BIT MANIPULATION 9

The hexadecimal number system, C bitwise operators, Working with individual bits, How to check if a given number is a power of 2, Count the number of ones in the binary representation of the given number, Check if the ith bit is set in the binary form of the given number, How to generate all the possible subsets of a set, Find the largest power of 2 (most significant bit in binary form), which is less than or equal to the given number N, Tricks with Bits, Applications of bit operations.

TOTAL: 45 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", (2nded.) Prentice Hall,1988

OUTCOMES:

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

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

20MGMC301 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

20CSPC501 SDG NO. 4 & 9	INTERNET PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

UNIT I WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0 9

Web Essentials: Clients, Servers And Communication –World Wide Web – HTML5 – Tables – Lists – Image – HTML5 Control Elements – Semantic Elements – Drag And Drop – Audio – Video Controls - CSS3 – Inline, Embedded and External Style Sheets – Rule Cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.

UNIT II CLIENT SIDE PROGRAMMING 9

Java Script: An Introduction to Javascript–Javascript DOM Model-Date and Objects,- Regular Expressions- Exception Handling-Validation-Built-In Objects-Event Handling- DHTML with Javascript- JSON Introduction – Syntax – Function Files – HTTP Request – SQL.

UNIT III SERVER SIDE PROGRAMMING 9

Servlets: Java Servlet Architecture - Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example - JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.

UNIT IV PHP 9

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation- Regular Expressions - File handling – Cookies - Connecting to Database.

UNIT V XML and INTRODUCTION TO AJAX 9

XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation. AJAX: Ajax Client Server Architecture-XML HTTP Request Object-Call Back

Methods.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Deitel and Deitel and Nieto, "Internet and World Wide Web- How to Program", Prentice Hall India Learning Pvt.Ltd, Fifth Edition, 2011.
2. Elliotte Rusty Harold, "Java Network Programming", O'Reilly Publishers, 2013.

REFERENCES:

1. Stephen Wynkoop and John Burke, " Running a Perfect Website", QUE, 2nd Edition, 1999.
2. Chris Bates, Web Programming – "Building Intranet Applications", 3rd Edition, Wiley Publications, 2009.
3. Jeffrey C and Jackson, — "Web Technologies A Computer Science Perspective", Pearson Education, 2011.
4. Gopalan N.P. and Akilandeswari J., "Web Technology", Prentice Hall of India, 2011.
5. Uttam K.Roy, "Web Technologies", Oxford University Press, 2011.

WEB REFERENCES:

1. https://www.brainkart.com/subject/Internet-Programming_173/
2. https://nptel.ac.in/courses/106105084/

ONLINE RESOURCES:

1. https://www.udemy.com/course/the-web-developer-bootcamp/
2. https://www.coursera.org/specializations/web-design

OUTCOMES:

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

1. Construct a basic website using HTML and Cascading Style Sheets.(K2)
2. Build dynamic web pages with validation using Javascript objects and by applying different event handling mechanisms. (K3)
3. Develop server side programs using Servlets and JSP.(K2)
4. Construct simple web pages in PHP.(K3)
5. Represent web data using XML and develop dynamic web page using AJAX.(K2)
6. Use web services to develop interactive web applications(K3)

CO – PO MAPPING:

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

SEMESTER - V

20CSPC502 SDG NO. 4	THEORY OF COMPUTATION	L	T	P	C
		2	1	0	3

OBJECTIVES:

- To construct Automata for any given pattern and find its equivalent regular expressions
- To design a context free grammar for any given language
- To understand Turing machines and their capability
- To understand undecidable problems and NP class problems

UNIT I AUTOMATA FUNDAMENTALS 9

Introduction to formal proof – Additional forms of Proof – Inductive Proofs – Finite Automata –Deterministic Finite Automata – Non-deterministic Finite Automata –Finite Automata with Epsilon Transitions

UNIT II REGULAR EXPRESSIONS AND LANGUAGES 9

Regular Expressions–FA and Regular Expressions –Proving Languages not to be regular –Closure Properties of Regular Languages –Equivalence and Minimization of Automata.

UNIT III CONTEXT FREE GRAMMAR AND LANGUAGES 9

CFG –Parse Trees –Ambiguity in Grammars and Languages –Definition of the Pushdown Automata –Languages of a Pushdown Automata –Equivalence of Pushdown Automata and CFG, Deterministic Pushdown Automata.

UNIT IV PROPERTIES OF CONTEXT FREE LANGUAGES 9

Normal Forms for CFG –Pumping Lemma for CFL –Closure Properties of CFL –Turing Machines –Programming Techniques for TM.

UNIT V UNDECIDABILITY 9

Non Recursive Enumerable (RE) Language – Undecidable Problem with RE – Undecidable Problems about TM –Post's Correspondence Problem, The Class P and NP.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. J.E.Hopcroft, R.Motwani and J.D Ullman, "Introduction to Automata Theory, Languages and Computations", Second Edition, Pearson Education, 2011.
2. Peter Linz, "An Introduction to Formal Languages and Automata", 5th Edition, Jones & Bartlett Learning, 2011.

REFERENCES:

1. H.R.Lewis and C.H.Papadimitriou, "Elements of the theory of Computation", Second Edition, PHI, 2010.
2. J.Martin, "Introduction to Languages and the Theory of Computation", 4th Edition, TMH, 2019.
3. Micheal Sipser, "Introduction of the Theory and Computation", 4th Edition Thomson Brokecole, 2014.
4. K.L.P.Mishra , N.Chandrasekaran ,"Theory of Computer Science (Automata, Languages and Computation)", Third Edition,PHI,2008.
5. S.P.Eugene Xavier "Theory of Automata, Formal Languages and Computation", New Age International Publishers, 2007.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106/104/106104148
2. https:// automation simulator.com/
3. https://swayam.gov.in/nd1_noc19_cs79/

ONLINE RESOURCES:

1. http://www.youtube.com/watch?v=eqCkkC9A0Q4
2. http://www.udemy.com/course/theory-of-computation-toc/
3. https://online.standford.edu/courses/soe-ycsautomata-automata-theory
4. https://www.aduni.org/courses/theory/index.php?view=cw

OUTCOMES:

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

1. Understand the models of computation, including formal languages, Grammars and Automata, and their connections (K2)
2. Construct Automata, Regular Expression for any pattern (K3)
3. Develop Context Free Grammar for any given language and understand the language of Push Down Automata (K3)
4. Construct Turing Machines for any Language, solve various problems by applying normal form techniques (K3)
5. Identify Computation Solutions using Turing Machines (K2)
6. Identify whether a problem is decidable or not. (K2)

CO – PO MAPPING:

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

SEMESTER - V

20CIPC501 SDG NO. 4	IOT ARCHITECTURE AND PROGRAMMING IN IOT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the overview of architecture in IoT.
- To learn about IoT Reference model.
- To understand programming frameworks for the Internet of Things.
- To acquire knowledge about XBEE with its application.
- To know how to apply ESP 32 & ESP 8266S various an application.

UNIT I IoT An Architectural Overview **9**

Building architecture- Main design principles and needed capabilities-An IoT architecture outline- Standards considerations- Devices and gateways-Local

and wide area networking- Data management- Business processes in IoT- Everything as a service (XaaS).

UNIT II IoT Architecture Reference Model 9

State of the art- European Telecommunications Standards Institute M2M/oneM2M, International Telecommunication Union Telecommunication sector view- Reference model and architecture- IoT reference model- Information model- Functional model- Communication model- Safety, privacy, trust, security model.

UNIT III Programming Frameworks for Internet of Things 9

How to select an OS - Open Source, GNU licensing and Linux- Memory Managed Unit-RAM-Cache-EEPROM-flash-FPU-upgrade path-second source--object model.

UNIT IV Wireless module- XBEE 9

Introduction to XBEE wireless module-Pin layout-configuring module-configuring the router-Loading the firmware of the module-configuring the XBEE modules-Testing the network-Hosting sensors with Raspberry pi-creating a Raspberry Pi data collector for XBEE sensor nodes.

UNIT V ESP 32 & ESP 8266 9

Introduction ESP 8266-Hardware Requirements-Software Requirements-connecting to wifi- ESP 32 & ESP8266 basic applications-blinking of LED-controlling tricolor LED-controlling servomotor-wiring instructions

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Jan Ho¨ller,VlasiosTsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand ,David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", Elsevier Science, 2014
2. Klaus Elk, "Embedded Software Development for the Internet of Things", CreateSpace Independent Publishing Platform, August 2016
3. Charles Bell, "Beginning Sensor Networks with XBee, Raspberry Pi and Arduino", Second Edition, Apress,2020
4. Peter Hoddie, Lizzie Prader, " IoT Development for ESP32 and ESP8266 with Javascript", Apress,2020

REFERENCES:

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications

2. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
3. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
4. Han-Way Huang, "Embedded system Design Using C8051", Cengage Learning2009.
5. Rajib Mall "Real-Time systems Theory and Practice" Pearson Education, 2007.
6. Schwartz, M. "Internet of Things with ESP8266/Marco Schwartz", 2016, Packt Publishing.

WEB REFERENCES:

1. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html
2. https://nptel.ac.in/courses/108102045
3. https://archive.nptel.ac.in/courses/106/105/106105193/
4. https://onlinecourses.nptel.ac.in/noc22_cs53/preview

OUTCOMES:

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

1. Understand the basic architecture of the Internet of Things.(K2)
2. Analyze various models in the Architecture reference model.(K2)
3. Summarize frameworks of the Internet of Things.(K2)
4. Understand the function wireless module XBee.(K2)
5. Compare the ESP 32 & ESP8266.(K2)
6. Develop a program based on ESP 32 & ESP8266.(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	-	-	-	-	1	1	1	2	2
CO2	3	2	2	2	2	-	-	-	-	1	1	1	2	2
CO3	3	2	2	2	2	-	-	-	-	1	1	1	2	2
CO4	3	2	2	2	2	-	-	-	-	1	1	1	2	2
CO5	3	2	2	2	2	-	-	-	-	1	1	1	2	2
CO6	-	3	2	1	2	-	-	-	2	1	-	-	1	2

SEMESTER - V

20CSPC503 SDG NO. 4	MOBILE COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic concepts of Mobile Computing
- To learn the basics of Mobile Telecommunication System
- To be familiar with the Network layer protocols and Ad-Hoc networks
- To know the basis of Transport and Application layer protocols

UNIT I INTRODUCTION **9**

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum - MAC Protocols – Wireless MAC Issues– SDMA– TDMA– FDMA– CDMA.

UNIT II MOBILE TELECOMMUNICATION SYSTEM **9**

Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) –Universal Mobile Telecommunication System (UMTS), Long Term Evolution (LTE), 5G NR.

UNIT III MOBILE NETWORK LAYER **9**

Mobile IP –Ad Hoc– Proactive Protocol-DSDV, Reactive Routing Protocols – DSR, AODV, Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) – Security.

UNIT IV MOBILE TRANSPORT AND APPLICATION LAYER **9**

Mobile TCP– Improvements in TCP–I TCP–S TCP–M TCP –WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WML.

UNIT V MOBILE PLATFORMS AND APPLICATIONS **9**

Mobile Device Operating Systems –Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce– Structure – Pros & Cons – Mobile Payment System – Security Issues.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Jochen Schiller, "Mobile Communications", Prentice Hall India, Second Edition, 2009.
2. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", Prentice Hall India Learning Pvt.Ltd, New Delhi, 2012.

REFERENCES:

1. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.
2. William.C.Y.Lee,"Mobile Cellular Tele communications-Analog and Digital Systems", Second Edition,TataMcGraw Hill Edition , 2006.
3. Michael Gregg, "Build Your Own Security Lab", Wiley Publishing Inc., 2009.
4. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems",Thomson Asia Pvt Ltd, 2005.
5. C.K.Toh, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106/106/106106147/
2. https://www.cse.iitb.ac.in/~mythili/teaching/cs653_spring2014/index.html
3. https://freevideolectures.com/course/4818/nptel- mobile-computing
4. https://alison.com/course/introduction-to-mobile-and-cloud-computing

ONLINE RESOURCES:

1. https://youtu.be/zp3KtaICq2U
2. https://youtu.be/Bz0aw4_K8oc
3. https://youtu.be/ytLkrvyIf6g
4. Android Developers : http://developer.android.com/index.html
5. Apple Developer : https://developer.apple.com/
6. Windows Phone DevCenter : http://developer.windowsphone.com
7. BlackBerry Developer : http://developer.blackberry.com/

OUTCOMES:

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

1. Understand the basics of Wireless and Mobile Communications. (K2)
2. Summarize and select the access medium based on the applications. (K2)
3. Illustrate the architecture of Mobile Networks. (K3)

4. Apply Various Security mechanisms in the Transmission protocols. (K3)
5. Demonstrate Various Mobile Routing Protocols based on the applications on different Mobile OS. (K3)
6. Determine the Fragmentation and Reassembling based on the communicating device and the availability of the network bandwidth.(K3)

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

SEMESTER - V

20CSPL501 SDG NO. 4 & 9	INTERNET PROGRAMMING LABORATORY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Familiar with Web page design using HTML/XML and Style sheets
- Exposed to creation of User Interfaces using Java Frames and Applets
- Create Dynamic Web Pages using Server Side Scripting
- To understand PHP programming

LIST OF EXPERIMENTS:

1. Create a web page with the following using HTML

a. To embed a map in a web page

b. To fix the hot spots in that map

c. Show all the related information when the hot spots are clicked.

2. Create a web page with the following.

a. Cascading style sheets.

b. Embedded style sheets.

c. Inline style sheets. Use our college information for the web pages.

3. Validate the Registration, user login, user profile and payment by credit card pages using JavaScript.

4. Write programs in Java using Servlets:

a. To invoke servlets from HTML forms

b. Session tracking using hidden form fields and Session tracking for a hit count

5. Write programs in Java to create three-tier applications using servlets for conducting on- line examination for displaying student mark list. Assume that student information is available in a database which has been stored in a database server.

6. Install TOMCAT web server. Convert the static web pages of programs into dynamic web pages using servlets (or JSP) and cookies. Hint: Users information (user id, password, credit card number) would be stored in web.xml. Each user should have a separate Shopping Cart.

7. Redo the previous task using JSP by converting the static web pages into dynamic web pages. Create a database with user information and books information. The books catalogue should be dynamically loaded from the database.

8. Create and save an XML document at the server, which contains 10 users Information. Write a Program, which takes user Id as an input and returns the User details by taking the user information from the XML document

9. a. Validate the form using PHP regular expression.

   b. PHP stores a form data into database.

10. Write a web service for finding what people think by asking 500 people's opinion for any consumer product.

TOTAL: 45 PERIODS

LAB REQUIREMENTS:

Dream Weaver or Equivalent, MySQL or Equivalent, Apache Server, WAMP/XAMPP

OUTCOMES:

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

1. Construct Web pages using HTML/XML and style sheets.(K1)
2. Build dynamic web pages with validation using JavaScript objects and by applying different event handling mechanisms.(K3)
3. Develop dynamic web pages using server side scripting.(K2)
4. Use PHP programming to develop web applications.(K3)
5. Construct web applications using AJAX and XML.(K2)
6. Develop web services in Java.(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	2	-	-	-	-	2	2	1	1
CO2	3	3	3	2	3	2	-	-	-	-	2	2	2	2
CO3	3	3	3	3	3	3	-	-	-	-	2	2	2	2
CO4	3	3	3	2	3	3	-	-	-	-	2	2	2	3
CO5	3	3	3	2	3	3	-	-	-	-	2	1	2	2
CO6	3	3	3	2	3	2	-	-	-	-	2	2	1	1

SEMESTER - V

20CIPL501 SDG NO. 4 & 9	IOT ARCHITECTURE AND PROGRAMMING IN IOT LAB	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To implement Programming using Arduino/Raspberry Pi
- To implement the interfacing with ESP 32 & ESP8266
- To get familiarized to Xbee
- To study about open vino tool kit

LIST OF EXPERIMENTS:

1. Air and Noise Pollution Monitoring System Over IOT
2. Weather Reporting Over IOT
3. IOT based Anti-theft Flooring System
4. IOT Garbage Monitoring
5. IOT Based Heart Monitoring System Using ECG
6. IOT Water Pollution Monitor RC Boat
7. IOT Based Automatic Vehicle Accident Detection and Rescue System
8. IOT Smart Parking Using RFID
9. IOT based Manhole Detection and Monitoring System
10. IOT based Three Phase Power Failure Monitoring with SMS Alerts
11. IOT based Intelligent Gas Leakage Detector
12. IOT based Smart Agriculture Monitoring System Project
13. Contactless IOT Doorbell

14. Study the basics of OpenVINO toolkit and it general functions
15. Study of Smart Edge Open software with general functionalities

TOTAL: 45 PERIODS

LAB REQUIREMENTS:

1. Arduino/Raspberry Pi/ESP32 ,/ ESP8266 / Systems with Linux Operating System

OUTCOMES:

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

1. Implement automatic accident detection. [K3]
2. Determine the gabage level using Io.[K3]
3. Read the Three Phase Power Failure Monitoring with SMS Alerts [K2]
4. Read the weather temperature and humidity value from the sensor.[K2]
5. Implementing the Smart Agriculture Monitoring System.[K3]
6. Identify the vehicle using Smart Parking Using RFID.[K3]

CO – PO, PSO MAPPING:

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

SEMESTER - V

20CITE501 SDG NO. 4,11&15	LIVE-IN-LAB III	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide opportunities for the students, expose to Industrial environment and real time work
- To give access to NASSCOM research and intelligence that tracks industry trends, growth opportunities and best practices, access to a repository of industry presentations, blogs, discussions and articles

- To impart detailed knowledge of Computer Networks, various protocols used in Communication, Managing and configuring Cisco Switches and Routers and various WAN technologies
- To automate repetitive and redundant tasks and eliminates the human intervention using UiPath a Robotic Process Automation tool

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. To engage students in CSE beyond their robust academic curriculum that sparks curiosity and imagination while teaching critical knowledge and skills.
3. This practice will engage beyond curriculum using industry-relevant technologies that help students get ready for the next step in their educations or careers. It helps the learners expand knowledge; develop skills, and their innovativeness.
4. The initiative is designed to provide students with foundational knowledge and skills in areas of CSE that are universally in high demand across computing jobs
5. On completion of the course, the student shall be able to develop applications and submit a detailed report for evaluation.

EVALUATION:

1. First evaluation (Immediately after first internal examination) : 20 marks
2. Second evaluation (Immediately after second internal examination): 30marksFinal evaluation (Last week of the semester) : 50marks

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

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Perform literature survey to identify the gap and an application oriented research problem in the specific domain (K2)
2. Design and validate the proposed system using simulation (K3)
3. Implement the proposed system (K3)
4. Examine 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 - V

20CITP501 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**

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

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

PYTHON PROGRAMMING & R PROGRAMMING – PHASE 2

COURSE OBJECTIVE:

- Gain strong knowledge of Python.
- Understand the concepts of R Programming
- Perform statistical computing and data visualizations

UNIT I INTRODUCTION, DATA TYPES AND STRINGS, LIST & TUPLES 10

DataTypes - Integer , Float , Boolean , String , List , Tuple , Dictionary and Sets. String - Concatenation and Replication, isalnum functions, Slicing Operation sorted() , reversed(), min() , max() , index() and count() function, packing and unpacking of data in a tuple

UNIT II DICTIONARY AND SETS HANDLING **10**

Dictionary - del Keyword,. Sets - Frozen sets, Internal working of sets, add() , union() , intersection() and difference() method, symmetric_difference, clear() method, Operators in sets, Higher Order Functions - map , filter , reduce and lambda function, Random Library

UNIT III EXCEPTIONAL HANDLING, REGULAR EXPRESSIONS AND OBJECT ORIENTED PROGRAMMING **10**

Exception Handling - All Error Categories, try , except , finally blocks, Raising an exception, Regular Expression, Object Oriented Programming - Types of Inheritance, Data encapsulation and Abstraction, Polymorphism, Method Overriding, Operator overloading, operator Overriding,

UNIT IV INTRODUCTION TO R PROGRAMMING **7**

Introduction, How to run R, R Sessions, and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

UNIT V BASICS OF R PROGRAMMING **8**

R Programming Structures, Control Statements, Loops, Looping Over Non Vector Sets, If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Extended Example: A Binary SearchTree.

REFERENCES:

1. Python-(Mark Lutz)
2. Python Training guide (BPB Publications)
3. Lander, "R for Everyone", Pearson
4. The Art of R Programming, Norman Matloff, CengageLearning

OUTCOMES:

Upon completion of this course, the students will 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. (K3)
5. Understand the basics of data science and R programming fundamentals. (K2)
6. Apply R programming language concepts such as data types, vectors, matrix arrays, structures, functions, and boolean operators by writing R programs and through examples. (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 - VI

20CSPC601 SDG NO. 4 & 9	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents and 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 toTypical 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 AND LEARNING **9**

Planning – Planning with State Space Search- Partial Order Planning Algorithm – Planning Graphs -Logical Formulation of Learning - Knowledge in Learning - Explanation-based Learning – Learning using Relevance Information.

UNIT V NATURAL LANGUAGE PROCESSING **9**

Language models - Phrase Structure Grammars - Syntactic Analysis – Augmented Grammars and Semantic Interpretation - Application with NLP: Developing a Simple Chatbot - Types of Chatbot.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Stuart J Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall,Third Edition, 2009.
2. Elaine Rich, Kevin Knight, Shivashankar B. Nair, "Artificial Intelligence", Tata McGraw-HillEducation, Third Edition, 2008.

REFERENCES:

1. M.TimJones, "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", Springer, Fifth Edition, 2003.
4. George F Luger, "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", Pearson Education, New Delhi, Fifth Edition, 2017.
5. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", O'Reilly, 2009, https://www.nltk.org/book/.
6. I. Bratko, "Prolog: Programming for Artificial Intelligence", Addison-Wesley Educational Publishers Inc., Fourth Edition, 2011.

WEB REFERENCES:

1. https://books.google.co.in/books?id=uSvYmki2yg0C&printsec=frontcover&dq=Supervised+Learning&hl=en&sa=X&v ed=0ahUKEwigkNa1xN3oAhWawjgGHe8hAzoQ6AEIKDAA#v=onepage&q=Supervised%20Learning&f=false

OUTCOMES:

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

1. Infer the agent characteristics and its problem solving approaches.(K2)
2. Select appropriate search algorithms for any AI problem.(K1)
3. Apply the principles of AI in game playing.(K3)
4. Construct and solve a problem using first order and predicate logic.(K3)
5. Identify the methods of solving problems using planning and learning.(K3)
6. Implement applications for Natural Language Processing that use Artificial Intelligence.(K3)

CO – PO, PSO MAPPING:

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

SEMESTER - VI

20CSPC602 SDG NO. 4 & 9	COMPILER DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about the various phases of the Compiler
- To learn various Parsing techniques
- To understand Intermediate code generation & runtime environment
- To analyze Code optimization techniques & Code generation algorithm

UNIT I INTRODUCTION TO COMPILERS 9

Translators-Compilation and Interpretation-Language processors – Analysis of the source program –Phases of a compiler – Cousins of the Compiler – Grouping of Phases – Compiler construction tools – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – LEX tool–Regular Expressions to Automata Direct method.

UNIT II SYNTAX ANALYSIS 12

Role of the parser –Writing a Grammar –Context-Free Grammars – Top Down parsing – Recursive Descent Parsing – Predictive LL(1) Parsing – Bottom-up parsing – Shift Reduce Parsing – Operator Precedence Parsing – LR Parsers – SLR Parser – Introduction to LALR & CLR Parser - Error Handling and Recovery in Syntax Analyzer - YACC.

UNIT III INTERMEDIATE CODE GENERATION 8

Intermediate languages – Declarations – Assignment Statements – Boolean Expressions – Case Statements –Back Patching – Procedure calls. Type Systems-Specification of a simple type checker-Equivalence of Type Expressions-Type Conversions.

UNIT IV RUN-TIME ENVIRONMENT AND CODE GENERATION 8

Source Language Issues - Storage Organization - Storage Allocation - Parameter Passing - Symbol Tables - Dynamic Storage Allocation. Issues in the design of code generator – The target machine – Basic Blocks and Flow Graphs – Next- use Information – A simple Code generator – DAG Representation of Basic Blocks.

UNIT V CODE OPTIMIZATION 8

Principal Sources of Optimization – Peep-hole optimization - DAG-Optimization of Basic Blocks-Global Data Flow Analysis - Efficient Data Flow Algorithm.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman," Compilers : Principles, Techniques and Tools", Second Edition, Pearson Education, 2009.
2. V. Raghavan, "Principles of Compiler Design", Tata Mc Graw Hill Education Publishers, 2010.

REFERENCES:

1. Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence based Approach", Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003
3. Keith D Cooper and Linda Torczon, "Engineering a compiler", Morgan Kaufmann Publishers Elsevier Science, 2004.
4. Allen I. Holub, "Compiler Design in C", Prentice - Hall Software Series, 1993.
5. Charles N. Fischer, Richard. J. LeBlanc, "Crafting a Compiler with C", 2008.

WEB REFERENCES:

1. http://www.holub.com/software/compiler.design.in.c.docs.pdf
2. http://www.cs.usfca.edu/~galles/compilerdesign/x86.pdf

ONLINE RESOURCES:

1. https://www.javatpoint.com/compiler-tutorial

OUTCOMES:

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

1. Explain the role of each phase of a compiler with its construction tools. (K2)
2. Illustrate the role of a Lexical Analyzer for recognizing the tokens of a given language with the knowledge of symbol table management and error-handling (K3)
3. Construct parsers like top-down, bottom-up for a given grammar(K3)
4. Develop semantic analyzers for type-checking and intermediate code generators to translate the source program into an intermediate code (K3)
5. Outline Runtime environment and a simple Code Generator using the code generation Algorithm (K2)
6. Implement code optimizers to optimize the target code generated (K3)

CO – PO, PSO MAPPING:

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

SEMESTER - VI

20CIPC603 SDG NO. 4 & 9	CLOUD COMPUTING AND FOG 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 appreciate the Emergence of Cloud as the next generation computing paradigm
- To remember the concept of Fog Computing and their challenges

UNIT I INTRODUCTION 8

IntroductiontoCloudComputing–DefinitionofCloud–EvolutionofCloudComputing–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 9

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

UNIT IV FOG COMPUTING 9

Introduction to Cloud Computing - Limitation of Cloud computing-Differences between Cloud and Fog computing-advantages of Fog computing-Business Models-architecture of Fog computing-Opportunities and Challenges.

UNIT V ADDRESSING THE CHALLENGES IN FOG RESOURCES 9

Introduction-Taxonomy and Characteristics-Resource Management Challenge-Optimisation challenges-Miscellaneous Challenges in IoT and Fog-Programming paradigms for IoT and Fog-Research challenges and Future Research Directions.

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, JohnW., and James F.Ransome, “Cloud Computing: Implementation, Management and Security”, CRC Press, 2017.
3. Rajkumar Buyya, Satish Narayana Srirama “Fog and Edge Computing”, Wiley Publications, 2019.

REFERENCES:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, “Mastering Cloud Computing”, Tata Mcgraw Hill, 2013.

2. TobyVelte, Anthony Velte, Robert Elsenpeter, "Cloud Computing-A Practical Approach", TataMcgraw 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.
4. Douglas Comer,"The Cloud Computing Book: The Future of Computing Explained", Chapmanand Hall/CRC,2021
5. Hemanand D, Chembian WT, Vallem Ranadheer Reddy, "CLOUD COMPUTING: Cloud Concepts; Methodology, Network Architecture" July 2021, LAPLAM BERT Academic Publishing

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
3. Research papers from IEEE,ACM,SpringerandElsevier)
4. FogcomputingintheInternetofThings:Springerpublications,2018

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 and Fog. (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 - VI

20HSMG601 SDG NO. 4,8,9,10&12	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–ScienceorArt–ManagerVsEntrepreneur–typesofmanagers–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 – CurrentissuesandfuturetrendsinManagement;Industry4.0 – 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–Planningpremises–MBO–process-Principlesand 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–departmentalization – delegation of authority – centralization and decentralization – Job Design – Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

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-Systemand 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 Entrepreneurship, Break through 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 McGrawHill, 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 Mamata Mohapatra, Management, Biztantra, 2008.
5. Harold Koontz and Heinz Weihrich Essentials of management Tata McGrawHill, 1998.

WEB RESOURCES:

1. https://www.managementstudyguide.com/organizationmanagement.html
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 - VI

20CSPL601 SDG NO. 4	ARTIFICIAL INTELLIGENCE LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To learn Prolog Program
- To Implement in Prolog, Candits 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. Study of Prolog.
2. Write simple fact for the statement using Prolong
3. Write predicates-one converts centigrade temperature to Fahrenheit, other checks if a temperature is below freezing.
4. Write a program to solve the 4-Queen problem.
5. Write a program to solve the 8-Puzzle problem.
6. Write a program to solve any problem using Breadth First Search.
7. Write a program to solve any problem using Depth First Search.
8. Write a program to solve the Travelling Salesman Problem.
9. Write a program to solve the Water Jug problem.
10. Write a program to solve Missionaries and Cannibal problems.
11. Write a program to implement a Library Management System.

TOTAL:45PERIODS

LAB REQUIREMENTS:

SOFTWARE : Prolog ,Turbo C

OUTCOMES:

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

1. Interpret the concepts of Turbo and Prolog programming in AI. (K3)
2. Examine First order predicate logic to solve AI problems. (K4)
3. Apply Informed search strategies to solve AI problems. (K3)
4. Apply Uninformed search strategies to solve AI problems. (K3)
5. Select State Space Searching method to solve AI problems.(K3)
6. Demonstrate an application using Natural Language Processing. (K3)

CO – PO, PSO MAPPING:

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

SEMESTER - VI

20CSPL602 SDG NO. 4	CLOUD COMPUTING LABORATORY	L	T	P	C
		3	0	0	3

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 Virtual Box / 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 Google App Engine. Create hello world app and other simple web applications usingPython/Java.
4. Use GAE launcher to launch the Web Applications.
5. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm that is not present in Cloud Sim.
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 Open stack Demo Version)
8. Install Hadoop single node cluster and run simple applications like word count.

TOTAL : 45 PERIODS

LAB REQUIREMENTS:

S.No.	Software
1.	Virtual box
2.	VMwareWorkstation
3.	Openstack,Hadoop
4.	Cloudism
5.	GAElauncher

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 - VI

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

OBJECTIVES:

- To develop effective communication and presentation skills
- To enhance the employability and career skills of the learners
- To enable the learners for preparing job application and e-portfolio
- To make the learners usesoftskills efficiently
- To develop their confidence and help the min 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/watchinginterviews, 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 – coverletter– 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 – teamwork – career planning – inter cultural 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:30PERIODS

TEXT BOOKS:

1. Business English Certificate Materials, Cambridge University Press.
2. Comfort, Jeremy, etal. 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, the student should be able to

1. Demonstrate a better understanding of the communication process by articulating effectively (K2)
2. Exhibits of tskills & 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, PSO 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

20CIPJ601 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.

- To create awareness among the students of the characteristics of several domain areas where IT can be effectively used

COURSEPLAN:

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

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

OUTCOMES:

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

1. Understand how to approach innovation challenges from a human-centred perspective[K2]
2. Develop many creative ideas through structured brainstorming sessions [K3]
3. Apply the perspectives of different people that lead to best innovations [K3]
4. Comprehend the importance of incorporating multi disciplinary approach that address human needs and sustainable development [K3]
5. The significance of developing innovation projects with a prototyping mindset, where iterations, trial and error, and even failure are all part of a valuable, creative learning process [K4]

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	2	2	3	3	3	2	3	3
CO2	3	3	3	3	3	3	2	2	3	3	3	2	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 - VI

20CITP601 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

APTITUDE AND COGNITIVE SKILLS – PHASE 1

OBJECTIVES:

- Enhance their quantitative ability.
- Enhance their reasoning ability
- Enhance their verbal ability.

UNIT I QUANTITATIVE ABILITY – VII **10**

Races And Games, Boats and Streams, Surds and Indices, Pipes and Cistern, Alligations And Mixtures

UNIT II QUANTITATIVE ABILITY – VIII **10**

Numbers, Problems on Numbers, Pick Wrong Number, Missing Number, Areas, Shapes, Perimeter

UNIT III REASONING ABILITY – IV **8**

Data Interpretation Pie Charts, Data Interpretation Line Charts, Data Sufficiency (DS), Data Arrangements, LR – Arrangements, LR – Ranking.

UNIT IV VERBAL ABILITY – IV **10**

Sentence Correction, Sentence Improvement, Completing Statements, Sentence Formation, Paragraph Formation

UNIT V CREATIVITY ABILITY–IV **7**

Dot Situation, Rule Detection, Embedded Images, Grouping Of Images, Image Analysis

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 Arunsharma

PROBLEM SOLVING USING BASIC DATA STRUCTURES – MOBILE APPLICATION DEVELOPMENT & ANDROID STUDIO - PHASE 2

COURSE OBJECTIVE:

- Familiarize students with basic data structures and their use in fundamental algorithms.
- Understand and develop application using Android

UNIT I LINKED LIST, STACK, QUEUE & HEAP **10**

Linked List –Doubly Linked List Traversal, Circular Linked List, Structure, Node creation, Traversal Stack, Stack –Time Complexities of the Operations, Infix to Postfix/Prefix Conversation, Histogram Problem, Implementation - Using Array, Using Linked List, Queue Implementation - Queue using Stack

UNIT II BINARY TREE AND HASHING **10**

Binary Tree - Types of Binary Tree, Balanced Tree, Degenerate or pathological Tree, Binary Search Tree, In order, Pre order, Post Order and Level Order Traversal, Hashing, Linear Probing for Collision Handling, Union and Intersection of two Linked Lists

UNIT III TREES AND GRAPH **10**

AVL Tree -Right-Left Imbalance, Left and Right Rotation, - Red Black Tree, Rules of coloring Left and Right Rotation, Graph terminology –Representation of graphs –Path matrix –Graph Traversal –BFS (breadth first search) –DFS (depth first search) –Minimum spanning Tree –Kruskal's Algorithm & Prim's Algorithm –Warshall's algorithm (shortest path algorithm).

UNIT IV INTRODUCTION TO ANDROID STUDIO APPLICATION 8

Android Studio Development Kit - The Android Platform - Eclipse Installation- Understanding the Anatomy of Android Application - Android Installation - Building the First Android Application -Android Manifest File -Android Technology - Android Application Design Essentials : Android Applications Anatomy -Application- Activities, Context, Services, Intents - Receiving and Broadcasting Intents - Using Intent Filter, Permissions - Android Manifest File and common settings.

UNIT V ANDROID APPLICATION PROGRAMMING INTERFACES 7

Using Android Data and Storage APIs – Designing User Interfaces and Layouts – Sharing Data between Applications with Content Providers – Managing Data Using Sqlite – Using Android Networking APIs - Using Android Telephony APIs-Using Android Web APIs –Deploying Android Application to the world – Testing Android Applications : Using Android Preferences –Publishing Android Application - Managing Application Resources in a Hierarchy - Drawing and working with Animation

TOTAL: 45 PERIODS

REFERENCES:

1. Weiss, Mark.A. (2012), Data structures and algorithm analysis in Java. 3edition. Harlow, Essex:Pearson (632p).
2. Zobel, Justin (2014), Writing for Computer Science.3 edition. Springer Verlag London Ltd (270p).
3. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference" Google Developer Training Team, 2017
4. Erik Hellman, "Android Programming – Pushing the Limits", 1stEdition, Wiley India Pvt Ltd, 2014.
5. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O'Reilly SPD Publishers, 2015.
6. JF DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126565580
7. Anubhav Pradhan, Anil V Deshpande, "Composing Mobile Apps" using Android, Wiley 2014, ISBN:978-81-265-4660-2

WEBLINK:

1. https://www.gitbook.com/book/google-developer-training/android-developerfundamentals-course-concepts/details (Download pdf file from the above link)

OUTCOMES:

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

1. Analyze the applications of linear data structure using Stack and Queue implementation. (K4)
2. Define the various hash functions and its implementation. (K2)
3. Apply the basic concepts of the Non Linear Data Structure –Trees and Graph.(K3)
4. Apply the components and structure of mobile application development frameworks for Android studio and windows OS. (K3)
5. Analyze various Android Application Programming Interfaces. (K4)
6. Analyze and discover own mobile app for simple needs. (K4)

CO-PO & PSO MAPPING:

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

SEMESTER - VII

20CSPC701 SDG NO. 4 &9	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To describe the basic concepts of Big Data Characteristics and Analytics
- To examine the Hadoop and MapReduce framework for processing large volume of datasets
- To demonstrate Hive, Pig, Mongo DB and Report generation
- To analyze the Big Data for useful Business applications and get familiarized with the Visualization

UNIT I INTRODUCTION TO BIG DATA ANALYTICS 9

Classification of Digital Data - Introduction to Big Data: Characteristics – Evolution – Definition - Challenges with Big Data - Other Characteristics of Data-Why Big Data - Traditional Business Intelligence versus Big Data - Data Warehouse and Hadoop Environment - Big Data Analytics: Classification of Analytics – Challenges - Big Data Analytics importance - Data Science - Data Scientist-Terminologies used in Big Data Environments – Basically Available Soft State Eventual Consistency-Top Analytics Tools.

UNIT II HADOOP AND MAP REDUCE PROGRAMMING 9

Hadoop: Features – Advantages – Versions – Ecosystems – Distributions – Hadoop Versus RDBMS - Distributed Computing Challenges – History - Hadoop Overview - Use Case of Hadoop - Hadoop Distributors - Hadoop Distributed File System – Processing Data with Hadoop – Managing Resources and Applications with Hadoop YARN – Interacting with Hadoop Ecosystem – Map Reduce: Mapper–Reducer–Combiner–Partitioner– Searching –Sorting –Compression.

UNIT III DATA PROCESSING SERVICES : HIVE & PIG 9

Hive: Introduction – Architecture - Data Types - File Formats - Hive Query Language Statements – Partitions – Bucketing – Views - Sub-Query – Joins – Aggregation - Group By and Having – RC File Implementation - Hive User Defined Function- Serialization and Deserialization- Hive Analytic Functions - Pig: Introduction-History and Anatomy–Features–Philosophy-Use Case for Pig-Pig Latin Overview –Pig Primitive Data Types –Running Pig -Execution Modes of Pig - HDFS Commands - Relational Operators - Eval Function - Complex Data Types - Piggy Bank - User-Defined Functions - Parameter Substitution - Diagnostic Operator - Word Count Example using Pig - Pig at Yahoo!-Pig Versus Hive.

UNIT IV NOSQL: MONGODB AND JASPER REPORTS 9

NoSQL Databases: Advantages - Usage - Vendors - New SQL – Comparison of SQL, NoSQL and New SQL - MongoDB: Why MongoDB - Termsused in RDBMS and MongoDB – Data Types – MongoDB Query Language Methods : Insert – Save - Update – Remove – Find – NULL – Count – Limit – Sort – Skip –Arrays – Aggregate – Map Reduce - Cursors in MongoDB - Indexes - Import and Export - Jasper Report using Jasper soft - Connecting to MongoDB NOSQL Database.

UNIT V FRAMEWORKS AND VISUALIZATION 9

Apache Hbase - Architecture/Storage - Features - Data Model - Shell and Implementation - Hbase Vs RDBMS - Zookeeper - Installation and Configuration - Running Zookeeper- Sqoop – Architecture – Import and Export Data – Sqoop Job - Flume - Log Collection - Working with Twitter Stream - Oozie - Simple and Complex Flow - Components - Service/Scheduler - Workflow - Apache Spark - Lambda Architecture - Spark Streaming - Spark Processing-ApacheKafka-Operations-Visualizations-VisualDataAnalysis Techniques-Interaction Techniques.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publications,FirstEdition,2015.
2. TomWhite,"Hadoop:TheDefinitiveGuide",3rdEdition,O'Reilly,2012.

REFERENCES:

1. Seema Acharya, “Data Analytics using R”, McGraw Hill Publications, New Edition,2018.
2. Judith Huruwitz, Alan Nugent, Fern Halper, Marcia Kaufman,“Big data for dummies”, John Wiley & Sons, Inc. ,2013.
3. Donald Miner, “Map Reduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems”, O'Reilly Media, 2012.
4. Vignesh Prajapati, “Big Data Analytics with R and Hadoop”, 1st Edition, Packet Publishing Limited, 2013.
5. Kyle Banker, “MongoDB in Action”, Manning Publications Company, 2012.

WEB REFERENCES:

1. https://www.mongodb.org
2. https://hadoop.apache.org/
3. https://hive.apache.org/
4. https://pig.apache.org/
5. https://community.jaspersoft.com

OUTCOMES:

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

1. Describe the characteristics and challenges of big data analytics. (K2)
2. Apply Hadoop and Map Reduce framework for processing massive volume of data.(K3)
3. Use Hive and Pig to demonstrate the structured and semi structured data. (K3)
4. Illustrate CRUD operations using MongoDB and Report generation using Jasper soft studio. (K3)
5. Explore the usage of Hadoop and its integration tools to manage Big Data and Use Visualization techniques. (K3)
6. Apply suitable frameworks and NoSQL Database to solve the real time problems.(K3)

CO – PO, PSO MAPPING:

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

SEMESTER - VII

20CSPC702 SDG NO. 4 &11	MACHINE LEARNING TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the need for machine learning for various problem solving
- To study the various supervised, semi-supervised and un supervised learning algorithms in machine learning
- To understand the latest trends in machine learning
- To design appropriate machine learning algorithms for problem solving

UNIT I INTRODUCTION 9

Learning Problems – Perspectives and Issues – Concept Learning – Version Spacesand Candidate Eliminations–Inductive bias–Decision Tree learning–Representation–Algorithm–Heuristic Space Search.

UNIT II NEURAL NETWORKS AND GENETIC ALGORITHMS 9

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

UNIT III BAYESIAN AND COMPUTATIONAL LEARNING 9

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

UNIT IV INSTANT BASED LEARNING 9

K - Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions–Case Based Learning.

UNIT V ADVANCED LEARNING 9

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set–First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task–Q-Learning–Temporal Difference Learning

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education(India) Private Limited,2017.
2. Marco Gori , "Machine Learning: A Constraint-Based Approach", Morgan Kaufmann. 2017

REFERENCES:

1. Ethem Alpaydin, "Introduction to Machine Learning (Adaptive Computation and Machine Learning)", The MIT Press 2004.
2. Stephen Marsland,"Machine Learning: An Algorithmic Perspective", CRC Press, 2009
3. Richard O. Duda, Peter E. Hart, David G. Stork, "Pattern Classification",

Wiley, Second Edition.
4. Christopher Bishop, "Pattern Recognition and Machine Learning", illustrated Edition, Springer, 2006.
5. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.

WEB REFERENCES:

1. https://towardsdatascience.com/best-resources-for-ai-machine-learning-data-science-d72625d4689d
2. https://www.analyticsvidhya.com/resources-machine-learning-deep-learning-neural-networks/
3. https://www.ritchieng.com/machine-learning-resources/
4. https://www.guru99.com/machine-learning-tutorial.html

OUTCOMES:

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

1. Gain knowledge about basic concepts of Machine Learning and differentiate between supervised, unsupervised, semi-supervised machine learning approaches. (K2)
2. Discuss and apply the back propagation algorithm and genetic algorithms to various problems.(K2)
3. Discuss the Decision Tree algorithm, identity and overcome the problem of overfitting and apply the Bayesian concepts to Machine Learning. (K2)
4. Solve the problems using various Machine Learning techniques and apply instant based learning techniques. (K3)
5. Analyze and suggest appropriate Machine Learning approaches for various types of problems. (K4)
6. Demonstrate various machine learning algorithms in a range of real-world applications (K3)

CO – PO, PSO MAPPING:

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

SEMESTER - VII

20CIPW701 SDG NO. 4 &9	SENSORS AND EMBEDDED SYSTEMS WITH LAB	L	T	P	C
		3	0	2	4

OBJECTIVES:

- Explain the real time embedded system and its components.
- Understand basic components and building blocks of Sensors.
- Apply skills to conduct interfacing of embedded boards with components, actuators and sensors.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9

Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT II TYPICAL EMBEDDED SYSTEM 9

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT III RTOS BASED EMBEDDED SYSTEM DESIGN 9

Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT IV SENSORS / TRANSDUCERS 9

Principles – Classification – Parameters – Characteristics - Environmental Parameters (EP) – Characterization Mechanical and Electromechanical Sensors: Introduction – Resistive Potentiometer – Strain Gauge – Resistance Strain Gauge – Semiconductor Strain Gauges - Inductive Sensors: Sensitivity and Linearity of the Sensor –Types-Capacitive Sensors:– Electrostatic Transducer– Force/Stress Sensors Using Quartz Resonators – Ultrasonic Sensors-Thermal Sensors: Introduction – Gas thermometric Sensors – Thermal Expansion Type Thermometric Sensors – Acoustic Temperature Sensor – Junction Semiconductor Types– Thermal Radiation Sensors –Quartz Crystal Thermoelectric Sensors – NQR Thermometry – Spectroscopic Thermometry – Noise Thermometry – Heat Flux Sensors Magnetic sensors:

Introduction – Sensors and the Principles Behind – Magneto resistive Sensors – Anisotropic Magneto resistive Sensing – Semiconductor Magneto resistors– Hall Effect and Sensors – Inductance and Eddy Current Sensors– Angular/Rotary Movement Transducers – Synchros – Synchro-resolvers - Eddy Current Sensors – Electromagnetic Flowmeter – Switching Magnetic Sensors SQUID Sensors

UNIT V RADIATION SENSORS AND SMART SENSORS 9

Introduction – Basic Characteristics – Types of Photosensistors/Photo detectors– X-ray and Nuclear Radiation Sensors– Fiber Optic Sensors Electro analytical Sensors: Introduction – The Electrochemical Cell – The Cell Potential - Standard Hydrogen Electrode (SHE) – Liquid Junction and Other Potentials – Polarization – Concentration Polarization-– Reference Electrodes - Sensor Electrodes – Electro ceramics in Gas Media. Introduction – Primary Sensors – Excitation – Amplification – Filters – Converters – Compensation– Information Coding/Processing - Data Communication – Standards for Smart Sensor Interface – The Automation Sensors –Applications: Introduction – On-board Automobile Sensors (Automotive Sensors)– Home Appliance Sensors – Aerospace Sensors – – Sensors for Manufacturing –Sensors for environmental Monitoring

TOTAL: 45PERIODS

LIST OF EXPERIMENTS:

1. Introduction of Components, Sensors and Actuators- Introduction of Arduino Mega2560.
2. Testing- Reading Switches and Blinking LED-Analog/Digital Port Programming - Accelerometer Sensor Interfacing- Temperature Sensor (LM35) Interfacing- Humidity Sensor (DHT11) Interfacing- PIR Sensor Interfacing.

TEXT BOOKS

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.
2. D. Patranabis – "Sensors and Transducers" –PHI Learning Private Limited

REFERENCE BOOKS

1. Embedded Systems - Raj Kamal, TMH.
2. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
3. W. Bolton – "Mechatronics" –Pearson Education Limited.
4. Sensors and Actuators – D. Patranabis – 2nd Ed., PHI, 2013

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc24_ee68/preview
2. https://onlinecourses.nptel.ac.in/noc22_cs93/preview
3. https://onlinecourses.nptel.ac.in/noc20_ee98/preview

OUTCOMES:

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

1. Understand the concepts of Embedded Systems.(K2)
2. Discuss the Off-The-Shelf Components and interface.(K2)
3. Interpret design of RTOS.(K2)
4. Illustrate the different types of Sensors and Transducers.(K3)
5. Infer the data accuracy, real-time monitoring and connectivity using smart sensors.(K2)
6. Apply the autonomous functionality across diverse applications.(K3)

CO-PO,PSOMAPPING:

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

SEMESTER - VII

20CSPL701 SDG NO. 4 &9	BIG DATA ANALYTICS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To implement Map Reduce programs for processing Big Data
- To analyze Big Data using Hive and Pig
- To realize storage of Big Data using MongoDB and Hbase
- To develop Big Data applications for streaming data using Apache Spark

LIST OF EXPERIMENTS:

1. Install, configure and run Hadoop and HDFS.
2. Implement word count / frequency programs using Map Reduce.
3. Implement an MR program that processes a weather dataset.
4. Implement an application using Hive/Pig.
5. Visualize data using any plotting frame work.
6. Implement an application that stores big datain Hbase / MongoDB using Hadoop / R.
7. Install, deploy and configure Apache Spark cluster. Run an application using Apache Spark.

TOTAL : 45 PERIODS

LAB REQUIREMENTS:

1. Hadoop / R
2. Hive and Pig
3. Hbase
4. MongoDB
5. Apache Spark

OUTCOMES:

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

1. Demonstrate Big Data using Hadoop framework.(K3)
2. Implement Map Reduce framework for processing big data.(K3)
3. Perform Data Analysis using Hive / Pig. (K3)
4. Use NoSQL database to Store and retrieve the data.(K3)
5. Perform Graphical Data Analysis. (K3)
6. Apply Apache Spark to build big data applications. (K3)

CO – PO, PSO MAPPING:

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

SEMESTER - VII

20AIPL302 SDG NO. 4	MACHINE LEARNING LABORATORY	L	T	P	C
		0	0	3	1.5

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 Back propagation algorithm and test the same using appropriate datasets.

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 - VII

20CIPJ701 SDG NO. 4,6,7,8,9, 11,12,13&17	PROJECT PHASE - I	L	T	P	C
		0	0	4	2

OBJECTIVES:

- Identify and describe the problem and scope of project
- Collect, analyze and present data into meaningful information using relevant tools
- Select, plan and execute a proper methodology in problem solving, work independently and ethically
- Present the results in written and oral format effectively and identify basic entrepreneurship skills in project management

GUIDELINES TO BE FOLLOWED:

The students may be grouped into 2 to 3 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/System Architecture/Process Flow)
2. Feasibility Study
3. List of possible solutions including alternatives and constraints
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. Literature survey on existing system
2. Implementation Phase (Hardware & Software)
3. Testing and Validation of the developed system

IV. Consolidated report preparation

TOTAL: 60 PERIODS

OUTCOMES:

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

1. Comprehend an industrial or real life problem and identify right / real issue with solution.(K2)
2. Analyze the necessary studies and review the literature, design a setup of equipment, complete the analysis.(K3)
3. Compose a project report based on the findings.(K6)

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	2	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

20CITP701 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

APTITUDE REFRESHER & APTITUDE COMPANY SPECIFIC TRAINING SKILLS – PHASE 1

OBJECTIVES:

- Enhance their quantitative ability.
- Enhance their reasoning ability
- Enhance their verbal ability.

UNIT I PRODUCT COMPANY SPECIFIC TRAINING – I 10

Product Specific Training for Amazon, Microsoft, IBM, Thought Works, Juspay, Paypal, MuSigma, Zoho Corporation,VMWare, Directi, Oracle, Wells Fargo, Goldman Sachs, Charge bee, Coda Global, Temenos, Fresh works, 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, Tech Mahindra, InfoView, RobertBosch, NTT Data, Verizon, Payoda Technologies.

UNIT IV SERVICE COMPANY SPECIFIC TRAINING - II 10

CTS, Accenture, Mind Tree, 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

APTITUDE & TECHNICAL REFRESHER & COMPANY SPECIFIC TRAINING & UNITY BASICS - PHASE 2

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, Thought Works, Juspay, Paypal, Mu Sigma, Zoho Corporation, VMWare, Directi, Oracle, Wells Fargo,

Goldman Sachs, Chargebee, Coda Global, Temenos, Freshworks, Adobe Systems., Ernstand Young, BA Continuum, StandardChartered,AONHewitt, Soliton Technologies, Payoda Technologies, Infoview Technologies, Athena Health Technology.

UNIT II PRODUCT COMPANY SPECIFIC TRAINING – II **10**

Product Specific Training for TCS, Wipro, Tech Mahindra, Info View, Robert Bosch, , NTT Data, Verizon, Payoda Technologies. CTS, Accenture, Mind Tree, MPhasis, Odessa Technologies, Vuram Technologies, Hewlett Packard, HCL.

UNIT III SERVICE COMPANY SPECIFIC TRAINING - I **10**

Capgemini, Infosys, IBM, UGAM Solutions, Skava Systems, L&T Infotech, Bahwan Cybertech, Dhyan Infotech.

UNIT IV UNITY INTRODUCTION **8**

Downloading unity and Project setup, Unity Objects and Components - Toolbar Tools, Toolbar Buttons, Project window, Scene view, Game View –Hierarchy window, Inspector window, Customizing your workspace, Wrapup, Creating our own component, Unity Engine UI - Working with user interface text, Creating account down Timer, Creating a Digital Clock, Unity UI – Images, Buttons, Toggles, Sliders, Dropdown.

UNIT V C# AND UNITY CODING **7**

Introduction to C# with Unity, C# if-Else statement, While-do While, for loop, for each loop, switch statement. Creating a simple calculator, creating a 2D side scroller, 3D game development Animations – Introduction, Animation Controller, Creating 2D Animations and 3D Animations, Triggering Animations from script.

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.
5. Jeremy Gibson Bond, "Introduction to Game Design, Prototyping, and Development", Latest Edition-Third, Publisher-Addison-Wesley
6. Alan Thorn, Unity Animation Essentials, Packt Publishing Limited, 24 June 2015.

WEBLINK:

1. https://docs.unity3d.com/560/Documentation/Manual/UnityBasics.html
2. https://unity.com/learn

OUTCOMES:

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

1. Apply quantitative and reasoning skills.(K3)
2. Improve verbal ability (K6)
3. Recognize Unity Interface such as panels, Tools and Components. (K1)
4. Understand foundational language and theory of game development technology (K2)
5. Define C# and its Role in Unity.(K1)
6. Apply problem solving, design and decision-making methodologies to develop components, systems and processes to meet specified requirements.(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	1	-	2	1	-	2	1	-
CO2	-	-	-	-	1	1	1	1	-	1	-	1	-	-
CO3	3	2	2	3	2	2	1	-	2	1	-	2	2	-
CO4	3	2	2	3	2	2	1	-	2	1	-	2	2	-
CO5	3	2	2	3	3	2	1	-	1	1	-	2	2	-
CO6	3	2	2	3	3	2	1	-	2	1	-	2	2	-

SEMESTER - VIII

20CIPJ801 SDG NO. 4,6,7, 8, 9, 11,12,13&17	PROJECT PHASE-II	L	T	P	C
		0	0	8	4

OBJECTIVES:

- Identify and describe the problem and scope of project
- Collect, analyze and present data into meaningful information using relevant tools
- Select, plan and execute a proper methodology in problem solving, work independently and ethically
- Present the results in written and oral format effectively and identify basic entrepreneurship skills in project management

GUIDELINES TO BE FOLLOWED:

The students may be grouped into 2 to 3 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. List of possible solutions including alternatives and constraints
2. Cost benefit analysis
3. Time Line of activities

II. A report highlighting the design finalization [based on functional, non-functional requirements and standards (if any)]

III. A presentation including the following:

1. Implementation Phase (Hardware & Software)
2. Testing and Validation of the developed system
3. Learning in the Project and Future Enhancement

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. (K2)
2. Analyze the necessary studies and review the literature, design a setup of equipment, complete the analysis. (K3)
3. Compose a project report based on the findings. (K6)

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 ELECTIVES - I

20CSEL501 SDG NO. 4 &9	DATA WAREHOUSING AND DATA MINING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand Data Warehouse concepts, Architecture, Business Analysis and Tools
- To understand Data Preprocessing and Data Visualization techniques
- To study algorithms for finding Hidden and Interesting patterns in Data
- To understand and apply various Classification and Clustering techniques

UNIT I DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING 9

Basic Concepts – Data Warehousing Components – Building a Data Warehouse–Database Architectures for Parallel Processing – Parallel DBMS Vendors –Multidimensional Data Model – Data Warehouse Schemas for Decision Support - Concept Hierarchies - Characteristics of OLAP Systems – Typical OLAP Operations – OLAP and OLTP.

UNIT II INTRODUCTION TO DATA MINING 9

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – Applications – Data Objects and Attribute Types - Statistical Description of Data - Data Preprocessing – Cleaning - Integration - Reduction - Transformation and Discretization - Data Visualization – Data Similarity and Dissimilarity Measures.

UNIT III FREQUENT PATTERN ANALYSIS 9

Mining Frequent Patterns – Associations and Correlations – Mining Methods-Pattern Evaluation Method – Pattern Mining in Multilevel – Multi Dimensional Space – Constraint Based Frequent Pattern Mining – Classification Using Frequent Patterns.

UNIT IV CLASSIFICATION AND CLUSTERING 9

Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Lazy Learners - Model Evaluation and Selection - Techniques to improve Classification Accuracy – Clustering Techniques – Cluster Analysis –Partitioning Methods – Hierarchical Methods – Density Based Methods –Grid Based Methods – Evaluation of Clustering – Clustering High Dimensional Data – Clustering with Constraints – Outlier Analysis – Outlier Detection Methods.

UNIT V DATA ANALYSIS TOOL **9**

Datasets – Introduction, Iris plants database, Breast cancer database, Auto Imports Database – Introduction to WEKA – Explorer – Getting started, Exploring the Explorer-Learning algorithms – Clustering algorithms –Association – Rule Learners.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Jiawei Hanand Micheline Kamber, "Data Mining Conceptsand Techniques", Third Edition, Elsevier, 2012.
2. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, 35th Reprint 2016.

REFERENCES:

1. K.P. Soman, Shyam Diwakar and V.Ajay, "Insight into Data Mining Theory and Practice", Eastern Economy Edition, Prentice Hall of India, 2006.
2. Ian H. Witten and Eibe Frank, "Data Mining: Practical Machine Learning Tools and Techniques", Elsevier, Second Edition, 2005.
3. Parteek Bhatia," Data Mining and Data Warehousing: Principles and Practical Techniques", Cambridge University Press, 2019.
4. Pranjali Deshpande, Soudamini Patil, "Data Warehousing and Data Mining", First Edition, Technical Publications, 2020.
5. Dr.B.Shadaksharappa, Mr.P.Ramkumar, Dr.T.N.Prabakar, "Data Warehousing and Data Mining", First Edition, Book Rivers, 2022.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106/105/106105174/00
2. https://swayam.gov.in/nd1_noc20_cs12/preview
3. https://freevideolectures.com/course/3609/data-warehousing

ONLINE RESOURCES:

1. https://www.tutorialspoint.com/data_mining/index.htm
2. https://www.guru99.com/online-analytical-processing.html
3. https://www.cs.waikato.ac.nz/ml/weka/courses.html
4. https://www.tutorialspoint.com/weka/what_is_weka.htm

OUTCOMES:

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

1. Use a Data Warehouse system and perform Business Analysis with OLAP Tools.(K3)

2. Recognize and identify suitable Pre-processing and Visualization techniques for Data Analysis.(K1)
3. Apply frequent Pattern and Association Rule Mining techniques for Data Analysis. (K3)
4. Apply appropriate Classification techniques for Data Analysis. (K3)
5. Apply appropriate Clustering techniques for Data Analysis.(K3)
6. Use WEKA tools for feature selection, classification and clustering for realtime data. (K3)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - I

20CIEL501 SDG NO. 4	INTRODUCTION TO CYBERSECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To examine secure software development practices in Web Security
- To incorporate approaches for incident analysis and response
- To learn computer forensics and cyber Law
- To become familiar with forensics tool

UNIT I INTRODUCTION TO CYBERSECURITY AND CYBERLAW 9

Overview of Cyber Security – Internet Governance – Challenges and Constraints - Cyber Threats - Cyber Space Concept - Fundamentals of Cyber Security- Understanding Cyber Security- Business Security - Importance of Cyber Security – Evolution of Hacking Equipped Tools and Techniques – Regulations – Notable Security Breaches Securing Web Application –Services and Servers – Introduction –Basic Security for HTTP Applications and Services Basic Security for SOAP Services - Identity Management and Web Services – Authorization Patterns – Security Considerations –Challenges – Introduction to Cyber Law – Need of Cyber Law – Cyber Law in India.

UNIT II CYBER SECURITY VULNERABILITIES AND CYBER SECURITY SAFE GUARDS 9

Cryptography in Information Security – Data Encryption – Challenges –Initiating Breach Protocol – Preventing Cyber Attacks - General Data Protection Regulation (GDPR) - Embracing the Future of Cyber Security - Cyber Security Vulnerabilities and Cyber Security Safeguards - Vulnerabilities Overview -Vulnerabilities in Software – System Administration – Complex Network Architectures - Open Access to Organizational Data - Weak Authentication - Unprotected Broadband Communications - Poor Cyber Security Awareness –Cyber Security Safeguards – Overview – Access Control – Audit – Authentication –Biometrics – Cryptography – Deception – Denial of Service Filters –Ethical Hacking – Firewalls - Intrusion Detection Systems – Response –Scanning –Security Policy – Threat Management.

UNIT III COMPUTER FORENSICS AND DATA ACQUISITION 9

Introduction to Computer Forensics and Investigations-Preparing for Computer Investigations – Understanding Computer Investigations –Taking a Systematic Approach - Procedures for Corporate High Tech Investigations - Understanding Data Recovery Workstations and Software - Conducting an Investigation - Completing the Case - Data Acquisition - Storage Formats for Digital Evidence - Determining the Best Acquisition Method – Contingency Planning for Image Acquisitions - Using Acquisition Tools - Validating Data Acquisitions - Performing RAID Data Acquisitions - Using Remote Network Acquisition Tools – Using other Forensic Acquisition Tools.

UNIT IV PROCESSING CRIME AND INCIDENT SCENE AND TOOLS IN COMPUTER FORENSICS 9

Processing Crime and Incident Scene – Identifying Digital Evidence-Collecting Evidence in Private Sector Incident Scenes - Processing Law Enforcement Crime Scenes- Preparing for a Search - Securing a Computer Incident or Crime Scene - Seizing Digital Evidence at the Scene - Storing Digital Evidence - Obtaining a Digital Hash - Computer Forensics Tool - Evaluating Computer Forensics Tool Needs - Computer Forensics Software and Hardware Tools –Validating and Testing Forensics Software.

UNIT V ANALYSIS, VALIDATION AND REPORT WRITING 9

Validating Forensics Data– Data Hiding Techniques – Performing Remote acquisition – Network Forensics – Performing Live Acquisitions - Developing Standard Procedures for Network Forensics- Using Network Tools - Email Investigations – Cell Phone and Mobile Devices Forensics – Report Writing For High Tech Investigations – Importance of Reports - Guidelines for Writing –Generating Report Findings with Forensics Software Tools – Expert

Testimony in High Tech Investigations- Preparing for Testimony - Testifying in Court -Preparing for a Deposition or Hearing - Preparing Forensic Evidence for Testimony – Ethics for the Expert Witness –Applying Ethics and Codes to Expert Witnesses – Organizations with Codes of Ethics –Ethical Difficulties in Expert Testimony.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Brain Walker, "Cybersecurity –comprehensive beginners guide to learn the basics and effective methods of cyber security", Independently Published, 2019.
2. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, "Computer Forensics and Investigations", Cengage Learning, India Edition, 2016.

REFERENCES:

1. Pavan Duggal, "Textbook on Cyber Law", Universal Law Publishing Co Ltd, 2012.
2. Raef Meuwisse, "Cyber Security for beginners", 2ndedition, 2016.
3. John R.Vacca,"Computer Forensics", Cengage Learning, 2005.
4. Marjie T.Britz, "Computer Forensics and Cyber Crime: An Introduction", 3rd Edition, Prentice Hall, 2013.
5. Ankit Fadia, "Ethical Hacking", Second Edition, Macmillan India Ltd, 2006
6. Kenneth C. Brancik "Insider Computer Fraud", Auerbach Publications Taylor & Francis Group – 2008.
7. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015.

WEB REFERENCES:

1. https://www.cisco.com
2. https://www.kaspersky.co.in
3. www.cyberforensics.in
4. www.nptel.com

OUTCOMES:

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

1. Understand about securing systems, protect personal data, and secure computer networks. (K2)
2. Explore the key terms and concepts in cyber law, intellectual property and cybercrimes, trademarks and domain theft. (K2)

3. Learn the basics of computer forensics and apply forensic tools to a given scenario. (K2)
4. Acquire knowledge on processing cybercrime scenes, formulate computer forensic investigation reports and data acquisitions. (K2)
5. Apply forensics data to identify the vulnerabilities in a given network infrastructure and implement real-world hacking techniques to test system security. (K3)
6. Apply tools to validate and test Forensic software and report writing. (K3)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - I

20CIEL502 SDG NO. 4	SENSORS, ACTUATORS AND SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the sensors and its characteristics
- To incorporate approaches for actuators and their working principles
- To understand the fundamentals and properties of signal
- To learn discrete Fourier transform, fast Fourier transform, properties of DFT

UNIT I SENSORS **9**

Difference between sensor– transmitter and transducer – Primary measuring elements – selection and characteristics: Range–resolution– Sensitivity–error, repeatability– linearity and accuracy–impedance– backlash–Response time– Dead band–Signal transmission – Types of signal: Pneumatic signal–Hydraulic signal– Electronic Signal–Principle of operation–construction details–characteristics and applications of potentiometer–Proving Rings– Strain Gauges– Resistance thermometer–Thermistor–Hot-wire anemometer– Resistance Hygrometer–Photo-resistive sensor.

UNIT II ACTUATORS 9

Definition, types and selection of Actuators– linear– rotary– Logical and Continuous Actuators–Pneumatic actuator– Electro-Pneumatic actuator– cylinder– rotary actuators–Mechanical actuating system– Hydraulic actuator –Control valves– Construction–Characteristics and Types–Selection criteria– Electrical actuating systems–Solid-state switches– Solenoids– Electric Motors– Principle of operation and its application– D.C motors –AC motors –Single phase & 3 Phase Induction Motor; Synchronous Motor– Stepper motors – Piezoelectric Actuator.

UNIT III MICRO SENSORS AND MICRO ACTUATORS 9

Micro Sensors: Principles and examples– Force and pressure micro sensors– position and speed micro sensors– acceleration micro sensors–chemical sensors– bio sensors–temperature micro sensors and flow micro sensors– Micro Actuators– Actuation principle–shape memory effects–one way– two way and pseudo elasticity– Types of micro actuators– Electrostatic– Magnetic–Fluidic– Inverse piezo effect–other principles.

UNIT IV CLASSIFICATION OF SIGNALS 9

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

UNIT V INTRODUCTION TO DISCRETE TIME SIGNAL PROCESSING 9

Frequency domain sampling–Discrete Fourier Transform (DFT) – deriving DFT from DTFT–properties of DFT – periodicity– symmetry– circular convolution- overlap save and overlap add method– Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fourier transform (FFT)– Decimation-in-frequency (DIF)– Fast Fourier transform (FFT).

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Patranabis. D, "Sensors and Transducers", Wheeler publisher, 1994.
2. Sergej Fatikow and Ulrich Rembold, "Microsystem Technology and Microbotics", First edition, Springer –Verlag NEwyork, Inc, 1997.
3. Allan V. Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson, 2015.
4. John G Proakis and Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", Pearson, Fifth Edition, 2021.

REFERENCE BOOKS:

1. Robert H Bishop, "The Mechatronics Hand Book", CRC Press, 2002.
2. Thomas. G. Bekwith and Lewis Buck.N, Mechanical Measurements, Oxford and IBH publishing Co. Pvt. Ltd.,
3. Massood Tabib and Azar, "Microactuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures", First edition, Kluwer academic publishers, Springer, 1997.
4. B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford, 2009
5. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata McGraw Hill, 2007.

WEB REFERENCES:

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

ONLINE RESOURCES:

1. https://swayam.gov.in/nd1_noc20_ee31https://nptel.ac.in/courses/117105134/

OUTCOMES:

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

1. Discuss the principle of different sensors and its applications. (K2)
2. Discuss the principle of different Actuators and its applications. (K2)
3. Analyze the characteristics of micro sensors and micro actuators. (K4)
4. Predict the different types of signals to represent in time domain. (K3)
5. Examine the signals in the frequency domain using DFT, DIT, DIF - FFT algorithms (K3)
6. Understand the fundamentals and properties of signal and its processing. (K2)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - I

20CIEL503 SDG NO. 4	DYNAMIC PARADIGM IN IOT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explore the role of the cloud in Internet of Things deployment.
- To introduce the usage of different machine learning algorithms on IoT Data.
- To explore data analytics and data visualization on IoT Data.
- To explore the role of Fog computing in Internet of Things.
- To explore design issues and working principles of various security measures and various standards for secure communication in IoT.
- To develop the ability to integrate IoT with Dev-ops.

UNIT I IOT AND CLOUD **9**

Cloud Computing Concept–Grid/SOA and Cloud Computing– Cloud Middleware NIST's SPI Architecture and Cloud Standards– The Cloud of Things– The Internet of Things and Cloud Computing The Cloud of Things Architecture–Four Deployment Models–Foundational Technological Enabler Cloud Providers and Systems – Microsoft Azure IoT–Amazon Web Services–Google's cloud IoTs.

UNIT II IOT AND MACHINE LEARNING **9**

Advantages of IoT and Machine Learning Integration– Implementation of Supervised Algorithm–Regression (Linear and Logistic) – SVM for IoT–Neural Network on case study: Agriculture and IoT– Smart Home etc. Regression–SVM

UNIT III IOT AND DATA ANALYTICS **9**

Defining IoT Analytics–IoT Analytics challenges– IoT analytics for the cloud–Microsoft Azure overview– Strategies to organize Data for IoT Analytics– Linked Analytics Data Sets–Managing Data lakes– Dash boarding–Designing visual analysis for IoT data–creating a dashboard –creating and visualizing alerts–Study real time –case study on IoT Analytics.

UNIT IV IOT AND IT'S SECURITY **9**

Cyber security vernacular Attack and threat terms– Defense terms, Anatomy of IoT cyber attacks – Mirai, Stuxnet–Chain Reaction, Physical and hardware security– Root of Trust–Network stack – Transport Layer Security– Software defined perimeter– Software-Defined Perimeter architecture – OWASP – Existing Security attacks and its prevention methods

UNIT V IOT AND DEVOPS **9**

Introduction to DevOps– DevOps application – business scenarios– DevOps process – Source Code Management (SCM)– Code review–Configuration Management– Build management–DevOps frameworks–DevOps maturity life cycle–DevOps maturity map– DevOps progression

TOTAL : 45 PERIODS

TEXT BOOKS:

1. The Internet of Things in the Cloud A Middleware Perspective, Honbo Zhou – CRC Publication.
2. Analytics for the Internet of Things (IoT), Andrew Minteer, Packt Publication 2017
3. Internet of Things- Hands on Approach, Arshdeep Bagha, Vijay Medisetti, Published by Arshdeep Bagha and Vijay Medisetti,2014.
4. Hands-on DevOps, Sricharan Vadapalli, Packt Publication, 2017
5. Internet of things For Architects, Perry Lea Packt Publication,2018

REFERENCES:

1. Enterprise Cloud Computing, Gautam Shroff, Cambridge,2010
2. Mastering Cloud Computing -Foundations and Applications Programming, Raj Kumar Buyya, Christian Vecchiola, S. Thamarai Selvi, MK Publication, 2013.
3. Machine Learning in Action||, Peter Harrington, DreamTech Press
4. Introduction to Machine Learning||, Ethem Alpaydın, MIT Press
5. Learning AWS IoT- Effectively Manage Connected Devices on the AWS Cloud Using Services Such as AWS Greengrass, AWS Button, Predictive Analytics and Machine Learning, Agus Kurniawan, Packt Publication,2018
6. Practical Dev-Ops, Joakim Verona, Packt Publication, 2016

WEB REFERENCES:

1. https://hub.packtpub.com/25-datasets-deep-learning-iot/
2. https://data.world/datasets/iot
3. https://dashboard.healthit.gov/datadashboard/data.php
4. https://www.data.gov/
5. https://dev.socrata.com/data/
6. https://www.kaggle.com/

OUTCOMES:

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

1. Identify the need for the cloud in IoT deployment and describe different Cloud provider's architecture. (K2)
2. Use and correlate machine learning techniques on IoT Data. (K2)
3. Apply IoT analytics and data visualization. (K3)
4. Recognize the use of Fog Computing in the Internet of things. (K3)
5. Explain the need of security measures in the Internet of Things. (K2)
6. Apply the knowledge of Dev-ops in IoT applications. (K3)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - I

20CIEL504 SDG NO. 3,4,11,15	INTRODUCTION TO INDUSTRY 4.0 AND TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Introduce how IIoT has become a game changer in the new economy where customers are looking for integrated value
- Bring the IIoT perspective in thinking and building solutions
- Introduce the tools and techniques that enable IIoT solutions and Security aspects

UNIT I INTRODUCTION AND ARCHITECTURE 9

Introductionto IOT, WhatisIIOT? IOTvs.IIOT,History of IIOT,fundamental terms in IIOT, Components of IIOT – Architectures of IIOT, Challenges & Benefits in implementing IIOT-Enablers of IIOT: sensitivity and connectivity, security threats and challenges.

UNIT II SENSOR AND ACTUATORS **9**

Introduction to sensors, Roles of sensors inIIOT, Characteristics of Sensors, types of sensors- thermal sensors, Mechanical sensors, Chemical sensors, Electrical Sensors, Optical Sensors, Acoustic sensors, Actuators.

UNIT III BUSINESS MODEL AND LEAN PRODUCTION SYSTEMS **9**

Business Models-Business opportunities and categorization in IIOT-IIRA frameworks- Product lifecycle management streams in the lean production system - Necessity of lean production system -Implementation of lean manufacturing system.

UNIT IV KEY TECHNOLOGIES AND IIOT ANALYTICS **9**

Requirements of Cybersecurity-Augmented Reality-Virtual Reality-Big Data Advanced Analytics-Industrial Sensing-Industrial internet systems-Cloud computing-Fog computing, Introduction to IoT analytics.

UNIT V APPLICATION DOMAIN IN IIOT **9**

Health care, Inventory Management, Quality Control, Plant Safety and Security, Oil, Chemical, and Pharmaceutical industries, applications of UAVs in industries, Case study on the Manufacturing industry, Mining Industry, and Automotive Industry.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Sudip Misra, Chandana Roy, and AnandarupMukherjee,"Introduction to Industrial Internet of Things and Industry 4.0",CRC Press,edition 2020
2. R. Anandan, Suseendran Gopalakrishnan , Souvik Pal and Noor Zaman ,"The Industrial Internet of Things (IIoT), Intelligent Analytics for Predictive Maintenance" wily publications
3. Alasdair Gilchrist, Industrial 4.0, the industrial internet of things, Apress

REFERENCES:

1. Hakima Chaouchi, "The Internet of Things Connecting Objects to the Web" ISBN : 978-1-84821-140-7, Willy Publications
2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2 nd Edition, Willy Publications
3. Internet of Things-From Research and Innovation to Market Deployment; By Ovidiu & Peter; River Publishers Series
4. Bernd Scholz-Reiter, Florian 2. Michahelles, "Architecting the Internet ofThings",ISBN978-3-642-19156-5e-ISBN978-3-642-19157-2, Springer

WEB REFERENCES:

1. https://nptel.ac.in/courses/106/105/106105195/
2. https://freevideolectures.com/course/4231/nptel- introduction-industry-industrial-internet-things.

ONLINE RESOURCES:

1. https://www.coursera.org/lecture/digital-thread-implementation/the-industrial-internet-of-things-iiot-za9wH.
2. https://swayam.gov.in/nd1_noc20_cs24/preview.

OUTCOMES:

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

1. Describe the architectures and security issues in IIOT (K2).
2. Interpret the various sensors and Actuators and their applications (K2).
3. Examine the business model and lean production systems.(K2).
4. Illustrate augmented reality, virtual reality (K2).
5. Discuss Data Analytics in IIoT (K2).
6. Analyze real-life applications using off-the-shelf hardware and software (K3).

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - I

20CIEL505 SDG NO. 4	DATA PREPROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To examine automated pre-processing of data
- To apply the statistical indicators from data for detecting and eliminating the missing values
- To learn data preprocessing in R programming
- **To become familiar with data preprocessing tools**

UNIT I DATA PREPROCESSING BASIC CONCEPTS 9

Big Data-Analytics-Data Preprocessing-Data Reduction-Imperfect Data-Imbalanced Datasets-Big Data Screaming – Technologies and Tools-Streaming Processing Frameworks for Big Data.

UNIT II SMART DATA AND REDUCTION 9

Distributed and Dimensionality Reduction–Theoretical Feature Selection Framework–Parallel and Rapid Prototype Reduction–MapReduce–Noise Filtering.

UNIT III BIG DATA DISCRETIZATION 9

Parallel and Distributed Discretization - DMDLP–Dchi2–Discretization in Big Data Streaming - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm-K-means clustering-Nonlinear or nonparametric methods (e.g., k-NN)-Preparation of data for machine learning-Basic notions of Explainable Artificial Intelligence (XAI)

UNIT IV QUANTUM INFORMATION THEORY 9

Useful data preprocessing and visualization packages-Linear regression, BLUE, RMSE, shrinkage methods (Lasso, ridge regression)-Linear classification (logistic regression, LDA)-Principal Components Analysis (PCA) for identifying linear correlations between variables

UNIT V VISUALIZE DATA AND TOOLS 9

R programming language and tools -Introduction to data processing and visualization in the Python programming language-Import and export of data from text files-data bases and other sources-Data visualization in R, in 2D and 3D Map visualizations

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Julián Luengo, Diego García-Gil "Big Data Preprocessing" Enabling Smart Data Springer International Publishing (Mar 2020)
2. Soraya Sedkaoui (ed.), Mounia Khelfaoui (ed.)"Big Data Analytics Harnessing Data for New Business Models"Apple Academic Press (Jul 2021)

REFERENCES:

1. Ramcharan, K., Sundar, K., Alla, S. (2020). Applied data science using PySpark: Learn the end-to-end predictive model-building cycle Apress
2. Leskovec, J. Rajaraman, A., Ullman, J. (2014). Mining of massive datasets. Cambridge University Press. By agreement with the publisher, you can download the book for free from this page

ONLINE RESOURCES:

1. https://github.com/trajanov/BigDataAnalytics
2. https://learn.bu.edu

OUTCOMES:

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

1. Understand data structures in the R programming language and have basic notions of data manipulation and programming in R.(K2)
2. Perform manual as well as automated pre-processing of data (cleaning, normalization, centering, scaling).(K2)
3. Extract and understand statistical indicators from data, as well as how to detect and eliminate missing values.(K3)
4. Perform regression analysis and clustering of data.(K2)
5. Visualize data and results of analyses using line plots, scatter plots, bar plots. maps etc., both in 2D and 3D.(K2)
6. Apply the various data processing tools to solve the real life problems. (K3)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - I

20CIEL506 SDG NO. 4	QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know the background of classical computing and quantum computing.
- To learn the fundamental concepts behind quantum computation.
- To study the details of quantum mechanics and its relation to Computer Science.
- To gain knowledge about the basic hardware and mathematical models of quantum computation.
- To learn the basics of quantum information and the theory behind it.

UNIT I QUANTUM COMPUTING BASIC CONCEPTS 9

Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits – Super positions

UNIT II QUANTUM GATES AND CIRCUITS 9

Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development - Quantum error correction

UNIT III QUANTUM ALGORITHMS **9**

Quantum parallelism - Deutsch's algorithm - The Deutsch–Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm

UNIT IV QUANTUM INFORMATION THEORY **9**

Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantum noiseless channel coding theorem - Classical information over noisy quantum channels

UNIT V QUANTUM CRYPTOGRAPHY **9**

Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm - Quantum Key Distribution - BB84 - Ekart 91

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Parag K Lala, Mc Graw Hill Education, "Quantum Computing, A Beginners Introduction", First edition (1 November 2020).
2. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, 2010.
3. Chris Bernhardt, The MIT Press; Reprint edition (8 September 2020), "Quantum Computing for Everyone".

REFERENCES:

1. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013.
2. 2. N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge University Press, 2007.

OUTCOMES:

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

1. Understand the basics of quantum computing.(K2)
2. Understand the background of Quantum Mechanics.(K2)
3. Analyze the computation models. (K2)
4. Model the circuits using quantum computation. environments and frameworks.(K2)
5. Understand the quantum operations such as noise and error–correction. (K2)
6. Apply the quantum algorithm to solve the real life problems (K3)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - I

20ITEL601 SDG NO. 4 & 9	SOFTWARE TESTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the criteria and design of Test Cases
- To learn the design of Test Cases
- To understand Test Management and Test Automation Techniques
- To apply Test Metrics and Measurements

UNIT I INTRODUCTION **9**

Testing as an Engineering Activity – Testing as a Process – Testing Maturity Model - Basic Definitions – Software Testing Principles – The Tester's Role in a Software Development Organization – Origins of Defects – Cost of Defects –Defect Classes – The Defect Repository and Test Design – Defect Examples-Developer/Tester Support of Developing a Defect Repository.

UNIT II TEST CASE DESIGN STRATEGIES **9**

Test Case Design Strategies – Using Black Box Approach to Test Case Design –Boundary Value Analysis – Equivalence Class Partitioning – State Based Testing – Cause - Effect Graphing – Compatibility Testing – User Documentation Testing – Domain Testing - Random Testing – Requirements Based Testing – Using White Box Approach to Test design – Test Adequacy Criteria – Static Testing Vs. Structural Testing – Code Functional Testing –Coverage and Control Flow Graphs – Covering Code Logic – Paths – Code Complexity Testing – Additional White Box Testing Approaches.

UNIT III LEVELS OF TESTING **9**

The Need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit Tests and Recording Results–Integration Tests – Designing Integration Tests – Integration Test Planning – Scenario Testing – Defect Bash Elimination System Testing – Acceptance Testing – Performance Testing – Regression Testing – Internationalization Testing – AdHoc Testing – Alpha, Beta Tests – Testing Object Oriented Systems – Usability and Accessibility Testing – Configuration Testing – Compatibility Testing–Testing the Documentation–Website Testing.

UNIT IV TEST MANAGEMENT **9**

People and Organizational Issues in Testing – Organization Structures for Testing Teams – Testing Services – Test Planning – Test Plan Components –Test Plan Attachments – Locating Test Items – Test Management – Test Process – Reporting Test Results – Introducing the Test Specialist – Skills Needed by a Test Specialist – Building a Testing Group- The Structure of Testing Group-The Technical Training Program.

UNIT V TEST AUTOMATION **9**

Software Test Automation – Skills needed for Automation – Scope of Automation – Design and Architecture for Automation – Requirements for a Test Tool – Challenges in Automation – Test Metrics and Measurements – Project, Progress and Productivity Metrics.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2006.
2. Ron Patton, "Software Testing Second Edition", Sams Publishing, Pearson Education, 2007.

REFERENCES:

1. Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2003.
2. Edward Kit, "Software Testing in the Real World–Improving the Process", Pearson Education, 1995.
3. Boris Beizer, "Software Testing Techniques" 2ndEdition, Van Nostrand Reinhold,NewYork,1990.
4. Aditya P. Mathur " Foundations of Software Testing-Fundamental Algorithms and Techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.
5. Naresh chauhan-software testing principles and practices, 2nd Edition, oxford University Press, 2017.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106/105/106105150/

ONLINE RESOURCES:

1. https://www.javatpoint.com/software-testing-tutorial
2. https://www.toolsqa.com/software-testing-tutorial/

OUTCOMES:

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

1. Understand about the Software Testing Principles and Defect Classes (K2)
2. Apply test cases suitable for software development for different domains (K3)
3. Discuss the various Levels of Testing (K2)
4. Identify suitable tests to be carried out. (K2)
5. Discuss the concepts of Test plan and its skill set (K2)
6. Apply automatic testing tools and discuss the various test metrics and measurements. (K3)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - I

20ITEL706 SDG NO. 4 & 9	COMPUTER GRAPHICS AND MULTIMEDIA	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gain knowledge about Graphics Hardware Devices and Software used
- To understand the 2D/3D Graphics and their Transformations
- To get knowledge about various Object representation methods and Visible Surface Detection methods
- To study the Multimedia concepts and various I/O technologies

UNIT I OUTPUT PRIMITIVES AND 2D GRAPHICS 9

Graphics Devices-Line–Curve and Ellipse Drawing Algorithms – Examples –Applications – Attributes – Input Techniques - 2D Geometric Transformations–2D Clipping And Viewing.

UNIT II 3D GRAPHICS 9

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

UNIT III ILLUMINATION, COLOR MODELS AND ANIMATION 9

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

UNIT IV MULTIMEDIA SYSTEMS DESIGN AND FILE HANDLING 9

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

UNIT V HYPERMEDIA 9

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

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Donald Hearn and Pauline BakerM, “Computer Graphics", Prentice Hall, New Delhi, 2007
2. Andleigh, P. K and Kiran Thakrar, “Multimedia Systems and Design”, PHI, 2003.

REFERENCES:

1. Judith Jeffcoate, "Multimedia in practice: Technology and Applications", PHI, 1998.
2. Foley, Vandam, Feiner and Hughes, "Computer Graphics: Principles and Practice", 2nd Edition, Pearson Education, 2003.
3. Jeffrey McConnell, "Computer Graphics: Theory into Practice", Jones and Bartlett Publishers, 2006.
4. HillFSJr.,"Computer Graphics",Maxwell Macmillan, 1990.
5. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen RMarschner, Erik Reinhard, Kelvin Sung, and AK Peters, "Fundamentals of Computer Graphics", CRC Press, 2010.
6. William M. Newman and Robert F.Sproull, "Principles of Interactive Computer Graphics", McGraw Hill 1978.

WEB REFERENCES:

1. https://www.blender.org/support/tutorials
2. http://www.doc.ic.ac.uk/~dfg/graphics/graphics.html
3. http://www.nptelvideos.in/2012/11/computer-graphics.html
4. http://cs.wellesley.edu/~cs110/lectures/M01-color/graphics.pdf

ONLINE RESOURCES:

1. www.scratchapixel.com
2. http://dl.finebook.ir/book/9e/11032.pdf
3. https://www.blender.org/support/tutorials
4. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-837-computer-graphics-fall-2012/download-course-materials

OUTCOMES:

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

1. Understand the concept of various Output Primitives, Illumination and Color Models (K2)
2. Demonstrate 2D transformations, viewing and clipping techniques (K3)
3. Illustrate various 3D Object representations, transformations, Projections and detect the Visible surfaces. (K3)
4. Understand Multimedia System Architecture, Data Interface standards and Databases (K2)
5. Interpret various Multimedia design and File Formats. (K2)
6. Demonstrate basic 3D Scenes using Blender Graphics in hyper media messages. (K3)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - I

20MGEL501 SDG NO. 4, 8, 9, 12	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To get an introductory insight about the IPR in national and international context.
- To understand the procedures for IPR, registration and its enforcement.

UNIT I INTRODUCTION **9**

Intellectual property: Introduction, Meaning, Nature and significance types of intellectual property, importance of intellectual property rights, Protection of human innovations by IPR such as Patents, Trademarks, Copyright, Industrial Designs Geographical Indications, and Trade Secrets

UNIT II AGREEMENTS AND TREATIES **9**

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, General agreement on trade and tariff (GATT), Ben convention, Rome convention, Role of WTO and WIPO

UNIT III PATENTS **9**

Concept of Patent–Historical view of Patent system in India and International Scenario, patents earching process, ownership rights and transfer, compulsory licenses, Procedure for filing of patents, Grants of patent, Benchmarks for patentability of inventions, Recent key changes and development.

UNIT IV TRADEMARKS AND COPYRIGHTS 9

Concept of Trademarks and copyrights – Rationale behind the protection-Purpose, function and acquisition, ownership issues, Procedure for Registration, Industrial design and integrated circuits, protection of geographical indications and plant varieties, Recent Trends in copyrights and Trademark., Trade secrets –liability form is appropriations of trade secrets

UNIT V LEGAL ASPECTS AND NEW DEVELOPMENTS 9

Infringements of patents– Criteria of Infringement – Modes of Infringement-remedies and modification Protection against unfair competition, enforcement of intellectual property rights, Intellectual property audits, New developments of intellectual property, Impact of international instruments relating to the protection of intellectual properties Future of IPR in National and International levels.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. S.V. Satarkar, Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002.
2. V.Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
3. P.Narayanan, Intellectual property rights Eastern law house-2018 3rd Edition (revised and updated)
4. Deborah, E.Bouchoux, Intellectual property right, Cengage learning-2018 5thEdition

REFERENCES:

1. Sterling, J.L.A.,World copyright law,(2008) 3rdEdition, London, Sweet & Maxwell
2. GP Reddy, Intellectual property rights & other laws, Gogia law agency
3. Barrett, Margreth, Intellectual Property, (2009) 3rd Edition, New York Aspen publishers
4. Inventing the Future: An introduction to Patents for small and medium sized Enterprises; WIPO publication
5. Cornish,William Intellectual Property: Patents, Copyright, Trademarks and allied rights, (2010) 7th Edition, London Sweet & Maxwell.
6. Kankanalaand Kalyan. C: Indian Patent Law and Practice (2010), India, Oxford University Press

WEB RESOURCES:

1. https://www.wipo.int/edocs/lexdocs/laws/en/ws/ws020en.pdf
2. http://caaa.in/Image/34_Hb_on_IPR.pdf

3. http://www.ipindia.nic.in/patents.htm
4. http://www.ipindia.nic.in/trade-marks.htm
5. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/627956/IP-Rights-in-India.pdf
6. https://economictimes.indiatimes.com/small-biz/resources/startup-handbook/intellectual-property-rights- registration/articleshow/59126802.cms?from=mdr

ONLINE RESOURCES:

1. https://www.coursera.org/learn/introduction-intellectual-property
2. https://www.edx.org/course/intellectual-property-law-and-policy-part-1
3. https://www.classcentral.com/tag/intellectual-property
4. https://swayam.gov.in/nd1_noc19_mg58/preview

OUTCOMES:

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

1. Describe the concepts of Intellectual property rights. (K2)
2 Explain the agreements and treaties of Intellectual property rights. (K2)
3 Identify the needs and avenues for patents.(K2)
4 Discuss the necessity of Trademarks and Copyrights. (K2)
5 Explain the legal context and developments of Intellectual property rights.(K2)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - II

20CSEL705 SDG NO. 4 & 16	ETHICAL HACKING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To teach students how to think like a hacker providing them with a deep understanding of security issues and concerns
- To provide the students with specialist knowledge and experience of advanced hacking techniques and their countermeasures
- To critically evaluate the potential countermeasures to advanced hacking techniques
- To analyze and critically evaluate techniques used to break into an insecure web application and identify relevant countermeasures

UNIT I INTRODUCTION **9**

Understanding the Importance of Security - Concept of Ethical Hacking and Essential Terminologies - Threat - Attack - Vulnerabilities - Target of Evaluation - Exploit - Phases Involved In Hacking - Foot Printing - Scanning - System Hacking – Session Hijacking.

UNIT II BUFFER OVERFLOWS AND SNIFFERS **9**

Significance of Buer Overflow Vulnerability-Why Programs/ Applications is Vulnerable - Reasons for Buer Overflow Attacks - Methods of Ensuring that Buer Overflows are Trapped - Sniers -Active and Passive Sniffing - ARP Poisoning and Counter measures - Man in the Middle Attacks -Spoofing and Sniffing Attacks - Sniffing Countermeasures.

UNIT III SQL INJECTION **9**

Attacking SQL Servers - Sniffing - Brute Forcing and Finding Application Configuration Files -Input Validation Attacks - Preventive Measures - Web Application Threats - Web Application Hacking - Cross Site Scripting / XSS Flaws / Countermeasures Correct Web Application Set-up.

UNIT IV WEB APPLICATION SECURITY AND TECHNOLOGIES **9**

Core Defence Mechanisms - Handling User Access - Authentication - Session Management – Access Control - Web Application Technologies - HTTP Protocol - Requests - Responses and Methods - Encoding Schemes - Server Side Functionality Technologies (Java, ASP, PHP).

UNIT V ATTACKING AUTHENTICATION 9

Attacking Session Management - Design Flaws in Authentication Mechanisms Attacking Forgotten Password Functionality - Attacking Password Change Functions- Counter measures to Authentication Attacks - Attacking Other Users - Reflected XSS Vulnerabilities - Stored XSS Vulnerabilities -DOM-Based XSS Vulnerabilities - HTTP Header Injection, Counter Measures to XSS.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Patrick Engebretson, "The Basics of Hacking and Penetration Testing", Elsevier, 2013.
2. Rajat Khare, "Network Security and Ethical Hacking", Luniver Press, 2006.

REFERENCES:

1. Ankit Fadia, Manu Zacharia, Thomson "Network Intrusion Alert: An Ethical Hacking Guide to Intrusion Detection", Course Technology PTR, 2007.
2. Thomas Mathew, "Ethical Hacking", OSB Publisher, 2003.
3. Stuart McClure, Joel Scambray and George Kurtz, "Hacking Exposed: Network Security Secrets & Solutions", McGraw-Hill, 2005.
4. Jon Erickson, "Hacking: The Art of Exploitation", Second Edition, No Starch Press, 2008.
5. Dafydd Stuttard, "The Web Application Hacker's Handbook", Second Edition, Wiley,2011.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_cs68/preview
2. https://nptel.ac.in/courses/106105217/
3. https://medium.com/quick-code/the-best-ethical-hacking-video-tutorials-for-everyone-e0cbd465b03c

ONLINE RESOURCES:

1. https://www.oreilly.com/library/view/ethical-hacking/9781491978375/
2. https://www.guru99.com/ethical-hacking-tutorials.html

OUTCOMES:

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

1. Obtain knowledge about Ethical hacking and basics of web application attacks(K3)
2. Learn about various types of attacks, attackers and security threats and vulnerabilities present in the computer system. (K1)

3. Examine how social engineering can be done by attacker to gain access of useful & sensitive information about the confidential data. (K2)
4. Review and practice computer and network etiquette and ethics found in working environments. (K3)
5. Acquire knowledge of the tools, techniques and ethical issues likely to face the domain of ethical hacking and ethical responsibilities (K3)
6. Evaluate best practices in security concepts to maintain confidentiality, integrity and availability of computer systems (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	1
CO2	2	3	1	-	2	-	-	-	-	-	1	-	3	2
CO3	1	-	3	2	-	-	-	-	1	-	-	-	3	2
CO4	1	-	2	3	-	3	-	-	-	2	-	-	2	1
CO5	2	1	2	-	-	-	2	2	1	-	-	3	2	3
CO6	3	2	2	1	-	-	-	1	1	2	-	1	2	2

PROFESSIONAL ELECTIVES - II

20CSEL605 SDG NO. 4	PREDICTIVE MODELING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the terms and terminologies of predictive modeling.
- To study the various predictive models, their merits, demerits and application.
- To get exposure to various analytical tools available for predictive modeling.
- To learn the predictive modeling markup language.
- To get familiar with the technologies in predictive modeling.

UNIT I INTRODUCTION TO PREDICTIVE MODELING 9

Core ideas in data mining - Supervised and unsupervised learning Classification vs Prediction -Steps in data mining- SEMMA Approach - Sampling -Pre-processing - Data cleaning – Data Partitioning - Building a model Statistical models - Statistical models for predictive analytics.

UNIT II PREDICTIVE MODELING BASICS 9

Data splitting – Balancing- Over fitting –Oversampling –Multiple Regression Artificial neural networks (MLP) - Variable importance- Profit/loss/prior probabilities - Model specification -Model selection - Multivariate Analysis.

UNIT III PREDICTIVE MODELS 9

Association Rules-Clustering Models –Decision Trees- Ruleset Models- K Nearest Neighbors –Naive Bayes - Neural Network Model – Regression-Models – Regression Trees – Classification& Regression Trees (CART) – Logistic Regression - Multiple Linear Regression Scorecards –Support Vector Machines – Time Series Models - Comparison between models - Lift chart Assessment of a single model.

UNIT IV PREDICTIVE MODELING MARKUP LANGUAGE 9

Introduction to PMML – PMML Converter - PMML Structure – Data Manipulation in PMML –PMML Modeling Techniques - Multiple Model Support – Model Verification.

UNIT V TECHNOLOGIES AND CASESTUDIES 9

Weka–Rapid Miner–IBMSPSS Statistics – IBMSPSS Modeler – SAS Enterprise Miner – Apache Mahout – R Programming Language - Real time case study with modeling and analysis.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Kattamuri S. Sarma, "Predictive Modeling with SAS Enterprise Miner: Practical Solutionsfor Business Applications", 2nd Edition, SAS Publishing, 2007.
2. Alex Guazzelli, Wen-Ching Lin, Tridivesh Jena, James Taylor, "PMML in Action Unleashing the Power of Open Standards for Data Mining and Predictive Analytics", 2ndEdition, Create Space Independent Publishing Platform,2012.

REFERENCES:

1. Ian H. Witten, EibeFrank , "Data Mining: Practical Machine Learning Tools and Techniques", Morgan Kaufmann Series in Data Management Systems, Morgan Kaufmann,3rd Edition, 2011.
2. Eric Siegel , "Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die", 1st Edition, Wiley, 2013
3. Conrad Carlberg, "Predictive Analytics: Microsoft Excel", 1st Edition, Que Publishing,2012.

4. Jeremy Howard, Margit Zwemer, Mike Loukides, "Designing Great Data Products- Inside the Drive train Approach, a Four-Step Process for Building Data Products – Ebook", 1stEdition, O'Reilly Media, March 2012.
5. Max Kuhn, Kjell Johnson, "Applied Predictive Modeling", First Edition, Springer, 2018.

WEB REFERENCES:

1. https://nptel.ac.in/courses/108108111/
2. https://www.coursera.org/learn/predictive-modeling-analytics

ONLINE RESOURCES:

1. https://bookdown.org/egarpor/PM-UC3M/
2. https://cics.nd.edu/research/applications/materials/

OUTCOMES:

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

1. Design and analyze appropriate predictive models. (K2)
2. Define the predictive models using PMML. (K1)
3. Apply statistical tools for analysis.(K3)
4. Use various analytical tools available for predictive modeling.(K3)
5. Apply predictive modeling markup language in data manipulation. (K2)
6. Apply regression and classification model on applications for decision making and evaluate the performance. (K3)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - II

20CIEL601 SDG NO. 4	IOT DEVICE PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explore the role of the IOT device programming.
- To introduce the solution of different real time problems in Healthcare.
- To explore smart cities.
- To explore the smart sensing healthcare and power challenge.

UNIT I ARDUINO PROGRAMMING 9

Arduino Programming, Integration of Sensors and Actuators with Arduino, Raspberry Pi, Implementation of IoT with Raspberry Pi.

UNIT II INTRODUCTION TO IOT BASED HEALTH CARE 9

Introduction to IoT applications in smart healthcare& their distinctive advantages – Patient Health Monitoring System (PHMS), Tele-Health, Tele Medicine, Tele-Monitoring, Mobile Health Things (m-health).

UNIT III IOT SMART SENSING HEATH CARE AND POWER CHALLENGE 9

Concept of Generic Biomedical sensors, Smart Sensors: Monitor health parameters, Wearable ECG sensors, IoT Data Acquisition System, Energy harvesting, Battery based systems, Power management.

UNIT IV INTEROPERABILITY FOR SMART CITY IOT 9

systems Wireless communication modules and topology such as Zigbee, Bluetooth, GSM module, Wi-fi module &Things speak (IoT Platform) cloud, Ethernet, M2M Wireless Sensor Network(WSN).

UNIT V APPLICATION AREA OF SMART CITIES IOT 9

Systems Working principle & Use of Geographical Information System (GIS), GPS module for vehicle speed measurement. Connected Parking - LoRaWAN private network

TOTAL : 45 PERIODS

TEXT BOOKS:

1. "Designing, Developing, and Facilitating Smart Cities Urban Design to IoT Solutions", Vangelis Angelakis Springer, 2019
2. "Introduction to IoT", S. Misra, A. Mukherjee, and A. Roy ,Cambridge University Press,2018

REFERENCES:

1 "Industry 4.0: The Industrial Internet of Things", Alasdair Gilchrist, Apress, 2016
2 "Introduction to Industrial Internet of Things and Industry 4.0", Sudip Misra, Chandana Roy, Anadarup Mukherjee, CRCPress, 2021
3 "Hands on Industrial Internet of Things", Giacomo Veneri, Antonio Capasso, Packt Press,2018.

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc19_cs65
2. https://onlinecourses.nptel.ac.in/noc21_cs20/preview
3. The Internet of Things in the Cloud | A Middleware Perspective | Honbo (taylorfrancis.com)

OUTCOMES:

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

1. Implement Arduino Programming. (K2)
2. Implement Raspberry Pi Programming. (K2)
3. Apply Introduction to IoT based Health Care. (K3)
4. Recognize IoT Smart Sensing Heath Care and Power challenge. (K3)
5. Explain the need of Interoperability for Smart City IoT. (K2)
6. Apply Area of Smart cities IOT. (K3)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - II

20CIPL602 SDG NO. 4	WEB OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the overview in web of things.
- To learn about WoT Reference model.
- To understand programming frameworks for the Web of Things.
- To acquire knowledge about WOT with its application.

UNIT I INTRODUCTION TO WOT AND TOOLS 9

Defining Internet of Things (IoT) and Web of Things (WoT) – Comparison of IoT and WoT –Connected objects – Applications - Features of WoT - Shortcomings of WoT - Ontology of WoT-Context Modelling - Embedded devices-Introduction to Raspberry Pi-Node.js on Raspberry Pi-ConnectingsensorsandactuatorsonPi-ModelingRESTfulservices-Mashuptools-Model driven engineering for WoT - Comparing mashup and model driven tools - Modeling of RESTful services-Modeling WoT system with generic RESTful operations.

UNIT II NETWORKING IN IOT 9

Building network of things: Topologies-Classification models-Network protocols for things: spatial considerations, Internet protocols and IoT - IoT Personal Area Networks, IoT Wide Area Networks-Application protocol for things: Zigbee, Bluetooth application stack-Application protocol for things: Apple home kit, Google weave-Message Queuing Telemetry Transport (MQTT)- Constraint application protocol - WoT architecture: Access, Find - WoT architecture: Share, Compose-Building IoT with Avatars: Avatar based IoT platform-Disruption tolerant communication-Context modeling and management - Social vision of WoT - Challenges of WoT - Testbeds of WoT and IoT - Hardware of a WoT testbed-Software of WoT testbed.

UNIT III INTEGRATION IN WOT 9

Web API's for things: Devices, resources, things – Principles for web API's –Publish subscribe model – Web hooks, Comes and web sockets – Implementing web things –Connecting devices to the web – Direct integration pattern - REST on devices-Gateway integration pattern – CoAP - Cloud integration pattern-MQTT communication-Findability problem-Discovering things-Describing web things-Implementing web thing model on Pi-Semantic WoT-Schema and JSON-LD.

UNIT IV REPRESENTATION AND STORAGE 9

Automatic integration and querying of semantic rich heterogeneous data: introduction-Semantic WoT (SWoT) - Semantic web as enabler of SWoT - Case study: smart application-Building entity graphs for WoT - Background and methodology - DisCor-T: classification - DisCor-T: recommendation – Interoperability and cross domain applications – Trends and evolution –Challenges in interoperability – Contributions - M3 framework - Data storage in WoT: framework-Methods and challenges - Data storage in cloud platform - Tendency for data storage technology-Future directions.

UNIT V SECURITY IN WOT 9

Securing things – Open issues and challenges – Web of Topics (WoX) model –Design and implementation – Security from IoT to WoT – Existing models –Security in WoT: Encryption 101, TLS - Enabling HTTPS and WSS with TLS on Pi-Authentication and access control with REST and API tokens – OAuth – Social WoT authentication proxy –Implementing a social WoT authentication proxy - Social impact and vulnerable populations - WoT and health-Potential positive implications for health - Challenges from health perspective - Unintended consequences for social health - Implications.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Quan Z. Sheng, Yongrui Qin, Lina Yao, Boualem Benatallah, Managing the Web of Things, Morgan Kaufmann publishers, 2017
2. Dominique D. Guinard, VladM. Trifa, Building the Web of Things, Manning publishers, 2016

REFERENCES:

1. http://www.w3.org/WoT/
2. http://www.element14.com/community/

WEB REFERENCES:

1. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html
2. https://nptel.ac.in/courses/108102045
3. https://archive.nptel.ac.in/courses/106/105/106105193/
4. https://onlinecourses.nptel.ac.in/noc22_cs53/preview

OUTCOMES:

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

1. Understand the tools in the Web of Things.(K2).
2. Analyze Networks in the Web of things. (K2)
3. Understand how to integrate the web of things. (K2).

4. Summarize frameworks of the web of Things. (K2).
5. Understand how to store and represent data (K2).
6. Acquire knowledge on security of the web of things. (K3)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - II

20CIEL603 SDG NO. 4, 8 & 9	DATA SCIENCE FOR INTERNET OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the fundamentals of data science and its relevance to IoT.
- Gain proficiency in collecting and preprocessing IoT data.
- Learn techniques for exploratory data analysis and visualization of IoT data.
- Develop skills in applying machine learning algorithms to IoT datasets.
- Explore real-world IoT applications and case studies.
- Discuss ethical considerations and privacy issues related to IoT data.

UNIT I INTRODUCTION TO DATA SCIENCE 9

Fundamentals of Data Science–Overview, Basic concepts, Data collection, processing, and analysis, Data Acquisition in IoT- Sensors and actuators, Data acquisition techniques and challenges, Data Processing and Analytics-Data preprocessing and cleaning, Exploratory data analysis (EDA),Statistical analysis and visualization techniques

UNIT II MACHINE LEARNING IN DATA SCIENCE 9

Introduction to Machine Learning, The Machine Learning Landscape - Main Challenges of Machine Learning, Testing and Validating, Support Vector Machines-Linear SVM Classification, Nonlinear SVM Classification, SVM Regression, Under the Hood, Decision Trees-Training and Visualizing a

Decision Tree, Dimensionality Reduction-PCA, Kernel PCA, LLE, Other Dimensionality Reduction Techniques

UNIT III INTERACTIVE DATA VISUALIZATION FOR THE WEB 9

Interactive Data Visualization--Applications & Principles, Web Technologies for Interactive Visualization--HTML--CSS—Java script, D3.js Fundamentals--Data Structures--Operations—Basic Visualizations, User Interaction in D3--Events--Dynamic Visualizations--User Experience Exploring & Preparing IoT Data for Visualization, Designing IoT Visualizations--Sensor Data--Time Series--Maps--Graphs, Advanced D3 Techniques--Animations--Custom Visualizations--Libraries, Deploying & Sharing Interactive Visualizations

UNIT IV USAGE OF PYTHON IN DATA SCIENCE 9

Python Libraries-NumPy and Pandas, Data Visualization with Python-Matplotlib and Seaborn, Machine Learning with Python - Scikit, Python for Natural Language Processing-NLTK (NaturalLanguage Toolkit), spaCy

UNIT V INTRODUCTION TO REAL-TIME DATA PROCESSING AND STREAM ANALYTICS FOR IOT 9

Introduction to Real-time Data Processing in IoT-Overview, Characteristics, Stream Processing Frameworks for IoT-Apache Kafka, Apache Flink, and Apache Storm, Techniques for Real-time Stream Analytics-Windowing techniques for processing streaming data, Aggregation and summarization

TOTAL : 45 PERIODS

TEXT BOOKS:

1. P. G. Madhavan, Ph.D., "Data Science for IoT Engineers A Systems Analytics Approach", MERCURY LEARNING AND INFORMATION 2016.
2. Aurélien Géron, Hands-on Machine Learning with Scikit-Learn, Keras, and Tensor Flow-2018
3. Arshdeep Bahga and Vijay Madisetti, Internet of Things A Hand-on Approach, Universities press, 2015
4. Shilpi Saxena, Saurabh Gupta, Practical Real-Time Data Processing and Analytics-2017
5. Murray, Scott, Interactive data visualization for the Web : an introduction to designing with D3 - 2017
6. Wes McKinney, Python for Data Analysis-2012

REFERENCES:

1. S.Smys, Tomonobu Senjyu, Pavel Lafata Editors, Second International Conference on Computer Networks and Communication Technologies-2019

2. Data Science and Internet of Things, Springer

WEB REFERENCES:

1. https://www.goodreads.com/book/show/55312891-artificial-intelligence-business-applications
2. https://www.mdpi.com/2073-431X/12/2/34

OUTCOMES:

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

1. Interpret & analyze diverse IoT data with confidence.
2. Leverage machine learning for predictive & optimized IoT solutions.
3. Craft compelling visualizations to communicate IoT insights effectively.
4. Design secure & privacy-conscious IoT systems for user trust.
5. Build & deploy real-world IoT applications, solving practical problems.
6. Stay informed about evolving trends & ethical considerations in IoT.

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - II

20CIEL604 SDG NO. 4 & 9	DESCRIPTIVE ANALYTICS FOR IOT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the basics of Data analytics
- To learn about big data analytics platform.
- To understand about handling the data with machine learning.
- To acquire knowledge about Mango DB.
- To know how the cloud is used to manage the data.

UNIT I INTRODUCTION DATA ANALYTICS FOR IOT 9

Data Analytics-Structured data-Semi structured data-Unstructured data-Data in Motion vs Data at rest-Characteristics of Data-Evolution of Big data-Why Big Data-Importance of Big data-Big data applications - IoT Data analytics Overview - IoT Data Analytics Challenges

UNIT II BIG DATA PLATFORMS FOR IOT 9

Massively Parallel processing databases-NoSQL-Definition-Types of NoSQL-AdvantagesofNoSQL-UseOfNoSQLinIndustry-SQLvsNoSQL-NewSQL-ComparisonofNoSQLvsSQL vs New SQL-Hadoop-Features of Hadoop-Key advantages of Hadoop-Versions of Hadoop - Overview of Hadoop ecosystem-Hadoop distributions-Hadoop vs SQL - cloud based Hadoop solutions-Processing data with Hadoop-Map reduce Daemons-HDFS (Hadoop Distributed File Systems) - Hadoop to YARN-Interacting with Hadoop ecosystem-Pig-Hive-Sqoop - Hbase

UNIT III HANDLING THE DATA WITH MACHINE LEARNING 9

Definition of Machine Learning-NumPy - Pandas - Matplot - SciPy-Data serialization-Regression Model-Clustering-Collaborative Filtering-Association Rule Mining-Decision tree-random forest-Supervised learning-Unsupervised learning-reinforcement learning-Support vector machine-KNN algorithm

UNIT IV INTRODUCTION TO MONGODB 9

Definition-Need-Using JSON -Creating or generating a unique key-support for dynamic queries-Storing Binary data-Replication-Sharding-Updating information In place-Create database-Drop database-Insert method-Save() method-Update method-Remove method-Find method-Dealing with NULL values-Count, Limit, Sort and Skip-Arrays-Aggregate Function-MapReduce Function-Java Script programming-Cursors in MongoDB-Indexes-Mongo Import-Mongo Export-Automatic generation of unique numbers for "_id" field

UNIT V BIG DATA TRENDS AND CLOUD COMPUTING 9

Edge streaming analytics-Comparing Big Data and Edge Analytics-Distributed Analytics System-Network Analytics-Flexible NetFlow Architecture-FNF components-Cloud computing-Massive Data challenges-Cloud Service Interactive Mode-Cloud Service Configuration Mode-Features, Scope ,Role and modes of Industrial Cloud-Resource management in Cloud Computing-Data management in Cloud-Cloud Security-Open Source and commercial Cloud-Cloud Stimulator

TOTAL : 45 PERIODS

TEXT BOOKS:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, "IoT Fundamentals Networking Technologies, Protocols and Use Cases for the Internet of Things" published by CISCO
2. Kris MY Law ,Andrew WH Ip, Brij B Gupta, Shuang Geng, "Managing IoT and Mobile Technologies with Innovation, Trust and Sustainable Computing", CRC press
3. Seema Acharya, Subashini Chellapan, "Big Data and Analytics", 2nd Edition by Wiley

REFERENCES:

1. Minteer, Andrew, Analytics for the Internet of Things (IoT), Packt Publishing Ltd. July 2017, ISBN 9781787120730
2. Kai Hwang, MinChen, Big-Data Analytics for Cloud, IoT and Cognitive Computing, Wiley.
3. Hwaiyu Geng, Internet of Things and Data Analytics Handbook, Wiley.
4. John Soldatos, Building Blocks for IoT Analytics Internet-of-Things Analytics, River Publishers Gerardus Blokdyk.
5. IoT Analytics A Complete Guide, 5starcooks

WEB REFERENCES:

1. https://www.udemy.com/course/iot-data-analytics/?coupon Code=KEEPLEARNING
2. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
3. https://onlinecourses.nptel.ac.in/noc22_cs18/preview
4. https://www.udemy.com/course/iot-data-analytics/?coupon Code=KEEPLEARNING

OUTCOMES:

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

1. Understand basic data analytics.(K2)
2. Develop platform for big data analytics.(K2)
3. Analyze how to handle the data with machine learning.(K2)
4. gain hands on experience how to handle mango DB.(K2)
5. acquire knowledge how to manage the data.(K2)

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 ELECTIVES - II

20CSEL601 SDG NO. 4	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 – Eort 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 StaSelection – 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", TataMcGraw 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.
3. Royce, "Software Project Management", Pearson Education, 1999.
4. Jalote, "Software Project Manangement in Practive", Pearson Education, 2002.
5. Shailesh Mehta, "Project Management and Tools & Technologies – An overview", SPD First Edition, 2017

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 student should be able to

1. Understand Project Management principles while developing software. (K2)
2. Gain extensive knowledge about the basic project management concepts, framework andt he process models. (K3)
3. Obtain adequate knowledge about software process models and software eort estimation techniques.(K3)
4. Estimate the risks involved in various project activities. (K3)Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles (K1)
5. Learn the staselection 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	2	1	-	-	-	-	-	-	-	-	1	2	3
CO2	3	3	2	-	-	-	-	-	-	-	-	2	3	3
CO3	3	3	3	-	-	-	-	-	-	-	-	2	3	3
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO5	3	1	1	-	-	-	-	-	-	-	-	3	3	3
CO6	3	1	1	-	-	-	-	-	-	-	-	3	2	3

PROFESSIONAL ELECTIVES - II

20CSEL602 SDG NO. 4	DIGITAL FORENSICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamental concepts of forensic science
- To understand the application of forensic science principles to digital evidence examinations.
- To articulate the steps of the forensic process as applied to digital evidence
- To analyze and validate the computer forensics data

UNIT I INTRODUCTION **9**

Introduction - Digital Forensics - Digital Evidence - Increasing Awareness of Digital Evidence -Digital Forensics: Past, Present, and Future – Principles - Challenging Aspects of Digital Evidence –Cyber trail - Language of Computer Crime Investigation - Role of Computers in Crime.

UNIT II EVIDENCE AND INVESTIGATIONS **9**

Evidence in the Courtroom - Duty of Experts – Admissibility - Levels of Certainty in Digital Forensics - Direct versus circumstantial evidence - Scientific Evidence - Presenting Digital Evidence - Conducting Digital Investigations - Digital Investigation Process Models - Scaf folding for Digital Investigations - Applying the Scientific Method in Digital Investigations - Investigative Scenario –Security Breach

UNIT III DISK AND FILE SYSTEM ANALYSIS **9**

Imaging- Internet Artifacts- Browser & Mail Artifacts- File Analysis- Image- Audio- Video-Archives- Documents- Graphical Investigation Environments- PyFLAG- Fiwalk- Forensic Ballistics and Photography- Face, Iris and Fingerprint Recognition.

UNIT IV LAWS AND ACTS **9**

Laws and Ethics- Digital Evidence Controls- Evidence Handling Procedures- Basics of Indian Evidence- ACT IPC and CrPC - Electronic Communication Privacy ACT- Legal Policies.

UNIT V NETWORK FORENSICS **9**

Network Basics for Digital Investigators- Applying Forensic Science to Networks- Digital Evidence on the Internet - Digital Evidence on Physical and Data-Link Layers - Digital Evidence at the Network and Transport Layers

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Eoghan Casey ,"Digital Evidence and Computer Crime, Forensic Science, Computers, and the Internet", Elsevier, 3rd Edition, 2011
2. Elsevier, 3rd Edition, 2011" Hand book of Digital Forensics and Investigation", Elsevier Publication, 2010

REFERENCES:

1. Adrian Farrel," The Internet and Its Protocols", Elsevier Publications, 2011.
2. Cory Altheide and Harlan Carvey," Digital Forensics with Open Source Tools" Elsevier publication, 3rd Edition, April 2011.
3. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics", TataMcGraw -Hill, New Delhi, 2006.
4. Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009
5. Robert M Slade," Software Forensics", Tata McGraw - Hill, New Delhi, 2005.

WEB REFERENCES:

1. https://www.forensicnotes.com/dfir-articles-software/
2. https://www.ncjrs.gov/app/publications/alphalist.aspx.

ONLINE RESOURCES

1. https://resources.infosecinstitute.com/category/computerforensics/introduction/online-resources/#gref.
2. https://www.classcentral.com/course/edx-computer-forensics-7857

OUTCOMES:

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

1. Understand the basics and Principles of digital forensics.(K2)
2. Apply the digital investigation process models to collect evidence.(K3)
3. Apply the Scientific Method in Digital Investigations.(K3)
4. Understand how to use the forensic concepts in an open platform.(K2)
5. Recall the Standard Operating Procedure.(K1)
6. Interpret the techniques and technologies in Network Forensics.(K2)

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	2	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	2	1	1	-	1	-	-	1	3	3
CO5	2	3	2	3	3	1	1	-	2	-	-	1	2	2
CO6	2	3	2	3	3	1	1	-	2	-	-	1	2	3

PROFESSIONAL ELECTIVES - II

20CSEL603 SDG NO. 4 & 16	VIRTUALIZATION TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire knowledge of Virtualization and its basic principles
- Ability to use commercial software for Virtualization
- Ability to set up virtual networks, provisioning the memory, and I/O systems
- To apply the concepts of Virtualization techniques on applications

UNIT I INTRODUCTION **9**

Overview: Why server virtualization –History and re-emergence – Classic virtual machines; VMware, VSphere, KVM, Xen; Taxonomy and basic principles, Architectures comparison – CPU virtualization – Privileged instructions handling – Hypervisor – Para virtualization. Hardware – assisted virtualization. Booting up. Time keeping. CPU scheduling. Commercial examples.

UNIT II MEMORY MANAGEMENT IN VIRTUALIZATION **9**

Memory management in virtualization: Virtual Storage, partitioning–reclamation –ballooning. Memory sharing. OS-level virtualization –VMWare–Red Hat Enterprise Virtualization.

UNIT III I/O VIRTUALIZATION **9**

I/O virtualization: Virtualizing I/O devices -Monolithic model -virtual I/O server. Virtual networking–Tunneling –overlay networks. Commercial examples. Virtual storage: Granularity –Centralized and Distributed File system, system level, Blocks level.

UNIT IV VIRTUALIZED COMPUTING **9**

Virtualized computing: Virtual machine based distributed computing, Elastic cloud computing, clustering, Cold and hot migration. Commercial examples. Challenges and future trends.

UNIT V APPLICATIONS **9**

Applications: In distributed computing: Grid and Cloud, Virtual Machine Provisioning, Desktop Virtualization, Application Virtualization, Security for virtualized environments, Business Continuity in virtual environments.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Jim Smith, Ravi Nair, Morgan, Kaufmann," Virtual Machines: Versatile Platforms for Systems and Processes "(1st Ed): (2005).
2. "Applied Virtualization Technology - Usage models for IT professionals and Software Developers" (1st Ed): Sean Campbell Intel Press (2006).

REFERENCES:

1. Robert P. Goldberg, Proc. "Architecture of Virtual Machines", Workshop on Virtual Computer Systems, Cambridge, MA, 1973, pp 74-112.
2. Gerald J. Popek, Robert P. Goldberg, "Formal Requirements for Virtualizable Third Generation Architectures", Communications of the ACM, 17(7), July 1974, pp 413-421.
3. Paul Barham, Boris Dragovic, Keir Fraser, Steven Hand, Tim Harris,Alex Ho, Rolf Neugebauer, Ian Pratt and Andrew Warfield -"Xen and the Art of Virtualization", Proceedings of the ACM Symposium on Operating Systems Principles (SOSP), October2003.
4. William von Hagen, "Professional Xen Virtualization", Wrox Publications, January, 2008.
5. Amy Newman, Kenneth Hess, "Practical Virtualization Solutions: Virtualization from the Trenches", Prentice Hall, October 2009.

WEB REFERENCES:

1. www.xenproject.org
2. https://nptel.ac.in/courses/106/106/106106144/

OUTCOMES:

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

1. Understand the basic concepts of server virtualization. (K2)
2. Recall the concepts of privileged instructions handling and hypervisor. (K1)

3. Understand the concepts of virtual networks, memory provisioning.(K2)
4. Define the concepts of Virtualized Computing.(K3)
5. Understand the concepts of I/O virtualization and Virtual Storage. (K2)
6. Apply the concepts of Virtualization techniques on 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	2	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	2	1	1	-	1	-	-	1	3	3
CO5	2	3	2	3	3	1	1	-	2	-	-	1	2	2
CO6	2	3	2	3	3	1	1	-	2	-	-	1	2	3

PROFESSIONAL ELECTIVES - II

20CSEL604 SDG NO. 4 & 15	BIO INFORMATICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To analyze the need for Bioinformatics Technologies
- To be familiar with the modeling techniques
- To learn microarray analysis
- To implement Pattern Matching and Visualization

UNIT I INTRODUCTION **9**

Need for Bioinformatics Technologies – Overview of Bioinformatics Technologies – Structural Bioinformatics – Data Format and Processing – Secondary Resources and Applications – Role of Structural Bioinformatics - Biological Data Integration System.

UNIT II DATA WARE HOUSING AND DATA MINING IN BIOINFORMATICS 9

Bioinformatics Data – Data Warehousing Architecture – Data Quality – Biomedical Data Analysis –DNA Data Analysis – Protein Data Analysis – Machine Learning – Neural Network Architecture -Applications in Bioinformatics.

UNIT III MODELING FOR BIOINFORMATICS 9

Hidden Markov Modeling for Biological Data Analysis – Sequence Identification –Sequence Classification – Multiple Alignment Generation – Comparative Modeling –Protein Modeling –Genomic Modeling – Probabilistic Modeling – Bayesian Networks – Boolean Networks – Molecular Modeling – Computer Programs for Molecular Modeling.

UNIT IV PATTERN MATCHING AND VISUALIZATION 9

Gene Regulation – Motif Recognition – Motif Detection – Strategies for Motif Detection –Visualization – Fractal Analysis – DNA Walk Models – One Dimension – Two Dimension – Higher Dimension – Game Representation of Biological Sequences – DNA –Protein -Amino Acid Sequences.

UNIT V MICROARRAY ANALYSIS 9

Microarray Technology for Genome Expression Study – Image Analysis for Data Extraction –Preprocessing – Segmentation – Gridding – Spot Extraction – Normalization - Filtering – Cluster Analysis–Gene Network Analysis–Scientific Data Management Systems– Cost Matrix–Evaluation Model - Benchmark – Trade os.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Yi-Ping Phoebe Chen (Ed), "Bio Informatics Technologies", First Indian Reprint, SpringerVerlag,2007.
2. Jin Xiong, "Essential Bioinformatics", Cambridge University Press, 2012.

REFERENCES:

1. Bryan Bergeron, "Bio Informatics Computing", Second Edition, Pearson Education India, 2003.
2. Arthur MLesk, "Introduction to Bio informatics", Second Edition, Oxford University Press, 2005.
3. David W.Mount, "Bioinformatics: Sequence and Genome Analysis", Second Edition, Cold Spring Harbor Laboratory Press, U.S., 2004.
4. Andreas D. Baxevanis, B. F. Francis Ouellette, "Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins", Second Edition, Wiley Interscience, 2001.
5. Mitchell L Model, "Bioinformatics Programming Using Python", O'Reilly Media, 2009.

ONLINE RESOURCES:

1. https://www.classcentral.com/subjects/bioinformatics
2. https://mooc-list.com/tags/bioinformatis?_cf_chi_jschi_tk
3. https://www.udemy.com/topic/bioinformatics/?utm_source=adwords?

OUTCOMES:

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

1. Understand the basic concepts of Bioinformatics and its significance in biological data analysis. (K2)
2. Describe the history, scope and importance of Bioinformatics and role of the internet in bioinformatics. (K1)
3. Elaborate the methods to characterize and manage the different types of biological data. (K2)
4. Discuss the classification of biological databases.(K1)
5. Explore the basics of sequence alignment and analysis. (K3)
6. Describe how bioinformatics methods can be used to relate sequence, structure and functions. (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	2	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	2	1	1	-	1	-	-	1	3	3
CO5	2	3	2	3	3	1	1	-	2	-	-	1	2	2
CO6	2	3	2	3	3	1	1	-	2	-	-	1	2	3

PROFESSIONAL ELECTIVES - III

20ITEL802 SDG NO. 4 & 9	VIRTUAL REALITY AND AUGMENTED REALITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce Virtual Reality, Input and Output devices
- To acquire knowledge on Computing architectures and modelling
- To explore VR programming and human factors
- To learn various application of Virtual and Augmented reality

UNIT I INTRODUCTION TO VIRTUAL REALITY AND INPUT AND OUTPUT DEVICES 9

Introduction-TheThree I's of Virtual Reality-A Short History of Early Virtual Reality-Early Commercial VR Technology-VR becomes an Industry-The Five Classic Components of a VR System. Input Devices-Three-Dimensional Position Trackers - Tracker Performance Parameters - Ultrasonic Trackers-Optical Trackers-Navigation and Manipulation Interfaces-Gesture Interfaces - Output Devices - Graphics Displays - Large - Volume Displays – Sound Displays.

UNIT II COMPUTING ARCHITECTURES AND MODELING OF VR SYSTEM 9

Computing Architectures for VR - The Rendering Pipeline - The Graphics Rendering Pipeline-The Haptics Rendering Pipeline-PC Graphics Architecture-PC Graphics Accelerators-Graphics Benchmarks-Distributed VR Architectures-Multipipeline Synchronization-Colocated Rendering Pipelines - Modeling - Geometric Modeling - Kinematics Modeling – Physical and Behavior Modeling.

UNIT III VR PROGRAMMING AND HUMAN FACTORS 9

Toolkits and Scene Graphs-World Tool Kit-Model Geometry and Appearance-The WTK Scene Graph-Sensors and Action Functions-WTK Networking-Java3D - Model Geometry and Appearance - Java 3D Scene Graph - Sensors and Behaviors-Java 3D Networking-WTK and Java 3D Performance Comparison Methodology and Terminology - User Performance Studies - VR Health and Safety Issues-VR and Society.

UNIT IV APPLICATIONS OF VR 9

Medical Applications of VR-Virtual Anatomy-Triage and Diagnostic-Surgery - VR in Education-VR and the Arts-Entertainment Applications of VR-Military VR Applications-Army Use of VR-VR Applications in the Navy-Air Force use of VR-Applications of VR in Robotics-Robot programming-Robot Teleoperation.

UNIT V AUGMENTED REALITY **9**

Augmented Reality-An overview-Introduction-History-Augmented Reality Technologies–Computer Vision Methods in AR-AR Devices-AR Interfaces-AR Systems-Visualization Techniques for Augmented Reality-Data Integration-Depth Perception-Augmenting Pictorial Depth Cues-Occlusion Handling-Image Based X-ray Visualization-Scene Manipulation-Rearranging Real World Objects - Space - Distorting Visualization - AR in Healthcare.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Grigore C.Burdea, PhilippeCoiffet, "Virtual Reality Technology", Wiley, Second Edition, 2006
2. BorkoFurht, "Hand book of Augmented Reality", Springer, 2011.

REFERENCE:

1. Sherman, William R & Craig, Alan B, "Understanding Virtual Reality", Elsevier India Private Limited, Noida, 2008.

WEB REFERENCE:

1. http://www.cs.upc.edu/~virtual/RVA/CourseSlides/03.%20VR%20Input%20H

OUTCOMES:

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

1. Summarize the basics of virtual reality and IO devices. (K2)
2. Associate the computing architectures and rendering pipelines used.(K2)
3. Demonstrate the virtual reality system using various tool kits and scene graphs. (K3)
4. Infer various applications of virtual reality systems. (K2)
5. Summarize the basics of augmented reality, IO devices and visualization techniques. (K2)
6. Construct augmented reality applications for various real time problems. (K3)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - III

20CIEL703 SDG NO. 4 & 9	ROBOTICS AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Learn the basics of Robotics and their applications
- Study the need for various Sensors and Drives in robotics
- Gain thorough knowledge about the Robot Kinematics and Path Planning and different Trajectories
- Apply the programming of Robots in contemporary use

UNIT I INTRODUCTION TO ROBOTICS **9**

Basics - Types - Mobility - Terrain - Components Classification and Performance Characteristics.

UNIT II WORKING COMPONENTS FOR ROBOTS **9**

Drives-Electric-Hydraulic and Pneumatic Drives-Tactile sensors-Proximity and Range Sensors-Acoustic Sensors-Vision Sensor Systems-Image Processing and Analysis - Image Data Reduction - Segmentation – Feature Extraction - Object Recognition.

UNIT III ROBOT KINEMATICS AND DYNAMICS **9**

Kinematics of Manipulators - Rotational - Translation and Transformation –Homogeneous Transformations – Denavat Hartenberg Representation –Inverse Kinematics - Linearization of Robot Dynamics, State Variable Continuous and Discrete Model

UNIT IV PATH PLANNING **9**

Types of Trajectories – Trajectory Planning and Avoidance of Obstacles-Path Planning - Skew Motion - Joint Integrated Motion and Straight Line Motion.

UNIT V APPLICATION OF ROBOTS **9**

Industrial Automation – Robots for Nuclear-Thermal and Chemical Plants-Remote Controlled Robots - Typical Examples of Automated Industries.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Mikell P. Groover, "Industrial Robotics: Technology, Programming and Applications", 2012, 2ndEdition, McGraw-Hill Publishers.
2. John J.Craig, "Introduction to Robotics, Mechanics and Control", 2010, 3rdEdition, Pearson Education.

REFERENCES:

1. M.W.Spong and M.Vidyasagar, "Robot Dynamics and Control," 2nd Edition, John Wiley & Sons, New York, 2012.
2. Lorenzo Sciavicco Bruno Siciliano, "Modelling and Control of Robot Manipulators", 1stEdition, Springer Science & Business Media, Berlin, 2012.
3. Deb.S.R and Sankha Deb, "Robotics Technology and Flexible Automation", Tata McGraw Hill Publishing Company Limited, 2010.
4. Klafter.R.D, Chmielewski.T.A, and Noggin's., "Robot Engineering: An Integrated Approach", Prentice Hall of India Pvt. Ltd., 1994.

WEB REFERENCES:

1. https://nptel.ac.in/courses/112/105/112105249/
2. https://www.coursera.org/learn/mobile-robot

OUTCOMES:

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

1. Understand the necessity and basics of Robotics in real time applications. (K2)
2. Explain the components and working principle in Robots. (K2)
3. Apply the use of Image Processing, Obstacle detection and Path planning in Robotic applications. (K3)
4. Demonstrate them a thematical model of Robotic systems. (K3)
5. Apply mathematical modeling in Kinematic behavior. (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	-	-	-	-	-	1	2	2
CO2	3	2	2	2	-	-	-	-	-	-	-	1	2	2
CO3	3	3	3	3	2	-	-	-	-	-	-	1	3	2
CO4	3	3	3	3	1	-	-	-	-	-	-	2	3	2
CO5	3	3	3	3	1	-	-	-	-	-	-	1	2	2

PROFESSIONAL ELECTIVES - III

20CSEL809 SDG NO. 4	GAME PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Understand the concepts of Game design and development
- To Learn the processes, mechanics and issues in Game Design
- To be exposed to the Core architectures of Game Programming
- To know about Game programming platforms, frame works and engines

UNIT I 3D GRAPHICS FOR GAME PROGRAMMING 9

3D Transformations, Quaternions, 3D Modeling and Rendering – Ray Tracing-Shader Models – Lighting – Color – Texturing – Camera and Projections - Cullingand Clipping - Character Animation - Physics - Based Simulation - SceneGraph

UNIT II GAME ENGINE DESIGN 9

Game Engine Architecture - Engine Support Systems - Resources and File Systems - Game Loop and Real-time Simulation - Human Interface Devices –Collision and Rigid Body Dynamics-Game Profiling.

UNIT III GAME PROGRAMMING APPLICATION 9

Application Layer – Game Logic – Game Views – Managing Memory-Controlling the Main Loop – Loading and Caching Game Data – User Interface Management - Game Event Management.

UNIT IV GAMING PLATFORMS AND FRAME WORKS 9

2D and 3D Game Development Using Flash – Direct X – Java – Python –Game Engines-Unity-DX Studio.

UNIT V GAME DEVELOPMENT **9**

Developing 2D and 3D Interactive Games Using Direct X or Python –Isometric and Tile Based Games - Puzzle Games - Single Player Games - Multi-Player Games.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Mike McShaffrfy and David Graham, "Game Coding Complete", Fourth Edition, Cengage Learning, PTR, 2012.
2. Jason Gregory, "Game Engine Architecture", CRC Press/AK Peters, 2009.

REFERENCES:

1. Eric Lengyel, "Mathematics for 3D Game Programming and Computer Graphics",3rd Edition, Course Technology PTR, 2011.
2. David H.Eberly, "3D Game Engine Design- A Practical Approach to Real-Time Computer Graphics", Second Edition, Morgan Kaufmann, 2006.
3. Ernest Adams and Andrew Rollings, "Fundamentals of Game Design", 2nd Edition, Prentice Hall/New Riders, 2009.
4. Jesse Schell, "The Art of Game Design: A book of lenses", First Edition, CRC Press,2008.
5. Rod Afshar, CliffJones, Duke Banerjee, "Adver gaming Developer's Guide: Using Macromedia Flash MX2004 and Director MX (Game Development Series)", Charles River Media, Feb, 2004.

ONLINE RESOURCES:

1. https://www.youtube.com/watch?v=GfwpRU0cT10

OUTCOMES:

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

1. Understand the concepts of Game design and development (K2).
2 Design the processes and use mechanics for game development (K3).
3 Study the Core architectures of Game Programming (K1).
4 Implement Game programming platforms, frameworks and engines (K3).
5 Develop Interactive Games (K3).
6 Apply design and development principles in the construction of two-dimensional (2D) and Three-dimensional (3D) computer and mobile games (K3).

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - III

20CIEL701 SDG NO. 4 & 9	ARTIFICIAL IOT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the concepts and principles of AI empowered IoT.
- To have preliminary background in computer programming, and AI.
- To understand the fundamentals of AIoT, develop AIoT systems and apply AIoT to real-world applications.

UNIT I INTRODUCTION TO IOT **9**

Introduction to IoT-IoT applications- sensor systems- IoT sensing techniques-IoT networking- IoT Data analytics- IoT platforms and systems-Raspberry Pi-ArduinoProgramming

UNIT II INTRODUCTION TO AI **9**

AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

UNIT III INTRODUCTION TO AIOT **9**

Introduction to AIoT-AIoT concepts and issues-Technologies behind AIoT-AIoT application segments-Distributed intelligence at the edge of IoT systems (edge computing; blockchain, etc.) -Robotics for AIoT

UNIT IV AIOT COMPONENTS **9**

Technical architecture of AIoT - Smart sensors and devices- Wearables- Smart object and human sensing- Challenges of AI in networks for IoT- AI for IoT data analytics and automation

UNIT V APPLICATIONS **9**

Intelligent manufacturing-Smart health-Smart infrastructure and construction-Smart Appliances in home and Industry-smart Vehicle-Intelligent Agriculture.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. "The Future of Artificial Intelligence, the Internet of Things, and Blockchain: From AI to AIoT to AIoTB". By Eugene Chang. Publisher: Amazon. 2019.
2. "Hands-On Artificial Intelligence for IoT: Expert machine learning and deep learning techniques for developing smarter IoT systems", by Amita Kapoor. Publisher: Packt Publishing Ltd. 2018.

REFERENCE BOOKS:

1. "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", by Francis DaCosta. Publisher: Apress. 2013.
2. "Internet of Things", by Vlasios Tsiatsis Stamatis Karnouskos Jan Holler David Boyle Catherine Mulligan. Publisher: Elsevier. 2nd edition. 2018.
3. "Big-Data Analytics for Cloud, IoT and Cognitive Computing", by Kai Hwang and Min Chen. Publisher: Wiley. 2017.
4. "AIoT Innovation", ed. Fadi AI-Turjman. Publisher: Springer. 2020

OUTCOMES:

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

1. Understand the fundamental concepts and applications of IoT.(K1)
2. Understand the fundamental concepts and technical challenges AI.(K1)
3. Understand the fundamental concepts, technical challenges, and the state-of-the-art technology development and applications of AIoT.(K1)
4. Understand the protocols and platforms for sensing, networking and data analytics in IoT systems.(K2)
5. Learn and deploy the AI models, algorithms and techniques for IoT operation efficiency, cost reduction, event detection, and predictive maintenance in practice.(K1)
6. Discover potential AI-oriented usage scenarios in IoT and apply AIoT methods and techniques to solve various challenging IoT problems.(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	-	-	-	-	-	2	3	3	2
CO2	3	3	3	2	2	-	-	-	-	-	2	3	3	2
CO3	3	3	1	2	2	2	1	-	-	-	2	3	3	2
CO4	3	3	1	3	3	3	2	-	-	-	2	3	3	2
CO5	3	3	3	3	1	2	3	-	-	-	2	3	3	2
CO6	2	2	2	1	3	3	3	-	-	-	1	2	2	2

PROFESSIONAL ELECTIVES - III

20CSEL701 SDG NO. 4 & 8	SOCIAL NETWORK ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concept of Semantic Web and related applications
- To learn knowledge representation using Ontology
- To understand human behaviour in social web and related communities
- To learn visualization of Social Networks

UNIT I INTRODUCTION **9**

Introduction to Semantic Web – Limitations of Current Web –Development of Semantic Web – Emergence of the Social Web – Social Network Analysis: Development of Social Network Analysis – Key Concepts and Measures in Network Analysis–Electronic Sources for Network Analysis: Electronic Discussion Networks – Blogs and Online Communities – Web–based Networks - Applications of Social Network Analysis.

UNIT II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION **9**

Ontology and their role in the Semantic Web - Ontology-based Knowledge Representation–Ontology Languages for the Semantic Web-Resource Description Framework–Web Ontology Language–Modelling and Aggregating Social Network Data: State-of-the-art in Network Data Representation –Onto logical Representation of Social Individuals –Onto logical Representation of Social Relationships – Aggregating and Reasoning with Social Network Data –Advanced Representations.

UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 9

Web Archive – Detecting Communities in Social Networks – Definition of Community – Evaluating Communities – Methods for Community Detection and Mining – Applications of Community Mining Algorithms–Tools for Detecting Communities Social Network Infrastructures and Communities –Decentralized Online Social Networks – Multi-Relational characterization of dynamic social network communities.

UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES 9

Understanding and Predicting Human Behaviour for Social Communities –User Data Management – Inference and Distribution – Enabling New Human Experiences – Reality Mining – Context – Awareness – Privacy in Online Social Networks–Trust in Online Environment – Trust Models Based on Subjective Logic – Trust Network Analysis – Trust Transitivity Analysis – Combining Trust and Reputation – Trust Derivation based on Trust Comparisons –Attack Spectrum and Counter Measures.

UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS 9

Graph Theory – Centrality – Clustering – Node – Edge Diagrams – Matrix Representation – Visualizing Online Social Networks – Visualizing Social Networks with Matrix – based Representations – Matrix and Node – Link Diagrams – Hybrid Representations – Applications – Cover Networks – Community Welfare – Collaboration Networks – Co-Citation Networks.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer, 2007.
2. Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.

REFERENCES:

1. Guandong Xu, Yanchun Zhang and LinLi, "Web Mining and Social Networking – Techniques and Applications", First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.

5. Przemyslaw Kazienko, Nitesh Chawla, "Applications of Social Media and Social Network Analysis", Springer, 2015.

WEB REFERENCES:

1. https://www.sagepub.com/sites/default/files/upm-binaries/35208_Chapter1.pdf
2. http://www.orgnet.com/sna.html
3. http://www.analytictech.com/networks/whatis.htm

ONLINE RESOURCES:

1. http://www.mjdenny.com/workshops/SN_Theory_I.pdf

OUTCOMES:

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

1. Understand abroad range of Network concepts and theories. (K1)
2. Appreciate how Network analysis can contribute to increasing knowledge about diverse aspects of society. (K1)
3. Use a relational approach to answer questions of interest to them (i.e.be able to apply 'Network Thinking'). (K2)
4. Analyse Social Network data using various software packages. (K3)
5. Present results from Social Network Analysis, both orally and in writing. (K2)
6. Use software to simulate the dynamics of networks based on social network models. (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	-	-	-	-	-	2	3	3	2
CO2	3	3	3	2	2	-	-	-	-	-	2	3	3	2
CO3	3	3	1	2	2	2	1	-	-	-	2	3	3	2
CO4	3	3	1	3	3	3	2	-	-	-	2	3	3	2
CO5	3	3	3	3	1	2	3	-	-	-	2	3	3	2
CO6	2	2	2	1	3	3	3	-	-	-	1	2	2	2

PROFESSIONAL ELECTIVES - III

20CIEL702 SDG NO. 4	SOFTWARE DEFINED NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To appreciate the need for Software Defined Networks
- To learn working of Software Defined Networking
- To know the Open Flow Specifications
- To know the applications of Software Defined Networking in Data Centers

UNIT I INTRODUCTION **9**

Basic Packet Switching Terminology - The Modern Data Center – Traditional Switch Architecture - Autonomous and Dynamic Forwarding Tables – Open Source and Technological Shifts - SDN - Evolution of Switches - Control Planes-Cost - SDN Implications for Research and Innovation - Data Center Innovation-Data Center Needs.

UNIT II THE GENESIS OF SDN **9**

The Evolution of Networking Technology - Sustaining SDN Interoperability –Open Source Contributions – Legacy Mechanisms Evolve Toward SDN - Network Virtualization - Fundamental Characteristics of SDN - SDN Operation -SDN Devices – SDN Controller – SDN Applications – Alternate SDN Methods.

UNIT III THE OPEN FLOW SPECIFICATION **9**

OpenFlow Overview - OpenFlow 1.0-1.1-1.2-1.3 - OpenFlow - Limitations - Alternative Definitions of SDN - Potential Drawbacks of Open SDN - SDN via APIs - SDN via Hypervisor – Based Overlays – SDN via Opening Up the Device – Network Functions Virtualization – Alternatives Overlap and Ranking.

UNIT IV SDN IN THE DATA CENTER **9**

Data Center Definition - Data Center Demands - Tunneling Technologies for the Data Center, Path Technologies in the Data Center – Ethernet Fabrics in the Data Center - SDN Use Cases in the Data Center-Open SDN versus Overlays in the Data Center – Real – World Data Center Implementations.

SDN IN OTHER ENVIRONMENTS: Consistent Policy Configuration – Global Network View – Wide Area Networks –Service Provider and Carrier Networks – Campus Networks – Hospitality Networks – Mobile Networks – In-Line Network Functions – Optical Networks – SDN vs P2P/Overlay Networks.

UNIT V SDN APPLICATIONS **9**

Reactive versus Proactive Applications – Reactive SDN Applications –Proactive SDN Applications - Analyzing Simple SDN Applications - Creating Network Virtualization Tunnels - Offloading Flows in the Data Center - Access Control for the Campus – Traffic Engineering for Service Providers.

SDN FUTURES: Potential Novel Applications of Open SDN-Applying Programming Techniques to Networks - Security Applications - Hiding IP Addresses – Segregating IPSec Traffic in Mobile Networks – Roaming in Mobile

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Paul Goransson, Chuck Black, "Software Defined Networks-A Comprehensive Approach", Elsevier, 2014.
2. Siamak Azodolmolky, "Software Defined Networking with OpenFlow", Second Edition, Packt Publishing, 2013.

REFERENCES:

1. Thomas D.Nadeau & Ken Gray, "SDN Software Defined Networks", O'Reilly publishers, First edition, 2013.
2. Sreenivas Voruganti, Sriram Subramanian, "Software Defined Networking (SDN) with Open Stack", First Edition, Packt Publishing,2016.
3. William Stallings, "Foundations of Modern Networking", First Edition, Pearson education limited, 2016.
4. Vivek Tiwari, "SDN and Open Flow for Beginners", Amazon Digital Services, Inc., 2013.
5. FeiHu, Editor, "Network Innovation through Open Flow and SDN: Principles and Design", Chemical Rubber Company Press, 2014.

WEB REFERENCES:

1. https://users.cs.fiu.edu/~fortega/storage/tcn6430/SDN_9780124166844.pdf
2. https://www.cs.rutgers.edu/~sn624/552-F18/papers/p4.pdf
3. https://www.cs.rutgers.edu/~sn624/552-F18/papers/road.pdf

ONLINE RESOURCES:

1. https://sdn.ieee.org/outreach/resources
2. https://www.coursera.org/learn/sdn

OUTCOMES:

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

1. Explain the key benefits of SDN by the separation of data and control planes (K1)
2. Interpret the SDN data plane devices and Open flow Protocols. (K2)
3. Implement the operation of SDN control plane with different controllers. (K2)
4. Apply techniques that enable applications to control the underlying network using SDN. (K3)
5. Appreciate the applications of Software Defined Networking in Data Centers (K2)
6. Describe Network Functions Virtualization components and their roles in SDN (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	3	3	3	3	3	-
CO2	1	3	1	2	-	1	-	3	1	-	1	1	1	3
CO3	3	3	3	3	1	-	-	-	3	1	3	3	3	3
CO4	3	3	3	3	3	2	-	2	2	1	3	2	3	3
CO5	3	3	3	3	3	1	-	-	1	1	3	2	3	3
CO6	3	3	3	2	3	2	-	2	2	1	3	2	3	3

PROFESSIONAL ELECTIVES - III

20CSEL703 SDG NO. 4 & 12	INFORMATION RETRIEVAL TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of Information Retrieval
- To apply Machine Learning techniques for Text Classification and Clustering
- To implement various Search engine system operations
- To learn different techniques of Recommender system

UNIT I INTRODUCTION 9

Information Retrieval – Early Developments – The IR Problem – The Users Task – Information Vs Data Retrieval – The IR System–The Software Architecture of the IR System – The Retrieval and Ranking Processes – The Web – Thee – Publishing Era – How the Web Changed Search –Practical Issues on the Web – How People Search – Search Interfaces Today –Visualization in Search Interfaces.

UNIT II MODELING AND RETRIEVAL EVALUATION 9

Basic IR Models – Boolean Model -TF/IDF (Term Frequency/Inverse Document Frequency) Weighting - Vector Model–Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User – Based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.

UNIT III TEXT CLASSIFICATION AND CLUSTERING 9

A Characterization of Text Classification – Unsupervised Algorithms –Clustering – Naıv̈ e Text Classification – Supervised Algorithms – Decision Tree – KNN Classifier – SVM Classifier–Feature Selection or Dimensionality Reduction – Evaluation Metrics – Accuracy and Error – Organizing the Classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-Dimensional Indexing.

UNIT IV WEB RETRIEVAL AND WEB CRAWLING 9

The Web – Search Engine Architectures – Cluster based Architecture –Distributed Architectures – Search Engine Ranking – Link based Ranking –Simple Ranking Functions – Learning to Rank – Evaluations - Search Engine Ranking – Search Engine User Interaction – Browsing –Applications of a Web Crawler – Taxonomy – Architecture and Implementation –Scheduling Algorithms – Evaluation.

UNIT V RECOMMENDER SYSTEM 9

Recommender Systems Functions – Data and Knowledge Sources –Recommendation Techniques – Basics of Content – Based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-Based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Ricardo Baeza- Yates and Berthier Ribeiro -Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", Second Edition, ACM Press Books,2 011.
2. Ricci,F, Rokach, L.Shapira, B.Kantor, "Recommender Systems Handbook", First Edition, 2011.

REFERENCES:

1. C. Manning, P. Raghavan, and H. Schü tze, "Introduction to Information Retrieval", Cambridge University Press, 2008.
2. Stefan Buettcher, C harles L.A.Clarke and Gordon V.Cormack, "Information Retrieval: Implementing and Evaluating Search Engines", The MIT Press,2010.
3. Cheng Xiang Zhai, "Statistical Language Models for Information Retrieval (Synthesis Lectures Serieson Human Language Technologies)", Morgan & Claypool Publishers, 2008.
4. Gerald J. Kowalski, Mark T. Maybury, "Information Storage and Retrieval Systems – Theory and Implementation", Second Edition, Springer 2013.
5. Frakes, W.B., Ricardo Baeza-Yates, "Information Retrieval Data Structures and Algorithms", Prentice Hall, 2007.

WEB REFERENCES:

1. https://libguides.lamk.fi/informationretrieval/techniques

ONLINE RESOURCES:

1. www.informationretrieval.org
2. https://nlp.stanford.edu/IR-book/html/htmledition/irbook.html

OUTCOMES:

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

1. Identify and design the various components of an Information Retrieval system. (K1)
2. Use an open source Search engine frame work and explore its capabilities. (K3)
3. Apply appropriate method of Classification or Clustering. (K3)
4. Design and implement innovative features in a Search engine. (K2)
5. Design and implement a Recommender system. (K2)
6. Demonstrate Information visualization technologies like Cognition and perception in the Internet or Web search engine. (K3)

CO – PO, 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 ELECTIVES - III

20CSEL704 SDG NO. 4	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the techniques in natural language processing
- To be familiar with the natural language generation
- To be exposed to machine translation
- To understand the information retrieval techniques

UNIT I OVERVIEW AND LANGUAGE MODELING 9

Overview: Origins and Challenges of NLP – Language and Grammar –Processing Indian Languages – NLP Applications – Information Retrieval-Language Modeling - Various Grammar - Based Language Models-Statistical Language Model.

UNIT II WORD LEVEL AND SYNTACTIC ANALYSIS 9

Word Level Analysis – Regular Expressions – Finite - State Automata - Morphological Parsing-Spelling Error Detection and Correction-Words and Word Classes-Part-of Speech Tagging-Syntactic Analysis-Context-Free Grammar-Constituency-Parsing-Probabilistic Parsing.

UNIT III SEMANTIC ANALYSIS AND DISCOURSE PROCESSING 9

Semantic Analysis: Meaning Representation-Lexical Semantics - Ambiguity-Word Sense Disambiguation - Discourse Processing - Cohesion-Reference Resolution-Discourse Coherence and Structure.

UNIT IV NATURAL LANGUAGE GENERATION AND MACHINE TRANSLATION 10

Natural Language Generation – Architecture of NLG Systems – Generation Tasks and Representations – Application of NLG – Machine Translation – Problems in Machine Translation – Characteristics of Indian Languages – Machine Translation Approaches – Translation Involving Indian Languages.

UNIT V INFORMATION RETRIEVAL AND LEXICAL RESOURCES 8

Information Retrieval - Design features of Information Retrieval Systems-Classical - Non-classical – Alternative Models of Information Retrieval – Valuation Lexical Resources – World Net – Frame Net – Stemmers – POSTagger – Research Corpora.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Tanveer Siddiqui, U.S.Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", First Edition, O_Reilly Media, 2009.

REFERENCES:

1. Daniel Jurafsky and James HMartin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Prentice Hall, 2008.
2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin / Cummings publishing company, 1995.
3. Hobson lane, Cole Howard, Hannes Hapke, "Natural language processing in action" MANNING Publications, 2019.
4. Alexander Clark, Chris Fox, Shalom Lappin, "The Handbook of Computational Linguistics and Natural Language Processing", Wiley-Blackwell, 2012.
5. Anne Kao and Stephen R. Poteet (Eds), "Natural Language Processing and Text Mining", Springer-Verlag London Limited, 2007.

WEB REFERENCES:

1. https://www.tutorialspoint.com/natural_language_processing/natural_language_processing_information_retrieval.htm
2. https://towardsdatascience.com/your-guide-to-natural-language-processing-nlp-48ea2511f6e1
3. https://machinelearningmastery.com/natural-language-processing/
4. https://becominghuman.ai/a-simple-introduction-to-natural-language-processing-ea66a1747b32

ONLINE RESOURCES:

1. https://www.coursera.org/learn/language-processing
2. https://www.youtube.com/playlist?list=PLoROMvodv4rOhcuXMZkNm7j3fVwBBY42z

OUTCOMES:

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

1. Learn the approaches of syntax and semantics in NLP. (K1)
2. Understand approaches to discourse, generation, dialogue and summarization within NLP. (K1)
3. Implement current methods for statistical approaches to machine translation. (K3)
4. Analyse machine learning techniques used in NLP. (K3)
5. Apply information retrieval techniques. (K2)
6. Develop a Statistical Methods for Real World Applications and explore deep learning based NLP. (K3)

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

PROFESSIONAL ELECTIVES - III

20CSEL707 SDG NO. 4	WEB ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know the importance of qualitative data, get insights and techniques.
- To develop customer-centric approach in dealing with data.
- To know the principles, tools and methods of web intelligence.
- To apply analytics for business situations.

UNIT I INTRODUCTION **9**

WebAnalytics–Basics–TraditionalWays–Expectations–DataCollection–Click stream Data – Weblogs – Beacons – JavaScript Tags – Packet Sniffing –Outcomes data – Competitive data – Search Engine Data.

UNIT II STRATEGIES FOR ANALYTICS **9**

Qualitative Analysis – Customer Centricity – Site Visits – Surveys – Questionnaires – Website Surveys – Postvisits – Creating and Running - Benefits of surveys – Critical components of successful strategy.

UNIT III CONCEPTS OF WEB ANALYTICS **9**

Web Analytic concepts – URLS – Cookies – Time on site – Page views –Understand standard reports – Website content quality –Navigation reports (toppages, top destinations, site overlay) – Search Analytics – Internal search, SEO and PPC – Measuring Email and Multichannel Marketing – Competitive intelligence and Web 2.0 Analytics – Segmentation – Connectable reports.

UNIT IV GOOGLE ANALYTICS **9**

Analytics – Cookies – Accounts vs Property – Tracking Code – Tracking Unique Visitors - Demographics - Page Views & Bounce Rate Acquisitions – Custom Reporting.

UNIT V ADVERTISING AND PROMOTION **9**

Goals & Funnels – Filters – Ecommerce Tracking – Real Time Reports – Customer Data Alert – Adwords Linking – Adsense Linking –Attribution Modeling – Segmentation – Campaign Tracking – Multi – Channel Attribution.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Avinash Kaushik, "Web Analytics 2.0: The Art of Online Accountability and Science Of Customer Centricity", 1st edition, Sybex, 2009.
2. Jason Burby, Shane Atchison, Jim Sterne, "Actionable Web Analytics: Using Data to Make Smart Business Decisions", 1st edition, Sybex, 29 May 2007.

REFERENCES:

1. Michael Beasley, "Practical Web Analytics for User Experience: How Analytics can help you Understand your Users", Morgan Kaufmann, 2013.
2. Magy Seif El-Nasr, Anders Drachen, Alessandro Canossa, eds., "Game Analytics: Maximizing the Value of Player Data", Springer, 2013.
3. Bing Liu, "Web Data Mining: Exploring Hyperlinks, Content, and Usage Data", 2nd Edition, Springer, 2011.

4. Justin Cutroni, "Google Analytics", O'Reilly, 2010.
5. Eric Fettman, Shiraz Asif, Feras Alhlou, "Google Analytics Breakthrough", John Wiley & sons, 2016.

WEB REFERENCES:

1. https://www.simplilearn.com/web-analytics-guide-for-newbies-article
2. https://www.tutorialspoint.com/web_analytics/web_analytics_tutorial.pdf

ONLINE RESOURCES:

1. https://www.techtarget.com/searchbusinessanalytics/definition/Web-analytics
2. https://www.optimizely.com/optimization-glossary/web-analytics/

OUTCOMES:

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

1. Know the concepts and terminologies related to web analytics. (K1)
2 Explore various parameters used for web analytics and their impact. (K3)
3 Explore the use of tools and techniques of web analytics. (K3)
4 Get experience on websites, web data insights and conversions. (K2)
5 Find out the applications of IoT in real time scenario. (K3)
6 List the quantifiable and measurable data of your website with the aim of understanding and optimizing the web usage. (K2)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - III

20CSEL708 SDG NO. 4	IT SECURITY COMPLIANCE AND FORENSICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the current security landscape, including the nature of threat and vulnerabilities
- To justify the need for appropriate strategies and processes for disaster recovery and fault tolerance
- To Know about the emerging security solutions for Web and Email
- To assess the current information security compliance and network forensics security tools, evidence and investigations

UNIT I INFORMATION SECURITY FUNDAMENTALS 9

Importance of Computer and Network Security – Confidentiality – Integrity- Availability- Accountability – Non- repudiation - Threats and Countermeasures – Policies and Standards – Authentication overview –Authentication credentials & protocols – Authentication services: LDAP, RADIUS, TACACS – Best practices for secure authentication – Authorization and access control models – Implementing access control on Windows and Unix

UNIT II NETWORK SECURITY & SERVER SECURITY 9

Best Practices for Network Security – Securing Network Transmission –Analyzing Security Requirements for Network Traffic - Defining Network Perimeters – Data Transmission Protection Protocols – Server Roles and Baselines – Securing Network Infrastructure Servers –Securing Domain Controllers – Securing File, Print and Application Servers.

UNIT III APPLICATION SECURITY AND DISASTER RECOVERY ASSURANCE 9

Web Browser Security - Email Security – Planning for the worst - Creating a Backup Strategy – Designing for Fault Tolerance.

UNIT IV INFORMATION SECURITY COMPLIANCE 9

Develop an Information System Strategy – Integrate security into an organization – Security compliance management and auditing – Information security program metrics.

UNIT V FORENSICS AND SECURITY **9**

Managing Updates - Auditing and Logging- Secure Remote Administration –Intrusion Detection – Honeypots – Forensics: Understanding Evidence-Gathering Evidence on a Live System – Preparing a Hard Drive Image – Searching for Data on a Hard Drive – Forensic Laboratories – Forensics Tools – Network Forensics: Network Security Tools–Incidence response–Network evidence and investigation.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Cole, Eric, Rachelle Reese, Ronald L. Krutz, and James Conley, "Network Security Fundamentals", United Kingdom: Wiley, John Sons, 2008. (ISBNNo.:978-0-470-10192-6).
2. Jason Andress, Mark Leary, "Building a Practical Information Security Program",Syngress Publication, 2017.

REFERENCES:

1. John Sommons, "The Basics of Digital Forensics - The Primer for getting Started in Digital Forensics", Syngress Publication, 2012.
2. Joshi, James, BruceS. Davie, and Saurabh Bagchi, "Network Security: Know It All" , United States: Morgan Kaufmann Publishers In, 2008. (ISBN No.:978-0-12-374463-0).
3. Ciampa, Mark. "Security Guide to Network Security Fundamentals". 4thedition, Boston, MA:Course Technology, Cengage Learning, 2011. (ISBNNo.:978-1-111-64012-5)
4. Thomas R, "Information Security Fundamentals", 2nd edition, CRC Press. Boca Raton, FL: Auerbach Publications, 2014. (ISBN No.: 978-1-4398-1063-7)
5. Vacca, JohnR., ed. "Network and System Security" United States: Syngress Media, U.S., 2010. (ISBNNo.:978-1-59749-535-6).

WEB REFERENCES:

1. https://www.google.com/search?q=information+security+ fundamentals+pdf&oq=INFORMATION+SECURITY+FUNDAMENTALS+&aqs=chrome.2.69i57j0i512l9.21467j0j7&sourceid=chrome&ie=UTF-8
2. https://www.cgi.com/sites/default/files/2019-08/cgi-understanding cybersecurity-standards-white-paper.pdf
3. https://www.google.com/search?q=forensics+and+security&oq=FORENSICS+AND+SECURITY&aqs=chrome.0.0i512j0i22i30l7j0i22i30i457j0i22i30.6488j1j7&sourceid=chrome&ie=UTF-8

OUTCOMES:

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

1. Remember various vulnerabilities of computer network systems, as well as the different modes of attack. (K1)
2. Understand design techniques to prevent security attacks. (K2)
3. Summarize about the emerging security solutions for Web and Email. (K2)
4. Apply and Build disaster recovery and fault tolerance systems. (K3)
5. Identify the need for information security compliance, forensics and security. (K3)
6. Understand Network Security Tools and Applications. (K2)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - IV

20CSEL801 SDG NO. 4 & 10	GREEN COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamentals of Green Computing
- To analyze the Green computing Grid Framework
- To understand the issues related with Green compliance
- To study and develop various case studies

UNIT I FUNDAMENTALS **9**

Green IT Fundamentals: Business - IT and the Environment – Green Computing: Carbon Foot Print - Scoop on Power – Green IT Strategies - Drivers - Dimensions and Goals – Environmentally Responsible Business - Policies - Practices and Metrics

UNIT II GREEN ASSETS AND MODELING **9**

Green Assets: Buildings - Data Centers - Networks and Devices – Green Business Process Management - Modeling - Optimization and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems - Design and Development Models

UNIT III GRID FRAMEWORK **9**

Virtualization of IT systems – Role of Electric Utilities - Telecommuting - Teleconferencing and Teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework

UNIT IV GREEN COMPLIANCE **9**

Socio cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols - Standards and Audits – Emergent Carbon Issues - Technologies and Future.

UNIT V CASE STUDIES **9**

The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home - Hospital - Packaging Industry and Telecom Sector

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Bhuvan Unhelkar "Green IT Strategies and Applications" Using Environmental Intelligence, CRC Press, June 2014.

2. Woody Leonhard, Katherine Murray "Green Home computing for dummies", August 2012.

REFERENCES:

1. Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey '', Shroff IBM/rebook, 2011.
2. John Lamb, " The Greening of IT" Pearson Education, 2009.
3. Jason Harris "Green Computing and Green ITBest Practices on regulations & industry", Lulu.com, 2008
4. Carl Speshocky "Empowering Green Initiatives with IT" John Wiley & Sons, 2010.
5. Wu Chun Feng (editor) "Green computing: Large Scale energy efficiency", CRC Press

WEB REFERENCES:

1. https://www.tutorialspoint.com/environmental_studies/environmental_studies_towards_sustainable_future.htm
2. https://www.javatpoint.com/green-computing

OUTCOMES:

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

1. Understand green computing fundamentals to minimize negative impacts on the environment (K2)
2. Discuss Green Assets, Green Process Management towards optimization and collaboration (K2)
3. Develop models that can reduce paper waste and carbon footprint for Green Information System (K3)
4. Explain different ways towards green PC, green Data Centre and green Grid (K2)
5. Summarize cultural aspects, protocols and standards of green computing (K2)
6. Apply Green IT Strategies to various sectors to create green society (K3)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - IV

20CSEL802 SDG NO. 4 & 9	DEEP LEARNING PRINCIPLES AND PRACTICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the concepts of Deep Learning
- To introduce Dimensionality Reduction techniques
- To illustrate Deep Learning techniques to support Real-time applications
- To examine the case studies of Deep Learning techniques

UNIT I INTRODUCTION **9**

Introduction to Machine Learning-Linear Models - SVMs – Perceptrons - Logistic Regression -Introduction to Neural Networks - Shallow Network - Training a Network - Loss Functions - Back Propagation and Stochastic Gradient Descent-Neural Networks as Universal Function.

UNIT II CONCEPTS OF DEEP LEARNING **9**

History of Deep Learning - Probabilistic Theory of Deep Learning - Back Propagation –Regularization –Batch Normalization-VC Dimension - Neural Networks-Deep Vs Shallow Networks- Convolutional Networks-Generative Adversarial Networks (GAN) - Semi-supervised Learning.

UNIT III METRIC LEARNING **9**

Principle Component Analysis – Linear Discriminant Analysis- Manifolds - Metric Learning -Auto Encoders -Dimensionality Reduction in Networks - Introduction to Convolution Network - Architectures – Alex Net – Visual Geometry Group –Inception– Residual Network.

UNIT IV OPTIMIZATION **9**

Optimization in Deep Learning–Non-Convex Optimization for Deep Networks- Stochastic optimization-Generalization in Neural Networks-Spatial Transformer Networks-Recurrent networks – Long Short Term Memory - Recurrent Neural Network Language Models-Word Level.

UNIT V ADVANCED TECHNIQUES **9**

ImageNet - Object Detection - Audio WaveNet - Natural Language Processing - Word2Vec Model -Joint Detection-Bio Informatics-Face Recognition-Scene Understanding-Gathering Image Captions.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Cosma Rohilla Shalizi, "Advanced Data Analysis from an Elementary Point of View", Carnegie Mellon University, Cambridge University Press (March 21, 2021); eBook.
2. Deng and Yu, "Deep Learning: Methods and Applications", Now Publishers, 2013.

REFERENCES:

1. Ethem Alpaydin, "Introduction to Machine Learning (Adaptive Computation and Machine Learning)", The MIT Press 2004.
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", CRC Press, 2009.
3. Richard O. Duda, Peter E. Hart, David G. Stork, "Pattern Classification", Wiley, Second Edition.
4. Christopher Bishop, "Pattern Recognition and Machine Learning", illustrated Edition, Springer, 2006.
5. Ian Goodfellow and Yoshua Bengio and Aaron Courville, "Deep Learning (Adaptive Computation and Machine Learning series)", An MIT Press book, 2016.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106105215/
2. https://nptel.ac.in/courses/106106201/
3. https://www.coursera.org/specializations/deep-learning

ONLINE RESOURCES:

1. https://www.simplilearn.com/deep-learning-tutorial
2. https://www.tutorialspoint.com/machine_learning/deep_machine_learning.htm

OUTCOMES:

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

1. Differentiate various learning approaches and to interpret the concepts of Machine Learning. (K2)
2. Understand the history of Deep Learning and theory behind Deep Learning techniques and analyze it.(K2)
3. Compare the different Dimensionality Reduction techniques and study about Convolution network technique.(K2)
4. Illustrate the working of Optimization techniques in Deep Learning.(K3)
5. Identify the case studies in Deep Learning and identify its applicability in real life problems.(K3)
6. Examine advanced techniques in Deep Learning like image detection, Bio Informatics-Face Recognition.(K3)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - IV

20CSEL803 SDG NO. 4 & 9	BLOCK CHAIN AND CRYPTO CURRENCY TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand how Block Chain systems (Bitcoin and Ethereum) work
- To securely interact with them
- Design, build, deploy Smart Contracts and Distributed applications
- Integrate ideas from Block Chain technology into their own projects

UNIT I BASICS **9**

Distributed Database - Two General Problem - Byzantine General Problem and Fault Tolerance - Hadoop Distributed File System - Distributed Hash Table - ASIC Resistance - Turing Complete - Cryptography - Hash Function - Digital Signature - ECDSA – Memory Hard Algorithm-Zero Knowledge Proof.

UNIT II BLOCK CHAIN 9

Introduction, Advantage Over Conventional Distributed Database - Block Chain Network – Mining Mechanism – Distributed Consensus Merkle Patricia Tree - Gas Limit - Transactions and Fee - Anonymity - Reward - Chain Policy - Life of Block Chain Application - Soft & Hard Fork - Private and Public Block Chain.

UNIT III DISTRIBUTED CONSENSUS 9

Nakamoto Consensus - Proof of Work - Proof of Stake - Proof of Burn - Difficulty Level- Sybil Attack - Energy Utilization and Alternate.

UNIT IV CRYPTOCURRENCY 9

Crypto Currency: History - Distributed Ledger - Bit coin Protocols - Mining Strategy and Rewards - Ethereum - Construction, - DAO - Smart Contract - GHOST - Vulnerability - Attacks - Side Chain, Name coin

UNIT V CRYPTO CURRENCY REGULATION AND BLOCK CHAIN APPLICATIONS 9

Crypto Currency Regulation: Stakeholders - Roots of Bit coin- Legal Aspects - Crypto Currency Exchange-Black Market and Global Economy-Block chain Applications: Internet of Things-Medical Record Management System-Domain Name Service - Future of Block Chain.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Crypto Currency Technologies: A Comprehensive Introduction", Princeton University Press (July 19,2016).
2. Narayanan et al., "Bit coin and Crypto currency Technologies: A Comprehensive Introduction," Princeton University Press, 2016.

REFERENCES:

1. Antonopoulos, "Mastering Bit coin: Unlocking Digital Crypto currencies", O'Reilly Media Inc., 2015.
2. Dr. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger," Yellow paper, 2014.
3. Mastering Bitcoin: Unlocking Digital Crypto currencies, by Andreas M Antonopoulos 2018.
4. Henning Diedrich, Ethereum: Block chains, Digital Assets, Smart Contracts, and Decentralized Autonomous Organizations-2016.
5. Don and Alex Tapscott, "Block chain Revolution". Portfolio Penguin 2016.

WEB REFERENCES:

1. https://www.blockchain.com/

ONLINE RESOURCES:

1. https://www.pwc.com/us/en/industries/financial-services/ fintech/ bitcoin-blockchain-cryptocurrency.html
2. https://www.investopedia.com/terms/b/blockchain.asp

OUTCOMES:

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

1. Understand Design principles of Bit coin and Ethereum. (K2)
2 Ability to extract the knowledge of Nakamoto consensus. (K2)
3 List and describe differences between proof-of-work and proof-of-stake consensus. (K1)
4 Design, build and deploy a Distributed application. (K3)
5 Ability to analyze the algorithms developed for bit coin mining. (K2)
6 Identify the security, privacy and efficiency of a given Block Chain system.(K1)

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

PROFESSIONAL ELECTIVES - IV

20CSEL804 SDG NO. 4 & 9	SOFTWARE QUALITY ASSURANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the basic tenets of software quality and quality factors.
- Be exposed to the Software Quality Assurance (SQA) architecture and the details of SQA components.
- Understand how the SQA components can be integrated into the project life cycle.
- Be familiar with the software quality infrastructure and exposed to the management components of software quality.

UNIT I INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE 9

Need for Software quality – Quality Challenges – Software Quality Assurance (SQA) – Definition and Objectives – Software Quality Factors- McCall's Quality Model – SQA System and Architecture – Software Project Life Cycle Components – Pre Project Quality Components – Development and Quality Plans.

UNIT II SQA COMPONENTS AND PROJECT LIFE CYCLE 9

Software Development Methodologies – Quality Assurance Activities in the Development Process- Verification & Validation – Reviews – Software Testing – Software Testing Implementations – Quality of Software Maintenance – Pre-Maintenance of Software Quality Components – Quality Assurance Tools – CASE Tools for Software Quality – Software Maintenance Quality – Project Management.

UNIT III SOFTWARE QUALITY INFRASTRUCTURE 9

Procedures and work instructions – Templates – Checklists – 3S Developmenting – Staff Training and Certification Corrective and Preventive Actions – Configuration Management – Software Change Control – Configuration Management Audit - Documentation Control – Storage and Retrieval.

UNIT IV SOFTWARE QUALITY MANAGEMENT & METRICS 9

Project Process Control – Computerized Tools - Software Quality Metrics – Objectives of Quality Measurement – Process Metrics – Product Metrics – Implementation – Limitations of Software Metrics – Cost of Software Quality – Classical Quality Cost Model – Extended Model – Application of Cost Model.

UNIT V STANDARDS, CERTIFICATIONS & ASSESSMENTS 9

Quality Management Standards – ISO 9001 and ISO 9000-3 – Capability Maturity Models – CMM and CMMI Assessment Methodologies - Bootstrap Methodology – SPICE Project – SQA Project Process Standards – IEEE st 1012 & 1028 – Organization of Quality Assurance – Department Management Responsibilities – Project Management Responsibilities – SQA Units and Other Actors in SQA Systems.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Daniel Galin, "Software Quality Assurance", Pearson Publication, 2009.
2. Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press, 1997.

REFERENCES:

1. Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press, 1997.
2. Milind Limaye, "Software Quality Assurance", TMH ,New Delhi, 2011
3. Claude Y. Laporte , Alain April, "Software Quality Assurance" , Wiley-IEEE Computer Society Pr, 1st Edition (January 4, 2018)
4. G. Gordon Schulmeyer, James I. McManus, "Handbook of Software Quality Assurance", Prentice Hall, 3rd Edition (8 September 1998).
5. R. Chopra , "Software Quality Assurance: A Self-Teaching Introduction" , Mercury Learning & Information, Illustrated Edition (13 April 2018)

WEB REFERENCES:

1. https://nptel.ac.in/courses/110105039/
2. https://nptel.ac.in/courses/106105087/

ONLINE RESOURCES:

1. http://www.softwareqatest.com/
2. https://www.tutorialride.com/software-testing/software-quality-assurance.html

OUTCOMES:

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

1. Utilize the concepts in software development life cycle.(K3)
2. Demonstrate their capability to adopt quality standards.(K2)
3. Estimate the quality of software products.(K3)
4. Apply the concepts in preparing the quality plan & documents.(K3)

5. Understand standards and certifications.(K2)
6. Apply techniques of quality assurance for typical applications(K3)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - IV

20CSEL805 SDG NO. 4 & 10	SPEECH PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamentals of Speech Processing
- To explore the various Speech Models, Phonetics and Pronunciation
- To perform Wavelet analysis of Speech
- To understand the concepts of Speech Recognition

UNIT I INTRODUCTION **9**

Introduction – Knowledge in Speech and Language Processing – Ambiguity – Models and Algorithms – Language – Thought – Understanding – Regular Expression And Automata – Words & Transducers – N Grams.

UNIT II SPEECH MODELLING **9**

Word Classes and Part of Speech Tagging – Hidden Markov Model - Computing Likelihood: The Forward Algorithm – Training Hidden Markov Model – Maximum Entropy Model – Transformation – Based Tagging – Evaluation and Error Analysis – Issues in Part of Speech Tagging – Noisy Channel Model for Spelling.

UNIT III SPEECH PRONUNCIATION AND SIGNAL PROCESSING 9

Phonetics – Speech Sounds and Phonetic Transcription – Articulatory Phonetics – Phonological Categories and Pronunciation Variation – Acoustic Phonetics and Signals.

UNIT IV SPEECH IDENTIFICATION 9

Speech Synthesis – Text Normalization - Phonetic Analysis – Prosodic Analysis – Diphone Waveform Synthesis – Unit Selection Waveform Synthesis – Evaluation.

UNIT V SPEECH RECOGNITION 9

Automatic Speech Recognition – Architecture – Applying Hidden Markov Model – Feature Extraction: Mfcc Vectors – Computing Acoustic Likelihoods – Search And Decoding – Embedded Training – Multipass Decoding: N-best Lists And Lattices – A*('stack') Decoding – Context-dependent Acoustic Models: Triphones –discriminative Training – Speech Recognition By Humans.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Daniel Jurafsky and James H.Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Pearson Education, 2013.
2. Rabiner/Yegnararayana, "Fundamentals of Speech Recognition", Pearson India, 1st Edition, 2008.

REFERENCES:

1. Kai-Fu Lee, "Automatic Speech Recognition", the Springer International Series in Engineering and Computer Science, 1999.
2. Himanshu Chaurasiya, "Soft Computing Implementation of Automatic Speech Recognition", LAP Lambert Academic Publishing, 2010.
3. Claudio Becchetti, Klucio PrinaRicotti, "Speech Recognition: Theory and C++ implementation", Wiley publications 2008.
4. Ikrami Eldirawy, Wesam Ashour, "Visual Speech Recognition",Wiley publications, 2011.
5. Thomas F.Quatieri, "Discrete-Time Speech Signal Processing: Principles and Practice", Pearson India, 1st Edition, 2003.

WEB REFERENCES:

1. https://www.sciencedirect.com/topics/neuroscience/speech-processing
2. https://nptel.ac.in/courses/117105145/

ONLINE RESOURCES:

1. https://www.cse.iitb.ac.in/~pjyothi/cs753/index.html
2. https://link.springer.com/chapter/10.1007/978-3-540-49127-9_1

OUTCOMES:

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

1. Understand the basic concepts in for Speech Processing.(K2)
2. Illustrate the various approaches in modeling the speech.(K3)
3. Describe the terms in language Phonetic. (K2)
4. Illustrate the wavelet approaches of Speech.(K3)
5. Enumerate the basics of Speech Recognition System.(K3)
6. Explain the decoding aspects of Speech Processing and Recognition. (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	-	-	3	2
CO2	3	2	3	2	2	-	-	-	2	3	2	-	2	3
CO3	2	1	3	-	-	-	-	-	-	-	-	-	2	2
CO4	3	3	3	2	2	-	-	-	2	2	2	-	3	2
CO5	3	2	2	-	-	-	-	-	2	2	-	-	2	3
CO6	2	1	2	1	-	-	-	-	1	-	1	-	2	2

PROFESSIONAL ELECTIVES - IV

20CSEL806 SDG NO. 4	COGNITIVE SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about theories, methods and discoveries in cognitive science, the historical context and the philosophical roots that allowed the rising of this multidisciplinary field of studies.
- To help students develop general scientific thinking and study skills that will be an important requirement for all the master courses
- To help students understand cognitive science application to real world artefacts.
- To help students to develop a critical approach to scientific research and literature

UNIT I INTRODUCTION TO COGNITIVE SCIENCE, PSYCHOLOGY, NERVOUS SYSTEM AND BRAIN 9

Introduction to the study of cognitive sciences. A brief history of cognitive science. Methodological concerns in philosophy, artificial intelligence and psychology. Structure and constituents of the brain; Brief history of neuroscience; Mathematical models; Looking at brain signals.

UNIT II BRAIN AND SENSORY MOTOR INFORMATION, REPRESENTATION OF SENSORY INFORMATION FROM SENSATION TO COGNITION AND ROOTS OF COGNITIVE SCIENCE 9

Processing of sensory information in the brain; Neural Network Models; Processing of sensory information in the brain; motor and sensory areas; Brain Imaging, fMRI, MEG, PET, EEG, Multisensory integration in cortex; information fusion; from sensation to cognition, cybernetics; From physics to meaning; Analog vs. Digital: Code duality

UNIT III LANGUAGE AND EMBODIMENT 9

What is language?; Linguistic knowledge: Syntax, semantics, (and pragmatics); Generative linguistics; Brain and language; Language disorders; Lateralization; The great past tense debate. Cognitivist and emergent standpoints; A robotic perspective

UNIT IV AFFORDANCE IN BIOLOGICAL AND ARTIFICIAL SYSTEM AND COGNITIVE DEVELOPMENT, ATTENTION 9

Affordances, direct perception, Ecological Psychology, affordance learning in robotics, Development, child and robotic development, Attention and related concepts; Human visual attention; Computational models of attention; Applications of computational models of attention.

UNIT V LEARNING –MEMORY AND REASONING 9

Categories and concepts; Concept learning; Logic ; Machine learning, Constructing memories; Explicit vs. implicit memory; Information processing (three-boxes) model of memory; Sensory memory; Short term memory; Long term memory, Rationality; Bounded rationality; Prospect theory ; Heuristics and biases; Reasoning in computers

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Gardner, The Mind's New Science, Gardner, Howard E, "The mind's new science: A history of the cognitive revolution", Basic books, 2008.
2. José Luis Bermú dez, "Cognitive Science: An Introduction to the Science of the Mind", Cambridge University Press, New York, 2014.

REFERENCES:

1. Michael I Posner, "The Foundations of Cognitive Science", MIT Press, Prentice October 1993
2. José Luis Bermú dez, "Cognitive Science: An Introduction to the Science of the Mind", Cambridge University Press, August 2010.
3. Gilbert Ryle, "The Concept of Mind", Cambridge University Press, 2003.
4. Pranjali Deshpande, Soudamini Patil, "Evolution of the Brain and Intelligence", Cambridge University Press, 2003.
5. Miller, Earl K., and Jonathan D. Cohen. "An Integrative Theory of Prefrontal Cortex Function." Annu Rev Neurosci 24 (2001): 167-202.
6. Bermudez Wallace, Mark T., and Barry E. Stein. "Sensory organization of the superior colliculus in cat and monkey." Progress in brain research 112 (1996): 301-311.

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc21_hs105/preview
2. https://onlinecourses.nptel.ac.in/noc20_hs29/preview

ONLINE RESOURCES:

1. https://en.wikipedia.org/wiki/Cognitive_science
2. https://plato.stanford.edu/entries/cognitive-science/
3. https://cognitivesciencesociety.org/
4. https://www.forcepoint.com/cyber-edu/cognitive-science

OUTCOMES:

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

1. Compare and contrast different philosophical views on the nature of mind.(K3)
2. Apply basic Artificial Intelligence techniques to solve some simple problems.(K3)
3. Interpret findings from cognitive psychology and cognitive neuroscience.(K3)
4. Discuss social, evolutionary, and other ecological aspects of cognition.(K2)
5. Promote cognitive science.(K1)
6. Understand the concept of memory.(K1)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - IV

20CSEL807 SDG NO. 4 & 9	COMPUTER VISION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To review image processing techniques for Computer Vision
- To understand shape and region analysis
- To understand Hough Transform and its applications to detect lines, circles, ellipses
- To understand three-dimensional Image Analysis & Motion Analysis techniques

UNIT I IMAGE PROCESSING FOUNDATIONS 9

Review of Image Processing Techniques – Classical Filtering Operations – Thresholding Techniques – Edge Detection Techniques – Corner and Interest Point Detection – Mathematical Morphology – Texture.

UNIT II SHAPES AND REGIONS 9

Binary Shape Analysis – Connectedness – Object Labeling and Counting – Size Filtering – Distance Functions – Skeletons and Thinning – Deformable Shape Analysis – Boundary Tracking Procedures – Active Contours – Shape Models And Shape Recognition – Centroidal Profiles – Handling Occlusion – Boundary Length Measures – Boundary Descriptors – Chain Codes – Fourier Descriptors – Region Descriptors – Moments.

UNIT III HOUGH TRANSFORM 9

Line Detection – Hough Transform (HT) for Line Detection – Foot-of-normal Method – Line Localization – Line Fitting – Ransac for Straight Line Detection –

HT Based Circular Object Detection – Accurate Center Location – Speed Problem – Ellipse Detection – Case Study: Human Iris Location– Hole Detection – Generalized Hough Transform (GHT) – Spatial Matched Filtering – GHT for Ellipse Detection – Object Location – GHT for Feature Collation.

UNIT IV 3D VISION AND MOTION **9**

Methods for 3D Vision – Projection Schemes – Shape from Shading – Photometric Stereo – Shape from Texture – Shape from Focus – Active Range Finding – Surface Representations – Point-based Representation – Volumetric Representations – 3D Object Recognition – 3D Reconstruction – Introduction to Motion – Triangulation – Bundle Adjustment – Translational Alignment – Parametric Motion – Spline-based Motion – Optical Flow – Layered Motion.

UNIT V APPLICATIONS **9**

Application: Photo Album – Face Detection – Face Recognition – Eigen Faces – Active Appearance And 3D Shape Models of Faces Application: Surveillance – Foreground - Background Separation – Particle Filters – Chamfer Matching - Tracking - and Occlusion – Combining Views From Multiple Cameras – Human Gait Analysis Application - In-vehicle Vision System - Locating Roadway – Road Markings – Identifying Road Signs – Locating Pedestrians.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. 1. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press, 2017.
2. R. Szeliski, "Computer Vision: Algorithms and Applications", Springer 2011.

REFERENCES:

1. D. L. Baggio et al., "Mastering Open CV with Practical Computer Vision Projects", Packt Publishing, 2012.
2. Jan Erik Solem, "Programming Computer Vision with Python: Tools and algorithms for analyzing images", O'Reilly Media, 2012.
3. Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", Third Edition, Academic Press, 2012.
4. Simon J. D. Prince, "Computer Vision: Models, Learning and Inference", Cambridge University Press, 2012.
5. David Forsyth and Jean Ponce ," Computer Vision: A Modern Approach", Second Edition, Pearson, 2011

WEB REFERENCES:

1. https://nptel.ac.in/courses/106105216/
2. https://nptel.ac.in/courses/106105032/

3. https://swayam.gov.in/nd1_noc19_cs58/preview
4. http://www.cse.iitd.ernet.in/~suban/vision/index.html
5. http://www.cse.iitm.ac.in/~vplab/courses/CV_DIP/PDF/INTRO_CV.pdf

ONLINE RESOURCES:

1. https://youtu.be/715uLCHt4jE
2. https://www.coursera.org/lecture/deep-learning-in-computer-vision/introduction-to-video-analysis-alApg
3. https://www.coursera.org/lecture/introduction-computer-vision-watson-opencv/applications-of-computer-vision-EEDvi
4. https://www.analyticsvidhya.com/blog/2020/01/computer-vision-learning-path-2020/

OUTCOMES:

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

1. Implement fundamental image processing techniques required for computer vision.(K3)
2. Perform shape analysis, Implement boundary tracking techniques & Apply chain codes and other region descriptors.(K3)
3. Apply Hough Transform for line, circle, and ellipse detections.(K3)
4. Apply 3D vision techniques.(K3)
5. Design of a computer vision system for identification and recognition of objects.(K4)
6. Implement motion related techniques & Develop applications using computer vision techniques.(K3)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - IV

20CSEL808 SDG NO. 4	SCIENTIFIC VISUALIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the various types of Data
- To apply and evaluate the principles of Data Visualization.
- To acquire skills to apply Visualization Techniques to a problem and its associated dataset.
- To apply structured approach to create effective visualizations thereby building visualization dashboard to support decision making.

UNIT I INTRODUCTION TO DATA VISUALIZATION 9

Overview of Data Visualization - Data Abstraction -Analysis: Four Levels for Validation- Task Abstraction - Analysis: Four Levels for Validation.

UNIT II VISUALIZATION TECHNIQUES 9

Scalar and Point Techniques Color Maps Contouring Height Plots - Vector Visualization Techniques - Vector Properties – Vector Glyphs - Vector Color Coding - Stream Objects.

UNIT III VISUAL ANALYTICS 9

Visual Variables - Networks and Trees - Map Color and Other Channels- Manipulate View - Arrange Tables - Geo Spatial data - Reduce Items and Attributes.

UNIT IV VISUALIZATION TOOLS AND TECHNIQUES 9

Introduction to Data Visualization Tools- Tableau - Visualization Using R- Time- Series Data Visualization - Text Data Visualization -Multivariate Data Visualization and Case Studies.

UNIT V VISUALIZATION DASHBOARD CREATIONS 9

Dashboard Creation Using Visualization Tools for the Use Cases: Finance- Marketing-Insurance Healthcare-Service and Support- Human Resources - Management -Procurement -IT

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Tamara Munzer, "Visualization Analysis and Design" (AK Peters Visualization Series), CRC Press 2014.
2. Alexandru Telea, "Data Visualization Principles and Practice", CRC Press 2014.

REFERENCES:

1. Brodlie, K.W., Carpenter, L.A., Earnshaw, R.A., Gallop, J.R., Hubbold, R.J., Mumford, A.M., Osland, C.D., Quarendon, P, "Scientific Visualization", Springer, 1992.
2. Foley, Van Dam, Feiner and Hughes, "Computer Graphics Principles & practice", second edition in C, Pearson Education, July 2013.
3. Helen Wright , "Introduction to Scientific Visualization Paperback – Illustrated", Springer, 29 November 2006
4. N.M Patrikalakis, Scientific Visualization of Physical Phenomena, Springer-Verlag.
5. Claus O. Wilke, Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures, March 2019, Oreilly.

WEB REFERENCES:

1. https://www.coursera.org/lecture/data-visualization-science-communication/introduction-to-scientific-visualization-vniPb
2. https://www.edx.org/course/data-science-visualization

ONLINE RESOURCES:

1. https://web.cse.ohio-state.edu/~crawfis.3/cis694L/index.html.
2. https://engineering.purdue.edu/online/courses/introduction- scientific-isualization
3. https://www.heavy.ai/technical-glossary/scientific-visualization

OUTCOMES:

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

1. Identify the different data types, attributes, identify and create various Visualizations for geospatial and table data.(K1)
2 Interpret the categorical, quantitative and text data. (K3)
3 Illustrate the integration of Visualization tools with Hadoop. (K3)
4 Design visualization dashboard to support the decision-making on large scale data. (K3)
5 Match the knowledge gained with the industries latest technologies and ability to create and interpret plots using R/Python. (K3)
6 Understand the characteristics and methods that are needed for the visualization of geospatial data. (K2)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - IV

20CIEL801 SDG NO. 4	OPEN SOURCE INTELLIGENCE (OSINT)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the open source intelligence and its work flow process
- To apply and evaluate the search tools.
- To acquire skills to apply web intelligencet.
- To approach privacy and security to support OSNIT.

UNIT I EVOLUTION OF OPEN SOURCE INTELLIGENCE 9

Open Source Information Categories, OSINT Types, Digital Data Volume, OSINT Organizations, Parties Interested in OSINT Information, Information Gathering Types, Benefits of OSINT, Challenges of Open Source Intelligence, Legal and Ethical Constraints

UNIT II SEARCH TOOLS 9

General Search, Meta Search, Visual Search and Clustering Engines, Decentralized Search Engines, Charitable Search Engines, Code Search, File and FTP Search, Open Database, Directories and Services Search

UNIT III WEB INTELLIGENCE 9

Researching Domains, SEO Tools, Analyzing Unique IDs, Subdomain Enumeration, Identifying Backlinks, Site Mapping Tools, Identifying Publish Date, Extracting Files, Analyzing URLs, Search Engines, Exploit Search Engines, General Webint Tools and Toolkits, Multipurpose OSINT Frameworks.

UNIT IV PRIVACY AND SECURITY **9**

Secure Operating Systems, Secure Browsers, Protecting Personal Data, Working with Incognito Mode, Cloud Storage Encryption, Secure File Sharing, Privacy-First E-mail Providers and Encrypting E-mails, Secure Communication Tools, Anti-Malware / Spyware, Dealing with Ransomware, Anti-Theft Software, Copyright Infringement, Plagiarism and Takedowns

UNIT V OSINT WORKFLOW PROCESSES **9**

Email Addresses, User Names, Real Names, Telephone Numbers, Domain Names, Locations.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Open Source Intelligence Techniques: Resources for Searching and Analyzing Online Information by Michael Bazzell
2. Open Source Intelligence Methods and Tools A Practical Guide to Online Intelligence by Nihad A. Hassan Rami Hijazi, Apress

REFERENCES:

1. Open Source Intelligence Methods and Tools A Practical Guide to Online Intelligence by Nihad A. Hassan Rami Hijazi, Apress

WEB REFERENCES:

1. https://www.udemy.com/course/osint-open-source-intelligence/?couponCode=NVDPRODIN35
2. https://elearn.nptel.ac.in/shop/iit-workshops/completed/open-source-tools-for-cyber-security/

ONLINE RESOURCES:

1. https://www.classcentral.com/subject/osint

OUTCOMES:

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

1. Identify the evolution , benefits and interested parties of open source intelligence.(K1)
2. Interpret the search tools required for open source intelligence. (K2)
3. Illustrate the requirements in web intelligence. (K2)
4. Acquired know on the privacy in operating system. (K2)
5. Design the security required in pen source intelligence. (K3)
6. Understand the workflow processes in open source intelligence. (K3)

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

PROFESSIONAL ELECTIVES - IV

20CIEL802 SDG NO. 4	DIGITAL TWIN TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce digital twin concepts and their applications in industry.
- To familiarize with trends in discrete Industry
- To be acquainted with digital twin in process industry.
- To impart knowledge in Industry 4.0
- To elaborate the advantages of digital twin.

UNIT I INTRODUCTION **9**

Digital twin - Definition, types of Industry & its key requirements, Importance, Application of Digital Twin in process, product, service industries, History of Digital Twin, DTT role in industry innovation, Technologies/tools enabling Digital Twin

UNIT II DIGITAL TWIN IN DISCRETE INDUSTRY **9**

Basics of Discrete Industry, Trends in the discrete industry, control system requirements in a discrete industry, Digital Twin of a Product, Digital Thread in Discrete Industry, Data collection & analysis for product & production improvements, Automation simulation, Digital Enterprise

UNIT III DIGITAL TWIN IN A PROCESS INDUSTRY **9**

Basics of Process Industry, Trends in the process industry, control system requirements in a process industry, Digital Twin of a plant, Digital Thread in process Industry, Data collection & analysis for process improvements, process safety, Automation simulation, Digital Enterprise

UNIT IV INDUSTRY 4.0 **9**

Industrial Revolutions, Industry 4.0 – Definition, principles, Application of Industry 4.0 in process & discrete industries, Benefits of Industry 4.0, challenges in Industry 4.0, Smart manufacturing, Internet of Things, Industrial Gateways, Basics of Communication requirements.

UNIT V ADVANTAGES OF DIGITAL TWIN **9**

Improvement in product quality, production process, process Safety, identify bottlenecks and improve efficiency, achieve flexibility in production, continuous prediction and tuning of production process through Simulation, reducing the time to market.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Alp Ustundag and Emre Cevikcan, "Industry 4.0: Managing The Digital Transformation", Springer Series in Advanced Manufacturing., Switzerland, 2017
2. Andrew Yeh Chris Nee, Fei Tao, and Meng Zhang, "Digital Twin Driven Smart Manufacturing", Elsevier Science., United States, 2019

REFERENE BOOKS:

1. Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things", Apress., United States , 2015.
2. Christoph Jan Bartodziej, "The Concept Industry 4.0 An Empirical Analysis of Technologies and Applications in Production Logistics", Springer Gambler., Germany, 2017.
3. Ibrahim Garbie, "Sustainability in Manufacturing Enterprises, Concepts, analyses and assessments for Industry 4.0", Springer., Switzerland, 2016.
4. Ronald R. Yager and Jordán Pascual Espada, "New Advances in the Internet of Things", Springer., Switzerland, 2018
5. Ulrich Sendler, "The Internet of Things, Industries 4.0 Unleashed", Springer., Germany, 2016.

OUTCOMES:

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

1. Acquire knowledge on digital twin and its importance.(K2)
2. Support digital twin in discrete Industry.(K2)
3. Value digital twin in process industry.(K2)
4. Operate Industry 4.0 and Smart Manufacturing in Industry.(K2)
5. Discover the advantages of digital twin.(K2)

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

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

Chairman & CEO – Sairam Institutions

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College Campus
Sai Leo Nagar, West Tambaram,
Chennai - 600 044. Ph : 044-2251 2222

Administrative Office
"Sai Bhavan", 31B, Madley Road, T.Nagar,
Chennai - 600 017. Ph : 044-4226 7777

e-mail : sairam@sairamgroup.in

www.sairamgroup.in