



Sri

SAI RAM
ENGINEERING COLLEGE

An Autonomous Institution

West Tambaram, Chennai - 44

www.sairam.edu.in

Approved by AICTE, New Delhi
Affiliated to Anna University



DEPARTMENT OF
**INFORMATION
TECHNOLOGY**

**REGULATIONS
2020**

Academic Year 2020-21 onwards

AUTONOMOUS
CURRICULUM AND

SYLLABUS
I - VIII
SEMESTERS

SRI SAIRAM ENGINEERING COLLEGE



VISION

To emerge as a "Centre of excellence " offering Technical Education and Research opportunities of very high standards to students, develop the total personality of the individual and instill 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 INFORMATION TECHNOLOGY



VISION

To emerge as a "Centre of Excellence in the field of IT" offering Technological Education and Research opportunities of high standards to students, develop high degree of digital knowledge and skillset, making our students technologically superior and ethically strong, who in turn shall contribute to the advancement of society and humankind.



MISSION

Department of Information Technology, Sri Sairam Engineering College is committed to

- M1** Provide quality education in Information Technology and also create technologically new and intellectually inspiring environment
- M2** Focus on research and development of technologies by engaging in value added courses and on evolution of digital environment.
- M3** Design and Develop state-of-the art on learning, creativity, innovation and inculcate in them ethical, social and moral values.
- M4** Establish continuous Industry Institute Interaction, participation and collaboration to contribute job oriented skilled IT Engineers by improving their entrepreneurial skills.

AUTONOMOUS CURRICULUM AND SYLLABI

Regulations 2020

SEMESTER I

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20BSMA101	Engineering Mathematics-I	3	1	0	4	4
2	20HSEN101	Technical English-I	3	0	0	3	3
3	20BSPH101	Engineering Physics	3	0	0	3	3
4	20BSCY101	Engineering Chemistry	3	0	0	3	3
5	20ESCS101	Problem solving and Programming in C	3	0	0	3	3
6	20ESGE101	Engineering Graphics	1	2	0	3	3
PRACTICAL							
7	20BSPL101	Physics and Chemistry Lab	0	0	3	3	1.5
8	20ESPL101	Programming in C lab	0	0	3	3	1.5
VALUE ADDITIONS - I							
9	20TPHS101	Skill Enhancement	0	0	2	2	1
10	20HSMG101	Personal Values	2	0	0	2	0
TOTAL						29	23

SEMESTER II

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

SEMESTER III

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20BSMA304	Statistics and Linear Algebra	3	1	0	4	4
2	20ITPC301	Data Structures	3	0	0	3	3
3	20CSPC301	Object Oriented Programming	2	1	0	3	3
4	20ITPC302	Software Engineering	3	0	0	3	3
5	20ITPC303	Computer Organization and Architecture	3	0	0	3	3
6	20ESEC301	Communication Engineering	3	0	0	3	3
PRACTICAL							
7	20ITPL301	Data Structures Laboratory	0	0	3	3	1.5
8	20CSPL301	Object Oriented Programming Laboratory	0	0	3	3	1.5
9	20ITTE301	Live-in-Lab – 1	0	0	2	2	1
VALUE ADDITIONS - III							
8	20ITTP301	Skill Enhancement	0	0	2	2	1
9	20MGMC301	Constitution of India	2	0	0	2	0
TOTAL						31	24

SEMESTER IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20BSMA402	Probability and queuing Theory	3	1	0	4	4
2	20CSPC402	Database Management Systems	3	0	0	3	3
3	20ITPC401	Design and Analysis of Algorithms	2	1	0	3	3
4	20CSPC401	Operating Systems	3	0	0	3	3
5	20CSPW401	Computer Networks with Laboratory	3	0	2	5	4
PRACTICAL							
6	20CSPL402	Database Management Systems Laboratory	0	0	3	3	1.5
7	20CSPL401	Operating Systems Laboratory	0	0	3	3	1.5
8	20ITTE401	Live-in-Lab 2	0	0	2	2	1
VALUE ADDITIONS - IV							
9	20ITTP401	Skill Enhancement	0	0	2	2	1
TOTAL						28	22

SEMESTER V

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20ITPW501	Statistical Analysis using R Programming with Laboratory	3	0	2	5	4
2	20ITPW502	Object Oriented Analysis and Design with Laboratory	3	0	2	5	4
3	20ITPC501	Web Technology	3	0	0	3	3
4	20ITPC502	Big Data Essentials	3	0	0	3	3
5	20ESEC502	Microprocessors and Microcontrollers	3	0	0	3	3
PRACTICAL							
6	20ITPL501	Web Technology Laboratory	0	0	4	4	2
7	20ESPL501	Microprocessors & Microcontrollers Laboratory	0	0	3	3	1.5
8	20ITTE501	Live-in-Lab III	0	0	4	4	2
VALUE ADDITIONS - V							
9	20ITTP501	Skill Enhancement	0	0	2	2	1
TOTAL						32	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	20ITPC601	Cloud Computing and Virtualization	3	0	0	3	3
3	20HSMG601	Principles of Engineering Management	3	0	0	3	3
4	20XXELXXX	Professional Elective - I	3	0	0	3	3
5	20XXOEXXX	Open Elective - I	3	0	0	3	3
PRACTICAL							
6	20HSPL501	Communication and Soft Skills Lab	0	0	2	2	1
7	20ITPL602	Cloud Computing & Virtualization Laboratory	0	0	3	3	1.5
8	20CSPL601	Artificial Intelligence Laboratory	0	0	3	3	1.5
9	20ITPJ601	Innovative Design Project	0	0	2	2	1
VALUE ADDITIONS - VI							
10	20ITTP601	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	20ITPC701	Cryptography and Network Security	3	0	0	3	3
2	20ITPC702	Data Science with Machine Learning	3	1	0	4	4
3	20XXELXXX	Professional Elective II	3	0	0	3	3
4	20XXELXXX	Professional Elective III	3	0	0	3	3
5	20XXOEXXX	Open Elective - II	3	0	0	3	3
PRACTICAL							
6	20ITPL701	Cryptography and Network Security Lab	0	0	3	3	1.5
7	20ITPL702	Data Science Laboratory	0	0	3	3	1.5
8	20ITPJ701	Project Phase - I	0	0	4	4	2
VALUE ADDITIONS - VII							
9	20ITTP701	Skill Enhancement	0	0	2	2	1
TOTAL						28	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	20ITPJ801	Project Phase - II	3	0	0	8	4
TOTAL						11	7

CREDIT DISTRIBUTION

Category	BS	ES	HS	EL	PC+PL	PW	OE	TE	PJ	TP	IS	MC	TOTAL
Credit	29.5	25.5	10	12	54	12	6	4	7	7	3	Y	170
Percentage	17.4	15.0	5.9	7.0	31.7	7.0	3.5	2.3	4.1	4.1	1.7	-	

*IS-Internship

PROFESSIONAL ELECTIVES - I

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20ITEL601	Software Testing	3	0	0	3	3	Computing & Infor. Systems
2	20ITEL602	Compiler Design	3	0	0	3	3	Computing & Infor. Systems
3	20ITEL603	Cyber Security and Forensics	3	0	0	3	3	Data Analytics & Security
4	20ITEL604	Network Programming Protocols and Standards	3	0	0	3	3	Cloud Computing
5	20CSEL501	Data Warehousing and Data Mining	3	0	0	3	3	AI & Machine Learning
6	20ITEL605	Visualization Techniques	3	0	0	3	3	Data Analytics & Security
7	20ITEL606	Mobile Application Development with Laboratory	2	0	1	3	3	Internet of Things
8	20ITEL607	Embedded Systems	3	0	0	3	3	Internet of Things
9	20ITEL608	Fundamentals of Edge and Soft Computing	3	0	0	3	3	AI & Machine Learning
10	20ITEL609	NoSQL Database Techniques	3	0	0	3	3	Cloud Computing
11	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	20ITEL701	C# and .Net Programming with Laboratory	2	0	1	3	3	Computing & Information Systems
2	20ITEL702	Wireless Ad hoc and Sensor Networks	3	0	0	3	3	Internet of Things
3	20ITEL703	Information Storage and Management	3	0	0	3	3	Cloud Computing
4	20ITEL704	Fundamentals of block chain technology with Laboratory	3	0	0	3	3	Data Analytics & Security
5	20ITEL705	Applied Machine Learning	3	0	0	3	3	AI Machine Learning
6	20CSEL703	Information Retrieval Techniques	3	0	0	3	3	Data Analytics & Security
7	20CSEL701	Social Network Analysis	3	0	0	3	3	AI & Machine Learning
8	20ITEL706	Computer Graphics and Multimedia	3	0	0	3	3	Computing & Information Systems
9	20ITEL707	Robotic Process Automation	3	0	0	3	3	Internet of Things
10	20ITEL708	Full Stack Software Development	3	0	0	3	3	Cloud Computing
11	20MGEL601	Total Quality Management	3	0	0	3	3	Management

PROFESSIONAL ELECTIVES - III

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20MEPC702	Robotics and Applications	3	0	0	3	3	Internet of Things
2	20ITEL709	Internet of Things	3	0	0	3	3	Internet of Things
3	20ITEL710	Service Oriented Architecture	3	0	0	3	3	Cloud Computing
4	20CSEL704	Natural Language Processing	3	0	0	3	3	AI & Machine Learning
5	20CSEL802	Deep Learning Principles & Practices	3	0	0	3	3	AI & Machine Learning
6	20CSEL607	Agile Methodologies	3	0	0	3	3	Computing & Infor. Systems
7	20CSEL604	Bio Informatics	3	0	0	3	3	Data Analytics & Security
8	20CSEL601	Software Project Management	3	0	0	3	3	Computing & Infor. Systems
9	20ITEL711	Storage Area Network	3	0	0	3	3	Cloud Computing
10	20ITEL712	Digital Forensics And Cyber Laws	3	0	0	3	3	Data Analytics & Security
11	20MGEL701	Foundation Skills in Integrated Product Development	3	0	0	3	3	Management

PROFESSIONAL ELECTIVES - IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20ITEL801	Free and Open Source Software Tools	3	0	0	3	3	Cloud Computing
2	20ITEL802	Virtual and Augmented Reality	3	0	0	3	3	Internet of Things
3	20ITEL803	Intrusion Detection Systems	3	0	0	3	3	Data Analytics & Security
4	20CSEL702	Software Defined Networks	3	0	0	3	3	Cloud Computing
5	20ITEL804	Digital Image Processing	3	0	0	3	3	Computing & Infor. Systems
6	20ITEL805	Information System Audit	3	0	0	3	3	Computing & Infor. Systems
7	20ITEL806	Pattern Recognition Techniques	3	0	0	3	3	AI & Machine Learning
8	20CSEL809	Game Programming	3	0	0	3	3	AI & Machine Learning
9	20ITEL807	IoT Based Smart Systems	3	0	0	3	3	Internet of Things
10	20ITEL808	Web Security	3	0	0	3	3	Data Analytics & Security
11	20MGEL801	Professional Ethics and Values	3	0	0	3	3	Management

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- PEO1** Graduates will embed in applying the mathematical and engineering knowledge in solving problems in digital environment and understanding Industrial requirements
- PEO2** Graduates will excel in Research, designing & developing solution for complex problems in the field of IT by adapting to the rapid technological advancements, thereby increasing industrial collaboration.
- PEO3** Graduates are inculcated with lifelong learning to function as an individual or team with ethics & social responsibility, for the advancement of society and service to humankind.
- PEO4** Graduates are trained in technical skills using modern tools to solve real time problems and evolve as entrepreneurs in the field of Information Technology.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Information Technology Program Students will be able to:

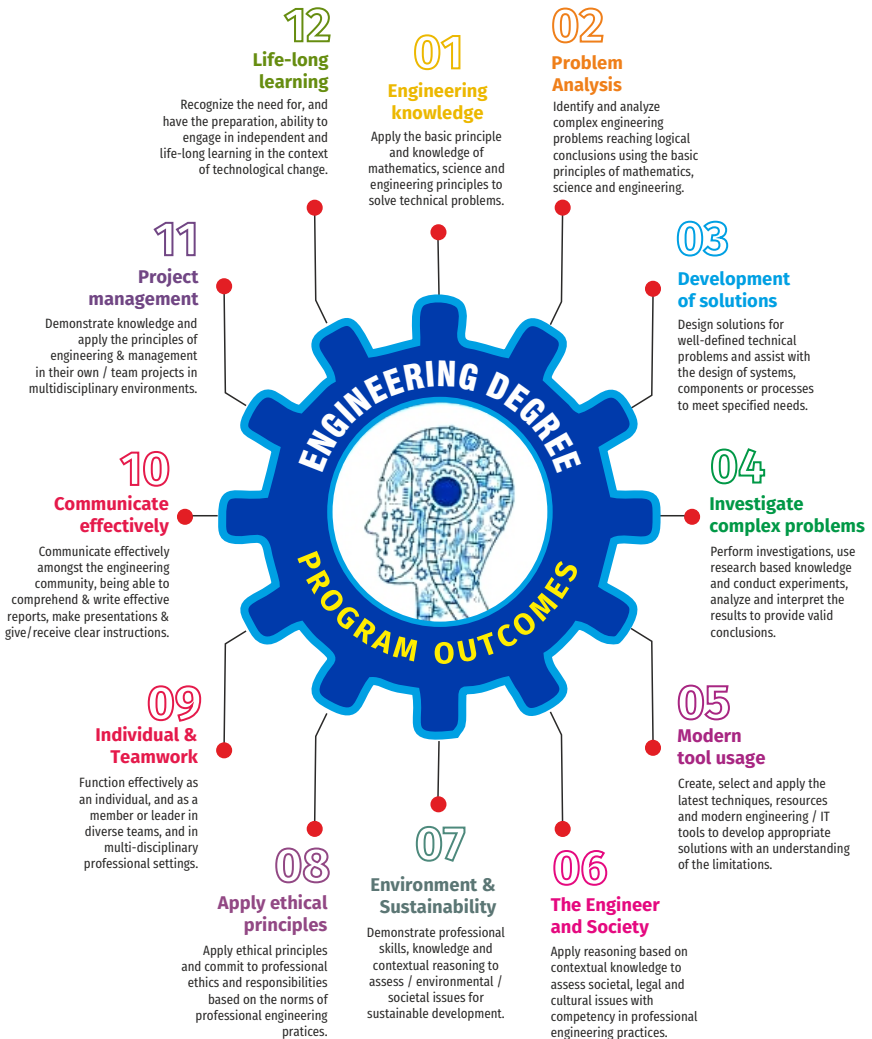
- PSO 1** Ability to build network based web application using different secured software design concepts
- PSO 2** Ability to design, implement and test information systems architecture to meet specific software requirements following the ethical values

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)	17.4	31	29.5
Engineering Sciences(ES)	15.0	33	25.5
Humanities and Social Sciences (HS)	5.9	12	10
Professional Electives(EL)	7.0	9	12
Program Core+Program Lab (PC+PL)	31.7	71	54
Program theory with Lab (PW)	7.0	15	12
Open Electives (OE)	3.5	06	6
Talent Enhancement (TE)	2.3	08	4
Project (PJ)	4.1	14	7
Training & Placement (TP)	4.1	14	7
Internships/Seminars (IS)	1.7	-	3
Mandatory Courses (MC)	NA	06	NA
Total number of Credits		219	170

PROGRAMME OUTCOMES(POs)

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



SEMESTER - I

20BSMA101 SDG NO. 4 & 9	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 - CO₂ 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.

- P.A. Tipler & G. Mosca "Physics for Scientists and Engineers", W.H.Freeman, 2020.
- Brijlal and Subramanyam, "Properties of Matter", S. Chand Publishing, 2018.
- Shatendra Sharma & Jyotsna Sharma, "Engineering Physics", Pearson, 2018.

OUTCOMES:

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

- To understand the crystal systems and elastic properties of Materials (K2)
- To distinguish different crystal structures and heat conduction in conductor and insulators (K4)
- To explain powder diffraction method-deformation of materials in response to action load, quantum mechanics to understand wave particle dualism (K2)
- 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)
- To analyze bending of beams, types of optical fiber and modes of heat transfer (K4)
- 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" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015.
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.
4. Ravikrishnan A, 'Engineering Chemistry', Sri Krishna Hitech Publishing Company Pvt. Ltd, New Edition 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	PS01	PS02
C01	3	3	3	3	2	1	1	-	2	2	-	3	2	3
C02	3	3	3	3	2	-	1	1	2	2	3	3	2	3
C03	3	3	3	3	2	1	1	1	2	-	3	-	3	2
C04	3	3	3	3	2	1	-	1	2	2	3	3	1	2
C05	3	3	3	3	2	1	1	1	2	2	3	3	2	1
C06	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. Jeyapooan, "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
C01	3	2	2	-	-	-	-	-	2	2	-	2	2	2
C02	3	2	2	-	-	-	-	-	2	2	-	2	2	2
C03	3	2	2	-	-	-	-	-	2	2	-	2	2	2
C04	3	2	2	-	-	-	-	-	2	2	-	2	2	2
C05	3	2	2	-	-	-	-	-	2	2	-	2	2	2
C06	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

TEXTBOOKS:

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)

- Interpret quantitative chemical analysis to generate experimental skills in building technical competence. (K3)
- Analyze the quality of water for domestic and industrial purpose. (K3)
- 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

- Write a program using I/O statements and expressions.
- Write programs using decision-making constructs.
- Write a program to find whether the given year is leap year or not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)

4. Write a program to perform the Calculator operations, namely, addition, subtraction, multiplication, division and square of a number.
5. Write a program to check whether a given number is Armstrong number or not?
6. Write a program to check whether a given number is odd or even?
7. Write a program to find the factorial of a given number.
8. Write a program to find out the average of 4 integers.
9. Write a program to display array elements using two dimensional arrays.
10. Write a program to perform swapping using function.
11. Write a program to display all prime numbers between two intervals using functions.
12. Write a program to reverse a sentence using recursion.
13. Write a program to get the largest element of an array using the function.
14. Write a program to concatenate two string.
15. Write a program to find the length of String.
16. Write a program to find the frequency of a character in a string.
17. Write a program to store Student Information in Structure and Display it.
18. The annual examination is conducted for 10 students for five subjects. Write a program to read the data and determine the following:
 - (a) Total marks obtained by each student.
 - (b) The highest marks in each subject and the marks of the student who secured it.
 - (c) The student who obtained the highest total marks.
19. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.
20. Count the number of account holders whose balance is less than the minimum balance using sequential access file.

TOTAL: 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C compiler

30 Nos.

(or)

Server with C compiler supporting 30 terminals or more.

OUTCOMES:

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

1. Solve some simple problems leading to specific applications. (K3)
2. Demonstrate C programming development environment, compiling, debugging, linking and executing a program. (K3)

3. 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
C01	3	3	3	3	2	1	1	-	2	2	-	3	2	3
C02	3	3	3	3	2	-	1	1	2	2	3	3	2	3
C03	3	3	3	3	2	1	1	1	2	-	3	-	3	2
C04	3	3	3	3	2	1	-	1	2	2	3	3	1	2
C05	3	3	3	3	2	1	1	1	2	2	3	3	2	1
C06	3	3	3	3	2	1	1	1	2	2	3	3	3	2

SEMESTER - I

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

OBJECTIVES:

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

UNIT I SOCIAL NETWORK ETIQUETTES**6**

Introduction to social network – Social Networking Etiquettes - Pros and Cons - Usage of Facebook, Instagram, WhatsApp, Telegram, Youtube, Evolution of Android and IOS, Introduction to LinkedIn & Benefits. (Practicals – Official Mail id- LinkedIn Id Creation, LinkedIn Profile Building, 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 compiler 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\](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
C01	-	-	-	-	-	2	2	3	3	1	1	1
C02	-	-	-	-	-	2	2	3	3	1	1	1
C03	-	-	-	-	-	2	2	3	3	1	1	1
C04	-	-	-	-	-	2	2	3	3	1	1	1
C05	-	-	-	-	-	2	2	3	3	1	1	1
C06	-	-	-	-	-	2	2	3	3	1	1	1

SEMESTER - II

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

OBJECTIVES:

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

UNIT I RELATION AND FUNCTION 12

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

UNIT II COMBINATORICS 12

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

UNIT III LOGICS AND PROOFS 12

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

UNIT IV ALGEBRAIC STRUCTURES 12

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

UNIT V GRAPHS AND TREES 12

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

TOTAL: 60 PERIODS

TEXT BOOKS:

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

REFERENCES:

1. Susanna S. Epp, "Discrete Mathematics with Applications", 4th edition, Brooks/Cole, Cengage Learning, 2010.
2. Norman L. Biggs, "Discrete Mathematics", 2nd Edition, Oxford University Press, 2002.
3. Seymour Lipschutz, Marc Lipson, "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/~aralal/book/mth202.pdf>

ONLINE RESOURCES:

1. https://www.youtube.com/watch?v=h_9WjWENWV8&list=PL3o9D4DI2FJ9q0_gtFXPh_H4POI5dK0yG
2. <https://www.youtube.com/watch?v=xIUfKMKSB3Y&list=PL0862D1A947252D203>.
3. https://www.youtube.com/watch?v=4LITmsfDS4Y&list=PLEAYkSg4uSQ2Wfc_l4QEZUSRdx2ZcFziO&index=13
4. <https://www.youtube.com/watch?v=jBsEKyx6Rj0&list=PLwdnzlV3ogoVxVxCTlI45pDVM1aoYoMHf>
5. <https://www.youtube.com/watch?v=rdXw7Ps9vxc&list=PLHXZ90QGMqxersk8fUxiUMSIx0DBqsKZS>

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=EAlaIQobChMI49DF9bnd6AIVSY6PCh1d_gV9EAAAYASAAEgIBPvD_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

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

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-Hill Education, 2017.
3. Kittel, C., "Introduction to Solid State Physics", Wiley, 2018.
4. S.O.Pillai, "Solid State Physics, New Academic Science", 2017.
5. D.K.Bhattacharya & 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.

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

OUTCOMES:

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

- Explain the different components of environment, structure and function of an ecosystem, importance of biodiversity and its conservation. (K1)
- Aware about problems of environmental pollution, its impact on human and ecosystem, control measures and basic concepts in Disaster Management. (K2)
- Disseminate the need for the natural resources and its application to meet the modern requirements and the necessity of its conservation. (K2)
- 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)
- 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", 2nd 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
C01	3	-	-	-	-	-	-	-	-	-	-	3	-	-
C02	-	2	-	-	-	-	-	-	-	-	3	1	-	-
C03	-	2	3	-	-	-	-	-	-	-	3	1	-	-
C04	-	-	-	-	-	-	-	-	-	-	3	-	-	-
C05	-	-	-	-	1	-	-	-	-	-	-	2	-	-
C06	-	-	-	-	-	-	-	-	-	-	3	-	-	-

SEMESTER - II

20ESGE201 SDG NO. 4,9,12	ENGINEERING PRACTICES				L	T	P	C
	LABORATORY				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	2 Nos
	Digital Live-wire detector	2 Nos

2. Electronics

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

3. Civil

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

4. Mechanical

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

OUTCOMES:

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

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

CO - PO, PSO 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

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

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/subtractor
 - 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
C01	2	3	3	2	2	1	1	-	2	2	-	2	1	1
C02	3	3	3	2	3	2	1	1	2	2	2	3	1	1
C03	2	3	3	3	3	2	2	1	2	2	2	3	1	1
C04	3	3	3	3	3	2	2	1	3	3	3	3	1	1
C05	2	3	3	2	2	-	-	2	-	2	2	2	1	1
C06	2	3	3	2	2	1	-	-	2	2	3	2	1	1

SEMESTER - II

20TPHS201 SDG NO. 4&5	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

OBJECTIVES:

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

UNIT I RESUME BUILDING**6**

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

UNIT II VIRTUAL MEETINGS**6**

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

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

UNIT III ONLINE LEARNING**6**

Online Certification - Coursera - Udemy - Edx - Cisco - Online Practice Platforms - SkillRack - Myslate - FACEprep - BYTS - aptimithra - Contest

Registrations - TCS Campus Commune - HackwithInfy, InfyTQ - Virtusa NurualHack - Mindtree Osmosis – Online assessment - AMCAT-PGPA.

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

UNIT IV GOOGLE SUITE

8

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

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

UNIT V PRESENTATION SKILLS

4

Email Writing – Group Discussion - Power Point Presentation (Practicals- Create a self SWOT Analysis report. A PowerPoint Slide Preparation)

TOTAL : 30 PERIODS

WEB REFERENCES :

Unit I: Resume Building:

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

Unit – II:Virtual Meetings

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

Unit – III:Online Learning

1. <https://www.coursera.org/browse>
2. <https://support.udemy.com/hc/en-us/articles/229603868-Certificate-of-Completion>

3. <https://www.edx.org/course/how-to-learn-online>
4. <https://www.cisco.com/c/en/us/training-events/training-certifications/certifications.html>
5. <https://campuscommune.tcs.com/en-in/intro>
6. <https://www.freshersnow.com/tcs-campus-commune-registration/>
7. <https://www.infosys.com/careers/hackwithinfy.html>
8. <https://www.mindtree.com/blog/osmosis-2013-my-experiences>
9. <https://www.myamcat.com/knowing-amcat>
10. <https://www.admitkard.com/blog/2020/02/06/amcat/>

Unit IV: Google Suite

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

Unit V: Presentation Skills

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

OUTCOMES:

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

1. Construct a suitable resume and registration procedure for online mock assessments. (K1)
2. Handle various virtual meeting tools. (K3)
3. Acquire exposure about online certification courses. (K4)
4. Get involved and work in a collaborative manner. (K2)

5. Gain knowledge in various presentation methodologies. (K1)
6. Apply knowledge to practice Google suite features and SWOT analysis. (K3)

CO – PO MAPPING:

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

SEMESTER - II

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

OBJECTIVES:

- Values through Practical activities

UNIT I INTERPERSONAL VALUES**6**

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

UNIT II EFFECTIVE COMMUNICATION**6**

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

UNIT III GROUP DYNAMICS**6**

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

UNIT IV MUTUAL RELATIONSHIP**6**

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

UNIT V POSITIVE ATTITUDE**6**

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

TOTAL: 30 PERIODS

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

REFERENCE BOOKS:

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

OUTCOMES:

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

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

CO – PO MAPPING :

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

SEMESTER - III

20BSMA304 SDG NO. 4	STATISTICS AND LINEAR ALGEBRA	L	T	P	C
		3	1	0	4

OBJECTIVES:

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

UNIT I BASIC STATISTICS

12

Measures of Central tendency: Moments, Skewness and Kurtosis - Probability distributions - Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation

UNIT II TESTING OF HYPOTHESIS

12

Sampling distributions - Estimation of parameters - Statistical hypothesis - Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means - Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independence) - Goodness of fit.

UNIT III VECTOR SPACES

12

Vector spaces – Subspaces – Linear combinations– Linear independence and linear dependence – Bases and dimensions.

UNIT IV LINEAR TRANSFORMATION AND DIAGONALIZATION

12

Linear transformation - Null spaces and ranges - Dimension theorem - Matrix of a linear transformation - Eigenvalues and eigenvectors - Diagonalizability.

UNIT V INNER PRODUCT SPACES

12

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

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Michael Baron, "Probability and Statistics for Computer Scientists" second edition, CRC press, USA (Unit-I&II)
2. Howard Anton, Chris Rorres, "Elementary Linear Algebra", Wiley Publications, 11th edition, 2014 (Unit-III, IV&V)

REFERENCES:

1. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics", Tata McGraw Hill Edition, 2004.
2. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.
3. Kapur J. N., Saxena H.C., "Mathematical Statistics", 18th Edition, S. Chand & Company Ltd., 1997.
4. Friedberg A.H., Insel A.J. and Spence L., "Linear Algebra", Prentice Hall of India, New Delhi, 2014.
5. Strang G., "Linear Algebra and its applications", Thomson (Brooks/Cole), New Delhi, 2005.
6. Kumaresan S., —"Linear Algebra – A Geometric Approach", Prentice – Hall of India, New Delhi, Reprint, 2010.
7. E. Kreyszig, "Advanced Engineering Mathematics", 8th Edition, John Wiley, 1999.

WEB REFERENCES:

1. <https://people.richland.edu/james/lecture/m113/>
2. <https://nptel.ac.in/courses/111105041/>
3. <https://www.imsc.res.in/~svis/Algebra/Sunder-LinearAlg-notes.pdf>

ONLINE RESOURCES:

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

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

1. Evaluate the statistical parameters of some standard discrete and continuous distributions in solving real life problems and the relationship between variables. (K3)
2. Apply the concepts of testing of hypotheses for large and small samples in testing the real life problems. (K3)
3. Compute the basis and dimension of a vector space. (K3)
4. Compute the matrix of a Linear transformation and examine the diagonalizability of a Linear transformation. (K3)
5. Determine an orthonormal basis of a linear transformation using Gram Schmidt orthogonalization process and fitting of curve by Least square approximations. (K3)

CO – PO MAPPING:

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

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, Sartaj Sahni, 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

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 - 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 MULTITHREADING 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 LAMBDA 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.

TEXT BOOKS:

1. Herbert Schildt, “JavaThe Complete Reference”, 10th Edition, McGrawHill Education,2017.
2. E.Balagursamy, “Programming with Java 6th Edition, McGrawHill Education, 2019.

REFERENCES:

1. Paul Deitel, HarveyDeitel, “Java SE 8 for Programmers”, 3rd Edition, Pearson, 2015.
2. Steven Holzner, ”Java 2Blackbook”, Dream Tech, Press, 2011.
3. Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education,2000.

WEB REFERENCES:

1. https://www.w3schools.com/java/java_oop.asp
2. <https://www.edureka.co/blog/object-oriented-programming/>

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, student 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

20ITPC302 SDG NO. 4	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To address the real time complex engineering problems using innovative approaches with strong core computing skills
- To apply core-analytical knowledge and appropriate techniques and provide solutions to real time challenges of national and global society
- Apply ethical knowledge for professional excellence and leadership for the betterment of the society
- Develop life-long learning skills needed for better employment and entrepreneurship

UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT**9**

Introduction to Software Engineering - Software Process - Perspective and

Specialized Process Models – Introduction to Agility - Agile process - Extreme programming - XP Process.

UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION 9

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

UNIT III SOFTWARE DESIGN 9

Design process – Design Concepts - Design Model – Design Heuristic – Architectural Design - Architectural styles - Architectural Design - Architectural Mapping using Data Flow - User Interface Design: Interface analysis, Interface Design – Component level Design: Designing Class based components, traditional Components.

UNIT IV TESTING AND MAINTENANCE 9

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

UNIT V PROJECT MANAGEMENT 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Roger S. Pressman, “Software Engineering – A practitioner's Approach”, Seventh Edition, McGraw-Hill International Edition, 2005
2. Ian Sommerville, “Software Engineering”, Seventh Edition, Pearson Education Asia, 2007.

REFERENCES:

1. Rajib Mall, “Fundamentals of Software Engineering”, Third Edition, PHI Learning Private Limited, 2009.
2. Pankaj Jalote, “Software Engineering - A Precise Approach”, Wiley India, 2010.

3. Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007.
4. Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited, 2007.

WEB REFERENCES:

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

ONLINE RESOURCES:

1. http://www.vssut.ac.in/lecture_notes/lecture1428551142.pdf
2. <https://freevideolectures.com/course/2318/software-engineering>
3. <https://courses.cs.washington.edu/courses/cse403/01au/lectures/>
4. <https://cosmolearning.org/courses/introduction-to-software-engineering/video-lectures/>
5. <https://www.ece.rutgers.edu/~marsic/books/SE/instructor/slides/>

OUTCOMES:

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

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

CO- PO, PSO MAPPING :

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

SEMESTER - III

20ITPC303 SDG NO. 4 & 9	COMPUTER ORGANIZATION AND ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the basic structure and operations of a Computer
- To study the implementation of Fixed-Point and Floating Point Arithmetic unit
- To understand Parallelism and Multi-core processors using Pipelined execution
- To understand the Cache memories, Virtual memories and Communication of I/O devices

UNIT I BASIC STRUCTURE OF A COMPUTER SYSTEM 7

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

UNIT II ARITHMETIC OPERATIONS IN PROCESSORS 11

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

UNIT III PROCESSOR AND CONTROL UNIT 11

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

UNIT IV PARALLELISM 7

Parallel Processing Challenges – Flynn's classification – SISD, MIMD, SIMD, SPM and Vector Architectures – Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors – Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.

UNIT V MEMORY AND I/O SYSTEMS 9

Memory Hierarchy – memory technologies – Cache Memory – Measuring and Improving Cache Performance – Virtual Memory, TLB's – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Bus Operation – Arbitration – Interface circuits – USB.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Fifth Edition, Morgan Kaufmann / Elsevier, 2014.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw Hill, 2012.

REFERENCES:

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

WEB REFERENCES:

1. <https://nptel.ac.in/courses/106/106/106106147/>

OUTCOMES:

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

1. Understand the physical and logical aspects of Computer System (K2)
2. Analyze the various parameters of the processor to improve system performance. (K4)
3. Evaluate the fixed and floating point arithmetic operations. (K5)
4. Design data path and control unit of computer system (K6)
5. Understand parallel processing architectures with pipelining and avoidance of hazards (K2)
6. Define the various components of computer system hardware (K1)

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	2	1	-	-	-	-	-	-	-	-	1	2	3
C02	3	3	2	-	-	-	-	-	-	-	-	2	3	3
C03	3	3	3	-	-	-	-	-	-	-	-	2	3	3
C04	3	3	3	-	-	-	-	-	-	-	-	3	3	3
C05	3	1	1	-	-	-	-	-	-	-	-	3	3	3
C06	3	1	1	-	-	-	-	-	-	-	-	3	2	3

SEMESTER - III

20ESEC301 SDG NO. 4	COMMUNICATION ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study the various analog and digital modulation techniques
- To study the principles behind information theory and coding
- To study the various digital communication techniques

UNIT I ANALOG MODULATION**9**

Amplitude Modulation – AM, DSBSC, SSBSC, VSB-Modulators and Demodulators – Angle modulation – PM and FM -Modulators and Demodulators – Super heterodyne receivers.

UNIT II PULSE MODULATION**9**

Low pass sampling theorem – Quantization – PAM, PTM – Line coding – PCM, DPCM, DM & ADM - Time Division Multiplexing, Frequency Division Multiplexing.

UNIT III DIGITAL MODULATION AND TRANSMISSION**9**

Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase shift keying – BPSK, QPSK, 8 PSK. QAM-8 QAM, 16 QAM – Comparison of various digital communication system, Inter Symbol Interference– Eye pattern.

UNIT IV INFORMATION THEORY AND CODING**9**

Measure of information – Entropy – Source coding theorem – Shannon–Fano coding, Huffman Coding , Mutual Information, Channel capacity – Error control codes-Linear block codes, Cyclic codes, Syndrome calculation – Convolution Coding.

UNIT V WIRELESS COMMUNICATION**9**

Spread Spectrum and Multiple Access Techniques –Global system for Mobile Communication (GSM)-Cellular Concept and Frequency Reuse-Satellite Communication-Bluetooth.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Wayne Tomasi, "Advanced Electronic Communication Systems", Sixth Edition, Pearson Education, 2007.
2. Simon Haykin, "Communication Systems", Fourth Edition, John Wiley & Sons. 2001.
3. H Taub, D L Schilling, G Saha, "Principles of Communication Systems" Third Edition, TMH2007

REFERENCES:

1. S. Haykin "Digital Communications" John Wiley, 2005.
2. B.Sklar, Digital Communications Fundamentals and Applications", Second Edition, Pearson Education, 2007.
3. B.P.Lathi, "Modern Digital and Analog Communication Systems", Third Edition, Oxford University Press, 2007
4. H P Hsu, Schaum Outline Series – "Analog and Digital Communications" TMH, 2006.

ONLINE RESOURCES:

1. <https://freevideolectures.com/search/communication-engineering/>
2. https://www.tutorialspoint.com/principles_of_communication/index.htm

WEB RESOURCES:

1. https://swayam.gov.in/nd1_noc20_ee16/preview
2. <https://www.scientechworld.com/education-software-training-and-skill-development/sku-online-learning/analog-and-digital-communication>

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

- 1 Interpret various modulation techniques to model a communication system (K3)
- 2 Discuss angle modulation techniques and compare various analog modulation techniques. (K2)
- 3 Interpret the performance of digital modulation schemes such as BPSK, BFSK, QPSK, DPSK & QAM. (K3)
- 4 Illustrate and compare the Encoding schemes such as PCM, DPCM, DM & ADM and different waveform coding schemes. (K3)
- 5 Infer the channel coding theorem and error control coding and decoding schemes like block codes, hamming codes, cyclic codes, convolutional codes and viterbi decoder. (K2)

- 6 Analyze the different multiple access Techniques, cellular concept and free reuse for wireless communication. (K4)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	3	-	3	-	-	3	-	-	-	-	-	1
C02	3	3	3	-	3	-	-	3	-	-	1	1	-	1
C03	3	3	3	2	-	-	-	-	-	-	-	1	2	1
C04	3	3	2	1	-	-	-	-	-	-	-	1	2	1
C05	3	3	3	2	-	-	-	-	-	-	-	1	2	1
C06	3	3	3	3	-	-	1	2	-	3	2	1	2	1

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:**On completion of this laboratory course, the student 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
C01	2	3	1	2	1	1	-	-	-	-	2	2	2	2
C02	2	3	2	2	2	1	-	-	-	-	2	3	2	2
C03	3	3	2	2	1	1	-	-	-	-	2	2	2	2
C04	3	3	2	2	1	1	-	-	-	-	2	3	2	2
C05	1	2	2	1	2	1	-	-	-	-	1	1	2	2
C06	1	2	2	1	1	-	-	-	-	-	1	1	2	2

SEMESTER - III

20CSPL301 SDG NO. 4 & 9	OBJECT ORIENTED PROGRAMMING				L	T	P	C
	LABORATORY				0	0	3	1.5

OBJECTIVES:

- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of Packages, Inheritance and Interfaces
- To develop a Java application with Threads and Generic classes
- To make the students understand life cycle of the Applets and its functionality

LIST OF EXPERIMENTS :

1. Basic JAVA Programs
 - a. Write a program to find the sum of individual digits of a positive integer.
 - b. Write a program to generate the first n terms of the sequence.
 - c. Write a program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
 - d. Write a program to find both the largest and smallest number in a list of integers.
 - e. Write a program to find factorial of list of number reading input as command.
2. Write a program to calculate bonus for different departments using method overriding.
3. Write a program to sort list of elements in ascending and descending order and show the exception handling.
4. Write a program to implement the concept of importing classes from user defined package and creating packages.
5. Write programs that illustrate how the following forms of inheritance are supported:
 - a) Single inheritance
 - b) Multiple inheritance
 - c) Multi level inheritance
 - d) Hierarchical inheritance
6. Write a program to demonstrate use of implementing interfaces.
7. Write a program to implement interfaces all string operations.
8. Write a program to create student report using applet, read the input using text boxes and display the output using buttons.
9. Write a program to implement thread priorities.
10. Write a program to implement thread, applets and graphics to animate ball movement.
11. JAVA Applet program
 - a) Write a Applet program using paint brush
 - b) Write a program to display analog clock using Applet
 - c) Write a program to create different shapes and fill colors using Applet
12. JAVA Event Handling program
 - a) Write a program that display the x and y position of the cursor movement using Mouse
 - b) Write a program that identifies key-up key-down event user entering text in a Applet

13. JAVA programs on Swings

- Write a program to build a Calculator in Swings
- Write a program to display the digital watch in swing
- Write a program that to create a single ball bouncing inside a JPanel.
- Write a program JTree as displaying a real tree upside down

TOTAL : 45 PERIODS**LAB REQUIREMENTS:****Hardware :**

Desktop Systems - Pentium IV with 2 GB RAM

160 GB HARD Disk

Monitor 1024 x 768 colour

Software :

Windows operating system

JDK 1.8

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

- Write Java programs in accordance with the object oriented programming concepts. (K6)
- Design user defined java packages. (K6)
- Create Java programs using Inheritance and Polymorphism. (K6)
- Implement Error-handling techniques using Exception handling and Multithreading. (K6)
- Develop Applet program and GUI using Swing components. (K6)
- Enumerate the event handling techniques in Java Programming. (K5)

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

SEMESTER - III

20ITTE301 SDG NO. 4,11 &15	LIVE-IN-LAB - I	L	T	P	C
		0	0	2	1

OBJECTIVES:

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

COURSE PLAN :

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

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

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

EVALUATION:

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

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

OUTCOMES:**Upon completion of the course, 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
C01	3	3	2	2	2	2	2	2	3	2	2	3	3	3
C02	3	3	3	2	3	3	2	2	3	3	3	3	3	3
C03	3	3	3	2	3	3	2	2	3	3	3	3	3	3
C04	2	2	2	1	2	1	1	1	3	2	3	3	3	2
C05	2	2	2	1	2	1	1	1	3	2	3	3	3	2
C06	2	2	2	1	2	1	1	1	3	2	3	3	3	2

SEMESTER - III

20ITTP301 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

APTITUDE & COGNITIVE SKILLS – PHASE 1

OBJECTIVE:

- To educate and enrich the students on quantitative ability, reasoning ability, and verbal ability.
- 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 AND PYTHON FOR DATA SCIENCE – 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 understand the basic process of data sciences
- To use Python and Open Source Tools to read datasets and load datasets using pandas
- To provide hands on experience in C and Python programming

UNIT I INTRODUCTION TO PRINCIPLES OF PROGRAMMING 6

Introduction to Programming - Programming Domain – Artificial Intelligence - Systems Programming - Assembly Level Languages - Problem solving using Algorithms and Flowcharts.

UNIT II INTRODUCTION TO C PROGRAMMING 6

Features of C and its Basic Structure - Simple C programs – Constants - Integer Constants - Real Constants - Character Constants - String Constants - Floating-point Numbers - The type cast Operator - Interactive Programming.

Operators Expressions and Control statement - The goto statement - The if statement - The if-else statement - Nesting of if statements - The conditional expression - The break statement and continue statement.

UNIT III ARRAYS, STRINGS AND POINTERS 6

Arrays - Multidimensional Arrays – Strings - Basics of Pointers - Pointer Arithmetic - Similarities between Pointers - One-dimensional Arrays.

Structures, Unions and Functions: Basics of Structures - Arrays of Structures - Pointers to Structures - Function Basics - Function Prototypes - Passing Parameters - Structures and Functions Recursion.

UNIT IV INTRODUCTION TO PYTHON AND DATA SCIENCE 6

Python Basics and Data Structures - Introduction to Data Science - Working with Data in Python.

UNIT V DATA HANDLING WITH PYTHON 6

Dataset Reading - Loading with Pandas - Data Filtering , Cleaning and Manipulation using Pandas - Data Visualizations - Report Generations.

TOTAL : 30 PERIODS

REFERENCES:

1. Balagurusamy, "Programming in ANSI C", Tata McGraw-Hill Education, 2008.
2. Stephen G. Kochan & Sams, "Programming in C", 3rd Edition, Pearson Education, 2004.
3. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, Numpy and IPython", O'reilly Publication, 2nd Edition, 2017.

ONLINE RESOURCES:

1. https://www.tutorialspoint.com/python_data_science/index.htm
2. <https://tanthiamhuat.files.wordpress.com/2018/04/pythondata-sciencehandbook.pdf>

COURSE OUTCOMES:

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

1. Analyze their quantitative ability. (K4)
2. Understand the ability of arithmetic reasoning along with creative thinking and problem solving skills. (K2)
3. Create their verbal ability through vocabulary building and grammar. (K6)
4. Evaluate the situations to analyse the computational methods in order to identify and abstract the programming task involved. (K5)
5. Analyse 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. Understand the data manipulation and visualization. (K2)

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 - III

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.

- R.C. Agarwal, (1997) "Indian Political System", S. Chand and Company, New Delhi.
- M.V. Pyle (2019) , "An Introduction to The Constitution of India, 5/e", Vikas Publishing, New Delhi.
- P.M. Bakshi, (2018) , "Constitution of India", Universal Law Publishing, New Delhi.

REFERENCES:

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

OUTCOMES:

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

- Explain the Constitution and Fundamental rights of citizens (K2)
- Discuss the structure, hierarchy and functions of Central Government (K2)
- Explain the functions of Supreme Court and Judiciary Systems in the state (K2)
- Discuss the structure, hierarchy and functions of State Government (K2)
- Recall the Centre-State relationship, constitutional amendments and functionaries (K1)
- 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 - IV

20BSMA402 SDG NO. 4	PROBABILITY AND QUEUEING THEORY	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To impart necessary basic knowledge in Probability theory, Random Processes and Queueing models which are invariably used in Computer science courses

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 – Correlation and Linear Regression – Transformation of Random Variables – Central Limit Theorem (for independent and identically distributed random variables).

UNIT III RANDOM PROCESSES 12

Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions.

UNIT IV QUEUEING MODELS 12

Markovian queues – Birth and Death processes – Single and multiple server Queueing models – Little's formula - Queues with finite waiting rooms –Self-service model.

UNIT V ADVANCED QUEUEING MODELS 12

Finite source models - M/G/1 queue – Pollaczek-Khinchin formula - M/D/1 and M/EK/1 as special cases – Series queues – Open Jackson networks.

TOTAL: 60 PERIODS

TEXT BOOKS:

- 1 Ibe, O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Indian Reprint, 2007. (1.1-1.3, 1.6, 1.7 - 1.7.1, 1.8, 1.13 - Exercise problems in the above sections; 2.1 – 2.8, 3.1 – 3.5, 3.9, 4.1 - 4.3, 4.4 - 4.4.2, 4.7 – 4.11, 5.1 - 5.7, 6.1 – 6.3, 6.8, 6.10, 8.1 - 8.5, 10.5 (10.5.1 -

10.5.6), 10.6, 10.7 – 10.7.1-10.7.5) (Units I, II & III).

2. Gross, D., Shortle, J.F, Thompson, J.M and Harris. C.M., “Fundamentals of Queueing Theory”, Wiley Student 4th Edition, 2014. (1.1 – 1.5, 1.7, 2.1 – 2.7, 4.1, 4.2, 5.1 – 5.1.1) (Units IV and V)

REFERENCES:

1. Hwei Hsu, “Schaum's Outline Theory and Problems of Probability, Random variables and Random Processes”, Tata Mcgraw Hill Edition, New Delhi, 2004.
2. Taha, H.A., “ Operations Research”, 9th Edition , Pearson India Education Services, Delhi, 2016.
3. Trivedi, K.S., “Probability and Statistics with Reliability, Queueing and Computer Science Applications”, 2nd Edition, John Wiley and Sons, 2002.
4. Yates, R.D. and Goodman. D.J., “Probability and Stochastic Processes”, 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.
5. Veerarajan T., “Probability and Statistics, Random Processes and Queueing Theory”, TataMc-Graw Hill Education Pvt. Ltd., New Delhi

WEB REFERENCES:

1. <https://nptel.ac.in/courses/117103017/>
2. <https://nptel.ac.in/courses/111105041/>
3. <http://home.iitk.ac.in/~skb/ee679/ee679.html>

ONLINE RESOURCES:

1. <https://freevideolectures.com/course/3066/performance-evaluation-of-computer-systems/5>
2. <https://freevideolectures.com/course/3066/performance-evaluation-of-computer-systems/6>

OUTCOMES:

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

1. Apply the knowledge of basic concepts of probability, one dimensional random variables and standard distributions in real life situations. (K3)
2. Study the relationship between two random variables and transformation by applying its basic concepts. (K3)
3. Apply the concepts of random processes in engineering disciplines. (K3)
4. Acquire the skills in analyzing Markovian queueing models. (K3)
5. Analyze the behavior of Non-Markovian queueing models, series queues and open networks. (K3)

CO- PO MAPPING :

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

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 refine the database system. (K1)
3. Demonstrate various SQL queries for the Transaction Processing & Locking using concept of Concurrency control. (K2)
4. Build the query processing techniques for the optimization of SQL queries. (K3)
5. Implement the indexing and hashing techniques for the organisation of database records. (K3)
6. Illustrate how the advanced databases differ from the traditional databases. (K2)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	1	1	1	2	1	0	0	0	0	0	0	2	2
C02	2	2	2	2	1	1	0	0	0	0	0	0	2	2
C03	2	1	2	1	2	1	0	0	0	0	0	0	2	2
C04	2	2	2	2	1	1	0	0	0	0	0	0	2	2
C05	2	2	2	2	1	1	0	0	0	0	0	0	2	2
C06	2	2	2	1	2	1	0	0	0	0	0	0	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 TECHNIQUES

9

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

UNIT IV ITERATIVE IMPROVEMENT

8

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

UNIT V COPING WITH THE LIMITATIONS OF ALGORITHM POWER 9

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

TOTAL: 45 PERIODS**TEXT BOOKS:**

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

REFERENCES:

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

WEB REFERENCES:

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

ONLINE RESOURCES:

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

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 BOOK :

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. Achyut S. Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.
3. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Pearson Education, 2004.
4. Gary Nutt, "Operating Systems", Third Edition, Pearson Education, 2004.
5. Harvey M. Deitel, "Operating Systems", Third Edition, Pearson Education, 2004.

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
C01	3	3	1	-	1	-	1	1	-	-	-	1	2	2
C02	3	3	3	2	2	-	1	1	-	-	-	1	2	2
C03	3	3	2	2	2	-	1	1	-	-	-	1	2	2
C04	2	2	3	2	2	-	1	1	-	-	-	1	2	2
C05	3	3	3	2	2	-	1	1	-	-	-	1	2	2
C06	3	3	2	2	2	-	1	1	-	-	-	1	2	2

SEMESTER - IV

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

OBJECTIVES:

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

UNIT I INTRODUCTION AND PHYSICAL LAYER**9**

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

UNIT II DATA LINK LAYER & MEDIA ACCESS**9**

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

UNIT III NETWORK LAYER**9**

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

UNIT IV TRANSPORT LAYER**9**

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

UNIT V APPLICATION LAYER**9**

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

LIST OF EXPERIMENTS:**15**

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

TOTAL: 60 PERIODS**LAB REQUIREMENTS:**

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

TEXT BOOKS:

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

REFERENCES:

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

5. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks ", 5th edition, Pearson Education, 2011

WEB REFERENCES:

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

ONLINE RESOURCES:

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

OUTCOMES:

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

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

CO-PO, PSO MAPPING :

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

SEMESTER - IV

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.

LIST OF EXPERIMENTS :

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements.
2. Database Querying – Simple queries, Nested queries, Sub queries and Joins.
3. Implementation of Views, Sequences and Synonyms.
4. Database Programming: Implicit and Explicit Cursors.
5. Procedures and Functions.
6. Triggers.
7. Exception Handling.
8. Database Design using ER Modeling, Normalization and Implementation for any application.
9. Database Connectivity with Front End Tools.
10. Case Study using Real Life Database applications.

TOTAL: 45 PERIODS

LAB REQUIREMENTS

SOFTWARE

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

Backend: Oracle / SQL / MySQL/ Postgres / DB2 or Equivalent

OUTCOMES:

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

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

CO-PO, PSO MAPPING :

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

SEMESTER - 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 Interprocess 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, ps, pmap, wget, free, Shutdown commands, ping, su, who, env).
2. Write programs using the following system calls of UNIX operating system fork, exec, getpid, 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:**On completion of this laboratory 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
C01	3	3	1	-	1	-	-	-	-	-	-	1	2	2
C02	3	3	3	2	1	1	1	2	2	2	1	2	2	2
C03	3	3	3	3	1	2	1	2	2	2	2	2	2	2
C04	3	3	3	2	1	-	-	1	1	1	1	2	2	2
C05	3	3	3	2	1	-	-	1	1	1	1	1	2	2
C06	3	3	2	2	1	-	-	1	1	1	1	1	2	2

SEMESTER - IV

20ITTE401 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 IT

COURSE METHODOLOGY:

1. This initiative is designed to inculcate ethical principles of research and to get involve in life-long learning process for the students.
2. The course must involve engineering design with realistic constraints. It must also include appropriate elements of the following: Engineering standards, design analysis, modeling, simulation, experimentation, prototyping, fabrication, correlation of data, and software development.
3. Project can be individual work or a group project, with maximum of 3 students. In case of group project, the individual project report of each student should specify the individual's contribution to the group project.

- On completion of the project, the student shall submit a detailed project report. The project should be reviewed and the report shall be evaluated and the students shall appear for a viva-voce oral examination on the project approved by the Coordinator and the project guide.

EVALUATION:

- First evaluation (Immediately after first internal examination) : 20 marks
- Second evaluation (Immediately after second internal examination): 30marks
- Final evaluation (Last week of the semester) : 50marks

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

TOTAL: 45 PERIODS

OUTCOMES:

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

- Conduct literature survey to identify the gap and an application oriented research problem in the specific domain(K4)
- Design and validate the proposed system using simulation(K6)
- Prototype the proposed system(K5)
- Analyze the obtained results and prepare a technical report(K4)
- Publish the work in journals and apply for the patents.(K3)
- 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
C01	3	3	2	2	2	2	2	2	3	2	2	3	3	3
C02	3	3	3	2	3	3	2	2	3	3	3	3	3	3
C03	2	2	2	1	2	1	1	1	3	2	3	3	3	2
C04	2	2	2	1	2	1	1	1	3	2	3	3	3	2
C05	2	2	2	1	2	1	1	1	3	2	3	3	3	2
C06	2	2	2	2	3	2	2	2	2	2	3	3	3	3

SEMESTER - IV

20ITTP401 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

PROBLEM SOLVING SKILLS - PHASE 1

OBJECTIVES:

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

UNIT I QUANTITATIVE ABILITY - III 6

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

UNIT II QUANTITATIVE ABILITY - IV 6

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

UNIT III REASONING ABILITY - II 6

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

UNIT IV VERBAL ABILITY - II 6

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

UNIT V CREATIVITY ABILITY - II 6

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

TOTAL : 30 PERIODS

REFERENCES:

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

ADVANCED C PROGRAMMING - PHASE 2**OBJECTIVES**

- To improve C programming skills with understanding of code organization and functional hierarchical decomposition with using complex data types
- To able to facility with Unix command syntax and semantics

UNIT I INTRODUCTION TO RECURSION AND GROWTH FUNCTIONS 6

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

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

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

UNIT III FILE MANAGEMENT AND BIT MANIPULATION 6

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

UNIT IV OVERVIEW OF LINUX AWK AND CONTROL STRUCTURES IN AWK 6

Basics of AWK – Variables and Operators – Built-in variables – Conditional Statements – Loops

UNIT V ARRAYS AND BUILT-IN FUNCTIONS 6

Basics of array – Single Dimensional Array – Multidimensional Array – Bult-in functions and User- Defined Functions.

TOTAL : 30 PERIODS

REFERENCES:

1. R. G. Dromey, "How to Solve It By Computer", Pearson, 1982
2. A.R. Bradley, "Programming for Engineers", Springer, 2011
3. Kernighan and Ritchie, "The C Programming Language", (2nd ed.) Prentice Hall, 1988
4. Arnold D. Robbins , "GAWK: Effective AWK Programming" 5th edition, 2020.

ONLINE RESOURCES:

1. <http://ce.sharif.edu/courses/95-96/1/ce153-12/resources/root/Books/Advanced%20C%201992.pdf>
2. www.spokentutorial.org/

COURSE OUTCOMES:

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

1. Analyze their quantitative ability. (K4)
2. Understand the ability of arithmetic reasoning along with creative thinking and problem solving skills. (K2)
3. Create their verbal ability through vocabulary building and grammar. (K6)
4. Evaluate code organization and functional hierarchical decomposition with complex data types. (K5)
5. Understand to improve C programming skills to apply advance structured and procedural programming. (K2)
6. Understand the Linux AWK concept and its working environment. (K2)

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 - V

20ITPW501	STATISTICAL ANALYSIS USING R	L	T	P	C
SDG NO. 4, 9	PROGRAMMING WITH LABORATORY	3	0	2	4

OBJECTIVES:

- To understand the basics of probability distributions
- To develop R code for statistical analysis
- To use R packages for regression analysis
- To use R graphics for data visualization

UNIT I INTRODUCTION TO R PROGRAMMING 9

Basics – First Steps – R Language Essentials - Expressions and Objects - Vectors-Missing Values -Functions that Create Vectors -Matrices and Arrays – Factors – Lists- Data Frames – Indexing – Conditional Selection – Indexing of Data Frames – Subset and Transform – Grouped Data and Data Frames – The Graphics Subsystem – R Programming – Flow Control – Classes and Generic Functions – Session Management - Data Entry – Reading from a Text File – The Data Editor – Interfacing to other Programs.

UNIT II PROBABILITY AND DISTRIBUTION 9

Probability and Distributions - Random Sampling - Probability Calculations and Combinatorics - Discrete Distributions - The Built-in Distributions in R - Densities -Cumulative Distribution Functions – Quantiles -Random Numbers - Graphical Display of Distributions – Histograms – Empirical Cumulative Distribution – Q-Q Plots – Boxplots.

UNIT III GROUP STATISTICS AND SAMPLE TESTS 9

Statistics by Groups - Graphics for Grouped Data-Histograms -Parallel Boxplots - Strip Charts -Generating Tables- Marginal Tables and Relative Frequency - Graphical Display of Tables -Bar Plots-Dot Charts-Pie Charts – Sample Tests- One-Sample T Test -Wilcoxon Signed-Rank Test -Two-Sample T Test-Comparison of Variances -Two-Sample Wilcoxon Test.

UNIT IV REGRESSION AND CORRELATION 9

Simple Linear Regression - Residuals and fitted Values -Prediction and Confidence Bands-Correlation - Pearson Correlation- Spearman's P - Kendall's T -One-Way Analysis of Variance- PairWise Comparisons and Multiple Testing- Relaxing the Variance Assumption- Graphical Presentation-

Bartlett's Test- Kruskal-Wallis Test- Two-Way Analysis of Variance- Graphics for Repeated Measurements- The Friedman Test- The ANOVA Table in Regression Analysis-Multiple Regression- Plotting Multivariate Data – Model Specification and Output – Model Search.

UNIT V LINEAR MODELS

9

Polynomial Regression - Regression through the Origin - Design Matrices and Dummy Variables -Linearity over Groups – Interactions - Two-Way ANOVA with Replication -Analysis of Covariance - Graphical Description- Comparison of Regression Lines –Diagnostics -Generalized Linear Models - Logistic Regression on Tabular Data.

LIST OF EXPERIMENTS :

15

1. Creation and manipulation of matrix in R.
2. Creation and manipulation of Vectors, Factors in R.
3. Draw a histogram for any ungrouped frequency data.
4. Fit a simple regression equation for a sample data and visualize using a scatter plot.
5. Demonstrate the one sample t test.
6. Demonstrate the two sample t test.
7. PLOT function to create graphs in R.
8. Usage of 3D plot in R.

LAB REQUIREMENTS : R Studio for Windows

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Peter Dalggaard, “Introductory Statistics with R”, Springer,2008.
2. Joseph Schmuller, “Statistical Analysis with R for Dummies”, March 2017, Wiley Publications, ISBN: 978-1-119-33706-5

REFERENCES:

1. Andy Field, Jeremy Miles and Zoe field, “Discovering Statistics using R”, Sage Publications Ltd. 2012.
2. Michael J Crowley , “The R Book”, Wiley Publications, 2012.

WEB REFERENCES:

1. <https://rstudio.com/>
2. <https://www.statistics.com/courses/r-for-statistical-analysis/>

ONLINE RESOURCES:

1. <https://scholar.harvard.edu/dromney/online-resources-learning-r>
2. <https://www.r-bloggers.com>

OUTCOMES:

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

1. Describe the syntax and semantics of the R programming language. (K2)
2. Understand the basics of probability distributions. (K2)
3. Experiment the data using some of the Data Visualization techniques. (K3)
4. Apply regression and correlation techniques for data analytics. (K3)
5. Understand the basic data types and programming constructs available in R. (K2)
6. Illustrate R code for solving real time problems using statistical analysis. (K3)

CO- PO, PSO MAPPING:

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

SEMESTER - V

20ITPW502 SDG NO. 4 & 9	OBJECT ORIENTED ANALYSIS AND DESIGN WITH LABORATORY	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To understand and differentiate Unified Process from other approaches
- To design with static UML diagrams
- To design with the UML dynamic and implementation diagrams
- To improve the software design with design patterns and test the software against its requirements specification

UNIT I UNIFIED PROCESS AND USE CASE DIAGRAMS 9

Introduction to OOAD with Object Oriented Basics - Unified Process – UML Diagrams – Use Case – Case Study – The Next Gen POS System - Inception - Use Case Modeling – Relating Use Cases – Include, Extend And Generalization – When to use Use Cases.

UNIT II STATIC UML DIAGRAMS 9

Class Diagram – Elaboration – Domain Model – Finding Conceptual Classes and Description Classes – Associations – Attributes – Domain Model Refinement – Finding Conceptual Class Hierarchies – Aggregation and Composition – Relationship Between Sequence Diagrams and Use Cases – When to use Class Diagrams.

UNIT III DYNAMIC AND IMPLEMENTATION DIAGRAMS 9

Dynamic Diagrams – UML Interaction Diagrams - System Sequence Diagram – Collaboration Diagram – When to use Communication Diagrams - State Machine Diagram and Modeling – When to use State Diagrams - Activity Diagram – When to use Activity Diagrams.

Implementation Diagrams - UML Package Diagram - When to use Package Diagrams - Component and Deployment Diagrams – When to use Component and Deployment Diagrams.

UNIT IV DESIGN PATTERNS 9

GRASP: Designing Objects with Responsibilities – Creator – Information Expert – Low Coupling – High Cohesion – Controller.

Design Patterns – Creational– Factory Method – Structural – Bridge – Adapter – Behavioral– Strategy – Observer – Applying GoF Design Patterns – Mapping Design to Code.

UNIT V TESTING 9

Object Oriented Methodologies – Software Quality Assurance – Impact of Object Orientation on Testing – Develop Test Cases and Test Plans.

LIST OF EXPERIMENTS: 15

1. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from the Domain model.
2. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams.
3. Draw relevant State Chart and Activity Diagrams for the same system

(For Retail Workflow).

4. Implement the system for Object Oriented design pattern for detailed design.
5. Test the software system for all the scenarios identified as per the Usecase diagram.
6. Improve the reusability and maintainability of the software system by applying appropriate design patterns.
7. Implement the modified system and test it for various scenarios.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", Third Edition, Pearson Education, 2005.
2. Ali Bahrami "Object Oriented Systems Development", McGraw Hill International Edition, 1999 (Digitized 2007).

REFERENCES:

1. Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, "Design patterns: Elements of Reusable Object-Oriented Software", Addison-Wesley, 1995.
2. Martin Fowler, "UML Distilled: A Brief Guide to the Standard Object Modeling Language", Third edition, Addison Wesley, 2003.

WEB REFERENCES:

1. https://en.wikipedia.org/wiki/Object-oriented_analysis_and_design
2. https://www.tutorialspoint.com/object_oriented_analysis_design/ood_object_oriented_analysis.htm

OUTCOMES:

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

1. Understand the principles of Object Oriented Concepts (K2)
2. Implement the static UML diagrams (K3)
3. Use dynamic and implementation UML diagrams in the appropriate scenarios (K3)
4. Identify an appropriate design pattern (K1)
5. Implement and develop test cases with various testing methodologies for Object Oriented software development (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	2	2	2	2	2	2	2	3	2
CO2	3	2	3	2	2	2	-	-	2	-	2	2	3	2
CO3	3	1	3	2	-	2	-	-	-	2	2	2	3	2
CO4	3	1	3	2	3	2	-	-	2	-	2	2	3	2
CO5	3	1	3	2	2	2	2	2	2	2	2	2	3	2

SEMESTER - V

20ITPC501 SDG NO. 4 & 9	WEB TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand about client-server communication and protocols used during communication
- To design interactive web pages using scripting languages
- To learn server side programming using servlets and JSP
- To acquire knowledge on web services

UNIT I WEB BASIC AND UI DESIGN**9**

Web Essentials: Clients – Servers - Communication - The Internet - Basic Internet Protocols - The World Wide Web - HTTP Request Message - Response Message - Web Clients - Web Servers - Markup Languages: Fundamentals of HTML5.0 - Elements - Relative URLs - Lists - Tables - Frames – Forms.

Style Sheets: CSS3.0 - Introduction to Cascading Style Sheets - Style Rule - Cascading and Inheritance - Text Properties - Box Model - Normal Flow - Box Layout - Beyond the Normal Flow - Responsive Web Design - Viewport - Grid View - Media Queries.

UNIT II CLIENT SIDE SCRIPTING**9**

Client-Side Programming: The JavaScript Language-History and Versions - Introduction - JavaScript in Perspective –Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in objects-JavaScript Debuggers.

Front-end Web Framework: Angular 6 - Introduction - Features - Data Binding - One-Way Binding - Two-Way Binding - Event Binding - Property Binding.

UNIT III DOM AND SERVER SIDE PROGRAMMING

9

Host Objects: Browsers and the Document Object Model-Introduction to the DOM- DOM History and Levels-Intrinsic Event Handling-Modifying Element Style-The Document Tree-DOM Event Handling-Accommodating Noncompliant Browsers Properties of window - Server-Side Programming: Java Servlets- Architecture -Overview-A Servlet-Generating Dynamic Content-Life Cycle- Parameter Data-Sessions-Cookies-URL Rewriting-Other Capabilities-Data Storage Servlets and Concurrency-Databases and Java Servlets.

UNIT IV JSP AND XML

9

Separating Programming and Presentation: JSP Technology Introduction-JSP and Servlets-Running JSP Applications Basic JSP-JavaBeans Classes and JSP-Tag Libraries and Files-Support for the Model-View-Controller Paradigm-Databases and JSP - Representing Web Data: XML-Documents and Vocabularies-Versions and Declaration-Namespaces- DOM based XML processing Event-oriented Parsing: SAX-Transforming XML Documents-Selecting XML Data: XPATH-Template Based Transformations: XSLT-Displaying XML Documents in Browsers.

UNIT V AJAX AND WEB SERVICES

9

AJAX: Ajax Client Server Architecture-XML HTTP Request Object - Call Back Methods - Web Services: JAX-RPC-Concepts-Writing a Java Web Service-Writing a Java Web Service Client-Describing Web Services: WSDL-Representing Data Types: XML Schema-Communicating Object Data: SOAP Related Technologies-Software Installation-Storing Java Objects as Files.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Jeffrey C. Jackson, "Web Technologies - A Computer Science Perspective", Pearson Education, 2006.
2. Ron Schmelzer et al., "XML & Web Services", Pearson Education, 2002

REFERENCES:

1. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007.
2. Deitel & Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.

3. Marty Hall and Larry Brown, "Core Web Programming", Second Edition, Volume I and II, Pearson Education, 2001.
4. Bates, "Developing Web Applications", Wiley, 2006.

WEB REFERENCES:

1. www.w3schools.com
2. <https://nptel.ac.in/courses/106105084/>
3. <https://angular.io/tutorial>

OUTCOMES:

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

1. Describe the fundamental concepts to develop web pages.(K2)
2. Understand the Web Frameworks and apply the various Client side scripting to design dynamic web pages.(K3)
3. Apply the various Server side scripting technologies to design interactive web pages.(K3)
4. Implement real time web applications using advanced web technologies. (K3)
5. Apply the database concepts and web services to design real time web applications.(K3)
6. Analyze and validate data in web pages and web services. (K4)

CO- PO, PSO MAPPING :

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

SEMESTER - V

20ITPC502 SDG NO. 4,8&9	BIG DATA ESSENTIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide the knowledge in the basic and advanced methods of big data technology and tools, including Hadoop and its ecosystem
- To understand the concepts of Hadoop and HDFS
- To perform MapReduce analytics using Hadoop and related tools
- To illustrate and implement the SPARK programming

UNIT I INTRODUCTION TO BIG DATA**9**

Evolution of Big Data - Best Practices for Big Data Analytics - Big Data Characteristics - The Promotion of the Value of Big Data - Unstructured Data – Big Data Use Cases- Industry Examples of Big Data – Web Analytics – Big Data and Marketing – Fraud and Big Data – Risk and Big Data – Credit Risk Management – Big Data and Algorithmic Trading – Big Data and Healthcare -- Big Data in Medicine – Advertising and Big Data – Big Data Technologies -- Characteristics of Big Data Applications - Perception and Quantification of Value -Understanding Big Data Storage -Big Data Analytics.

UNIT II BASICS OF HADOOP**9**

Hadoop: History of Hadoop- The Hadoop Distributed File System – Components of Hadoop-Analysing the Data with Hadoop- Scaling Out- Hadoop Streaming- Hadoop Distributed File System(HDFS)-Design of HDFS-HDFS Concepts-Command Line Interface-HadoopFile System Interfaces- Data Flow-Data Ingest with Flume and Scoop and HadoopArchives- Hadoop I/O-Compression- Serialization- Avro and File-Based Data structures.

UNIT III MAP REDUCE FRAMEWORK**9**

Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a MapReduce Job Run-Failures-Job Scheduling-Shuffle and Sort – Task execution - MapReduce Types and Formats- Map Reduce Features-Hadoop Environment. YARN – Failures in Classic MapReduce and YARN – job scheduling – Shuffle and sort – Task execution – MapReduce types – Input formats – Output formats.

UNIT IV HADOOP ECO SYSTEM**9**

Introduction to PIG-Execution Modes of Pig-Comparison of Pig with Databases- Grunt- Pig Latin- User Defined Functions- Data Processing

Operators- Hive-Hive Shell-Hive Services- Hive Metastore-Comparison with Traditional Databases- HiveQL- Tables- Querying Data and User Defined Functions-Hbase-HBasics- Concepts- Clients-Hbase Versus RDBMS.

UNIT V SPARK FRAMEWORK

9

Introduction to GPU Computing-CUDA Programming Model- CUDA API-Simple Matrix- Multiplication in CUDA- CUDA Memory Model- Shared Memory Matrix Multiplication- Additional CUDA API Features-Data Analysis with Spark Shell-Writing Spark Application - Spark Programming in Scala, Python, R, Java - Application Execution.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'reily Media, 2012.
2. Mike Frampton, "Mastering Apache Spark", Packt Publishing, 2015.

REFERENCES:

1. Glen J. Myat, "Making Sense of Data", John Wiley & Sons, 2007 .
2. Pete Warden, "Big Data Glossary", O'Reilly, 2011.
3. Eric Sammer, "Hadoop Operations", O'Reilly, 2012.
4. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & Sons, 2012.
5. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilly, 2012.
6. Lars George, "HBase: The Definitive Guide", O'Reilly, 2011.
7. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilly, 2010.
8. Alan Gates, "Programming Pig", O'Reilly, 2011.
9. Nick Pentreath, Machine Learning with Spark, Packt Publishing, 2015.
10. Mohammed Guller, "Big Data Analytics with Spark", Apress, 2015.

WEB REFERENCES:

1. <https://www.analyticsvidhya.com/resources-big-data/>
2. https://www.tutorialspoint.com/big_data_analytics/index.htm

ONLINE RESOURCES:

1. <https://www.analyticsvidhya.com/resources-big-data/>
2. <https://www.edureka.co/blog/big-data-tutorial>

OUTCOMES:

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

1. Acquire knowledge about big data concepts and its use cases in various application domains.(K1)
2. Understand the Hadoop distributed file systems on different applications.(K2)
3. Understand the working of Hadoop architecture and Mapreduce Framework.(K2)
4. Apply the different Hadoop ecosystem components.(K3)
5. Analyze the big data solutions using Spark Programming(K4)
6. Examine the solutions for various distributed applications using the Big data technologies.(K3)

CO- PO, PSO MAPPING

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

SEMESTER - V

20ESEC502 SDG NO. 4	MICROPROCESORS AND MICROCONTROLLERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the basics of 8086 Microprocessor and 8051 Microcontroller
- To understand and implement the 8086 family Assembly Language Programming and basic 8051 programming
- To explore the I/O interfacing with 8086 and 8051
- To learn about advanced Microprocessors like Pentium and Intel Core i7 Processors

UNIT I INTRODUCTION TO MICROPROCESSOR 8

Introduction - Microprocessors and Microcontrollers - Evolution of Microprocessors - Basic Functional Blocks of a Microprocessor - 8086 Architecture - Instruction and data flow in 8086 - Even and Odd Memory Banks - Addressing Modes.

UNIT II 8086 FAMILY ASSEMBLY LANGUAGE PROGRAMMING 8

Pin Diagram-Instruction Set-Assembler Directives- System Bus Timing - Bus Cycles of 8086 - Timing Diagram.

UNIT III PROGRAMMING CONCEPTS 9

Password Validation - Reverse a String - Rotate a byte 3 places to the left - Convert to uppercase letter - Modular Programming - Using the Keyboard and Video Display - Data Conversions - Example Programs: Binary to ASCII - ASCII to Binary.

UNIT IV I/O INTERFACE AND ADVANCED MICROPROCESSORS 10

Introduction to I/O Interfacing - Programmable Peripheral Interface - Intel 8253/8254 Programmable Timer/Counter - Programmable Keyboard/Display Controller - Programmable Interrupt Controller - Intel 8237 DMA Controller - Case Studies: Traffic Light Control System - LED Display - Architecture of Intel Pentium IV and Intel Core i7 Processors.

UNIT V ARCHITECTURE AND PROGRAMMING 8051 10

Introduction to the Intel 8051 Microcontroller - Architecture of 8051 - Special Function Registers - Instruction set - Addressing modes - ALP - Programming - 8051 Timers - Serial Port Programming - Interrupt Programming - Stepper Motor Control using 8051.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. A. NagoorKani, "Microprocessors and Microcontrollers", McGrawHill Education (India) Private Limited, 2013.
2. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family - Architecture Programming and Design", Second Edition, Prentice Hall of India, 2007.

REFERENCES:

1. N. Senthilkumar, M. Saravanan, S. Jeevananthan, "Microprocessors and Microcontrollers", Oxford University Press, 2011.
2. A.K.Ray and K.M. Bhurchandi, "Advanced Microprocessor and Peripherals", Tata McGraw Hill, 3rd Edition, 2013.

- Kenneth J Ayala, "The 8086 Microprocessor: Programming and Interfacing the PC", Cengage Learning, Reprint 2014.
- Kenneth J Ayala, "The 8051 Microcontroller", 3rd edition, Cengage Learning, Reprint 2014.
- Muhammed Ali Mazidi, Janice Gillispie Maida, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems, Using Assembly and C", Second edition, Pearson Prentice Hall, 2015.

ONLINE RESOURCES:

- <http://read.pudn.com/downloads165/ebook/754892/micro.pdf>
- http://www.openloop.com/education/classes/sjsu_engr/engr_comp/Org/spring2002/studentProjects/Truc_Tran/Eng120.htm
- <https://www.intel.com/content/dam/www/public/us/en/documents/white-papers/ia-introduction-basics-paper.pdf>
- <http://ecerelatedbooks.blogspot.com/2018/01/microprocessor-and-microcontroller.html>

OUTCOMES:

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

- Describe the fundamental concepts of 8086 Microprocessors. (K2)
- Understand the pin diagram, instruction set and assembler directives of 8086 Microprocessor. (K2)
- Summarize the timing diagram of 8086. (K2)
- Implement various Assembly Language Programming using 8086. (K3)
- Interpret I/O interfaces using 8086 and advanced microprocessors. (K3)
- Discuss the concepts of 8051 Microcontroller. (K2)

CO-PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	1	-	-	-	-	-	-	-	-	-	1	1	2
C02	2	1	-	-	-	-	-	-	-	-	-	1	1	2
C03	2	1	-	-	-	-	-	-	-	-	-	1	1	2
C04	2	1	2	-	-	-	-	-	-	-	-	1	1	2
C05	2	1	2	-	-	-	-	-	-	-	-	1	1	2
C06	2	1	2	-	-	-	-	-	-	-	-	1	1	2

SEMESTER - V

20ITPL501 SDG NO. 4 & 9	WEB TECHNOLOGY LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To design static and dynamic interactive and responsive web pages
- To learn server side programming using servlets and JSP
- To create web services using web technologies
- To familiarize with angular framework

LIST OF EXPERIMENTS:

1. Create a web page with the following using HTML
 - a) To embed an image map in a web page
 - b) To fix the hot spots
 - c) Show all the related information when the hot spots are clicked
2. Create a web page with all types of Cascading style sheets using RWD.
3. Client Side Scripts for Validating Web Form Controls using DHTML.
4. Installation of Apache Tomcat web server.
5. Write programs in Java using Servlets:
 - a. To invoke servlets from HTML forms.
 - b. Session Tracking.
6. Write programs in Java to create three-tier applications using JSP and Databases
 - a) For conducting on-line examination.
 - b) For displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
7. Programs using XML – Schema – XSLT/XSL.
8. Programs using DOM and SAX parsers.
9. Programs using AJAX.
10. Consider a case where we have two Web Services- an airline service and a travel agent and the travel agent is searching for an airline. Implement this scenario using Web Services and Data base.
11. Design a Login page using Angular Framework

TOTAL: 45 PERIODS**LAB REQUIREMENTS: SOFTWARE**

Dream weaver or Equivalent, MYSQL Or Equivalent, ApacheServer, NetBeans/ Eclipse, NodeJS, Visual Studio Code.

OUTCOMES:

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

1. Understand the concept of web page development to design real world applications.(K2)
2. Compare the development of the web application performance using different set of web development tools like HTML, XHTML, CSS, JAVASCRIPT and XML. (K3)
3. Apply the usage of web development tools to serve the purpose of different end users of Internet.(K3)
4. Interpret an existing static web application to make it a robust one and Integrate dynamic features of web development. (K4)
5. Utilize the various Server side technologies to design and develop the interactive web applications. (K3)
6. Design Server side database application and web services applications. (K6).

CO- PO,PSO MAPPING:

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

SEMESTER - V

20ESPL501 SDG NO. 4	MICROPROCESSORS AND MICROCONTROLLERS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To write Assembly Language Programs for arithmetic and logical operations using the 8086 instruction set
- To perform Data transfer and Matrix operations in 8086
- To interface various I/O devices with 8086
- To implement Arithmetic and Logical operations using the 8051 instruction set

LIST OF EXPERIMENTS :**8086 programs**

1. Basic arithmetic and Logical operations
2. Code conversion
3. Searching
4. Sorting
5. Data transfer operations
6. Matrix operations
7. Print RAM size and system date
8. Traffic Light Control
9. Stepper motor control
10. Digital Clock
11. Keyboard and Display

8051 programs

1. Basic arithmetic and Logical operations
2. Find 2's complement of a number
3. Find Square and Cube of a number

TOTAL: 45 PERIODS**LAB REQUIREMENTS****HARDWARE**

1. 8086 development kits - 30Nos
2. Interfacing Devices - 15 each
3. Microcontroller – 30 Nos

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

1. Write various ALP programs for arithmetic and logical operations using 8086.(K3)
2. Demonstrate various ALP programs for data manipulation and matrix operations using 8086.(K3)
3. Implement the interfacing of 8086 to control the devices.(K3)
4. Interpret the Interfacing of 8086 to display the output.(K3)
5. Write various ALP programs for arithmetic and logical operations using 8051.(K3)
6. Demonstrate various ALP programs for data manipulation in 8051.(K3)

CO-PO, PSO MAPPING:

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

SEMESTER - V

20ITTE501 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 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 IT.

COURSE METHODOLOGY:

1. This initiative is designed to inculcate ethical principles of research and to get involve in life-long learning process for the students.
2. The course must involve engineering design with realistic constraints. It must also include appropriate elements of the following: Engineering standards, design analysis, modeling, simulation, experimentation, prototyping, fabrication, correlation of data, and software development.
3. Project can be individual work or a group project, with maximum of 3 students. In case of group project, the individual project report of each student should specify the individual's contribution to the group project.

- On completion of the project, the student shall submit a detailed project report. The project should be reviewed and the report shall be evaluated and the students shall appear for a viva-voce oral examination on the project approved by the Coordinator and the project guide.

EVALUATION:

- First evaluation (Immediately after first internal examination) : 20 marks
- Second evaluation (Immediately after second internal examination): 30marks
- Final evaluation Last week of the semester) : 50marks

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

TOTAL: 45 PERIODS

OUTCOMES:

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

- Undertake problem identification, formulation and solution. (K2)
- Design engineering solutions to complex problems utilizing a systems approach. (K4)
- Conduct an engineering project. (K4)
- Communicate with engineers and the community at large in written and oral forms. (K3)
- Demonstrate the knowledge, skills and attitudes of a professional engineer. (K3)

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	2	2	2	2	2	2	3	2	2	3	3	3
C02	3	3	3	2	3	3	2	2	3	3	3	3	3	3
C03	2	2	2	1	2	1	1	1	3	2	3	3	3	2
C04	2	2	2	1	2	1	1	1	3	2	3	3	3	2
C05	2	2	2	1	2	1	1	1	3	2	3	3	3	2

SEMESTER - V

20ITTP501 SDG NO. 4 & 9	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

APTITUDE & COGNITIVE SKILLS – PHASE 1

OBJECTIVES:

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

UNIT I QUANTITATIVE ABILITY – V 10

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

UNIT II QUANTITATIVE ABILITY – VI 10

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

UNIT III REASONING ABILITY – III 8

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

UNIT IV VERBAL ABILITY – III 10

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

UNIT V CREATIVITY ABILITY – III 7

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

TOTAL : 45 PERIODS

REFERENCES :

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

PYTHON PROGRAMMING AND SCILAB- PHASE 2

OBJECTIVES :

- To provide strong knowledge of python
- Python programming is intended for software engineers, system analysts, program managers and user support personnel who wish to learn the Python programming language.
- To get knowledge about SCILAB programming

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 and 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 SCILAB 7

Introduction – Installation of Scilab – Expressions-Variables-Basic Functions –Vector Operations –Matrix Operations

UNIT V CONTROL STRUCTURES AND FILE FORMATS IN SCILAB 8

Conditional Branching – Iteration – Scripts and Functions – Plotting 2D Graphics

TOTAL : 45 PERIODS

REFERENCES :

1. Mark Lutz, "Programming Python", 4th Edition, 2010.
2. HK Malik, A Singh, "Scilab Textbook Companion for Engineering Physics",2016.

ONLINE RESOURCES :

1. <https://www.python.org>
2. <https://spoken-tutorial.org/keyword-search/?q=scilab>

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

- 1 Describe the basic concepts like Data types, list, tuple and strings. (K2)
- 2 Apply various string functions, dictionaries and its applications in problem solving and programming. (K3)
- 3 Determine the usage of sets and its handling in various applications. (K3)
- 4 Explain the concepts of exception handling, regular expressions and object oriented programming concepts. (K2)
- 5 Understand basic vector operations and matrix operations in Scilab (K2)
- 6 Illustrate mathematical modeling and plot graphs. (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 to Typical AI Problems – Search Strategies - Uninformed - Heuristics - Informed.

UNIT II PROBLEM SOLVING METHODS 9

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

UNIT III REPRESENTATION OF KNOWLEDGE 9

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

UNIT IV PLANNING 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-Hill Education, Third Edition, 2008.

REFERENCES:

1. M. Tim Jones, "Artificial Intelligence: A Systems Approach(Computer Science)", Jones and Bartlett Publishers, Inc.; First Edition, 2008.
2. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
3. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", 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&ved=0ahUKEwigkNa1xN3oAhWawjgGHe8hAzoQ6AEIKDAA#v=onepage&q=Supervised%20Learning&f=false>

OUTCOMES:**Upon completion of the course, the students 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
C01	2	3	2	3	2	1	1	-	1	-	-	1	2	3
C02	2	3	2	3	2	1	1	-	1	-	-	1	3	3
C03	2	3	2	3	2	1	1	-	1	-	-	1	3	2
C04	2	3	2	3	2	1	1	-	1	-	-	1	3	3
C05	2	3	2	3	3	1	1	-	2	-	-	1	2	2
C06	2	3	2	3	3	1	1	-	2	-	-	1	2	3

SEMESTER - VI

20ITPC601 SDG NO. 4	CLOUD COMPUTING AND VIRTUALIZATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concept of cloud computing
- To understand virtualization concepts
- To appreciate the emergence of cloud technologies and advancements
- To learn the concepts of Container Networking, Docker and Kubernetes

UNIT I INTRODUCTION**9**

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

UNIT II VIRTUALIZATION**9**

Basics of Virtualization – Types of Virtualization – Implementation levels of Virtualization – Load Balancing and Virtualization - Understanding Hypervisors - Virtualization Structures – Tools and Mechanisms – Full Virtualization vs Para Virtualization - Virtualization of CPU – Memory – I/O Devices – Virtual Clusters and Resource Management - Physical Vs Virtual Clusters-Live Migration-Migration of Memory, Files and Network Resources-Dynamic Deployment of virtual Clusters-Virtualization for Data Center Automation.

UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE**9**

Layered Cloud Architecture Design – NIST Cloud Computing Reference

Architecture – Public, Private and Hybrid Clouds - IaaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3 - Disaster Recovery.

UNIT IV CLOUD TECHNOLOGIES AND ADVANCEMENTS

9

Hadoop– MapReduce – Virtual Box - Cloud Platforms in Industry-Google App Engine – Programming Environment for Google App Engine –Microsoft Azure – Amazon Web Services- Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.

UNIT V CONTAINER NETWORKING, DOCKER AND KUBERNETES

9

Motivation-The Container Networking Stack-Introduction to Container Networking-Single Host Container Networking-Modes for Docker Networking-Multi Host Networking -Multi Host Container Networking-Docker Networking- Kubernetes Networking – A Gentle Kubernetes Introduction - Overview - Intra-Pod Networking - Inter-Pod Networking - Service Discovery in Kubernetes - Ingress and Egress - Advanced Networking Topics in Kubernetes.

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

1. Michael Hausenblas, "Container Networking From Docker to Kubernetes", O'Reilly Media, 2018.
2. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", Tata McGraw Hill, 2013.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach", Tata McGraw Hill, 2009.
4. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice) ", O'Reilly, 2009.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_cs64
2. <https://www.edx.org/learn/cloud-computing>

ONLINE RESOURCES:

1. https://www.cse.iitb.ac.in/~abhirup09/Docs/cloud_computing_final_report.pdf
2. <https://www.netdevgroup.com/online/courses/virtualization/cloud-and-virtualization-concepts>

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

1. Understand key technologies, strengths and limitations of cloud computing.(K1)
2. Explore the importance of virtualization and usage of different types of virtualization(K2)
3. Recognize the core issues in cloud resource management(K1)
4. Learn different types of cloud services and cloud storage (K1)
5. Apply the various current cloud technologies (K3)
6. Interpret concepts of Container Networking,Docker and Kubernetes (K2)

CO- PO, PSO MAPPING:

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

SEMESTER - VI

20HSMG601 SDG NO. 4,8,9,10&12	PRINCIPLES OF ENGINEERING MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

At the end of the course, the student is expected to

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

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

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

UNIT II PLANNING 9

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

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority –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 - System and process of controlling – budgetary and non-budgetary control techniques.

UNIT IV DIRECTING AND CONTROLLING**9**

Innovation management of Product and Services, Role of R & D in Entrepreneurship, Breakthrough Innovation, Disruptive Innovation – Modern approaches in Engineering management – Green management, Lean management, Managing diversity. IPR – Principles of Ethics for Engineering Managers.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Tripathy.P.C and Reddy.P.N, “Principles of Management”, Tata McGraw Hill, 1999.

REFERENCES:

1. Stephen P. Robbins and Mary Coulter, “Management”, Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
2. JAF Stoner, Freeman R. E. and Daniel R Gilbert, “Management”, Pearson Education, 6th Edition, 2004.
3. Stephen A. Robbins and David A. Decenzo and Mary Coulter, “Fundamentals of Management”, Pearson Education, 7th Edition, 2011.
4. Robert Kreitner and Mamata Mohapatra, “Management”, Biztantra, 2008.
5. Harold Koontz and Heinz Weihrich, “Essentials of Management”, Tata McGraw Hill, 1998.

WEB RESOURCES:

1. <https://www.managementstudyguide.com/organization-management.htm>
2. <https://nptel.ac.in/courses/110/105/110105034/>
3. <https://courses.lumenlearning.com/boundless-management/chapter/principles-of-management/>

ONLINE RESOURCES:

1. <https://nptel.ac.in/courses/110/105/110105033/>

OUTCOMES:

Upon completion of the course, the students 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

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 use soft skills efficiently
- To develop their confidence and help them in attending interviews successfully

UNIT I LISTENING AND SPEAKING SKILLS**6**

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

UNIT II ADVANCED READING AND WRITING SKILLS**6**

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

UNIT III SKILLS FOR COMPETITIVE EXAMS**6**

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

UNIT IV SOFT SKILLS**6**

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

UNIT V INTERVIEW SKILLS**6**

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

TOTAL: 30 PERIODS**REFERENCES:**

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

WEB REFERENCES:

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

ONLINE RESOURCES:

1. <https://www.britishcouncil.my/english/courses-adults/learning-tips/importance-of-soft-skills>
2. <https://www.skillssoft.com/content-solutions/business-skills-training/soft-skills-training/>

OUTCOMES:

Upon completion of the course learners should be able to

1. Demonstrate a better understanding of the communication process by articulating effectively(K2)
2. Exhibit soft skills & technical skills and construct e-portfolio effectively(K3)

3. Apply critical thinking abilities and perform well in group discussions(K2)
4. Adapt the skills towards grooming as a professional continuously(K2)
5. Identify different types of personal interview skills through mock interviews and practices(K2)
6. Execute the employability and career skills in their chosen profession(K3)

CO - PO MAPPING:

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

SEMESTER - VI

20ITPL602 SDG NO. 4	CLOUD COMPUTING AND VIRTUALIZATION LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To develop Web Applications in Cloud
- To learn the design and development process involved in creating a Cloud Based Application
- To understand the installation of Cloud Simulation tools and Cloud Setup tools
- To learn to implement and use Parallel programming using Hadoop

LIST OF EXPERIMENTS :

1. Install VirtualBox/VMware Workstation with different flavors of Linux or Windows OS on top of Windows 7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute simple programs.

3. Install Google App Engine. Create hello world app and other simple web applications using Python/Java.
4. Use GAE launcher to launch the Web Applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one Virtual Machine to another Virtual Machine.
7. Find a procedure to launch Virtual Machine using try stack (Online Openstack Demo Version)
8. Install Hadoop single node cluster and run simple applications like wordcount.

TOTAL: 45 PERIODS

LAB REQUIREMENTS:

S.No.	Software
1.	Virtual box
2.	VMware Workstation
3.	Openstack, Hadoop
4.	Cloudism
5.	GAE launcher

OUTCOMES :

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

1. Understand various virtualization tools such as Virtual Box, VMware.(K1)
2. Apply the usage of web application development in a PaaS environment.(K2)
3. Understand cloud environment simulation to implement new schedulers.(K3)
4. Apply large data sets in a parallel environment.(K3)
5. Illustrate the Cloud based applications using simulation tools (K3)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	2	1	3	1	1	-	-	-	-	-	2	2
C02	3	3	3	2	3	1	1	-	-	-	-	-	2	2
C03	3	3	3	3	3	-	-	-	-	-	-	-	2	2
C04	2	2	3	2	3	-	-	-	-	-	-	-	2	2
C05	3	3	3	3	2	1	1	-	-	-	-	-	2	2

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, C and its working environment
- To Implement N-Queen problem and puzzle problem using Prolog
- To Analyze the problem using BFS and DFS algorithm

LIST OF EXPERIMENTS :

1. Study of Prolog.
2. Write simple fact for the statements using Prolog.
3. Write predicates - one converts 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 using Depth First Search.
8. Write a program to solve Travelling Salesman Problem.
9. Write a program to solve Water Jug problem.
10. Write a program to solve Missionaries and Cannibal problem.
11. Write a program to implement Library Management System.

TOTAL: 45 PERIODS

LAB REQUIREMENTS :

SOFTWARE : Prolog, Turbo C

OUTCOMES:

On completion of this laboratory 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	PS01	PS02
C01	2	3	2	3	2	1	1	-	1	-	-	1	3	3
C02	2	3	2	3	2	1	1	-	1	-	-	1	3	3
C03	2	3	2	3	2	1	1	-	1	-	-	1	3	2
C04	2	3	2	3	3	1	1	-	2	-	-	1	2	2
C05	2	3	2	3	2	1	1	-	1	-	-	1	3	3

SEMESTER - VI

20ITPJ601 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

COURSE PLAN :

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

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

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

EVALUATION:

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

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

OUTCOMES:

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

1. 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 multidisciplinary approach that address human needs and sustainable development [K3]
5. The significance of developing innovation projects with a prototyping mind set, 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
C01	3	3	3	3	3	3	2	2	3	3	3	2	3	3
C02	3	3	3	3	3	3	2	2	3	3	3	2	3	3
C03	2	2	2	1	2	1	1	1	3	2	3	3	3	2
C04	2	2	2	1	2	1	1	1	3	2	3	3	3	2
C05	2	2	2	1	2	1	1	1	3	2	3	3	3	2

SEMESTER - VI

20ITTP601 SDG NO. 4 & 9	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 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

BASIC DESIGN AND ANALYSIS OF ALGORITHMS AND GRAPHICS MODELING USING BLENDER - PHASE 2

OBJECTIVES :

- Analyze simple algorithms and data structures.
- Design of computer algorithms, as well as analysis of sophisticated algorithms.
- Familiar with the CST Studio Suite interface
- Perform basic tasks in terms of modeling, setup of simulation, and analyzing pre and post processing results.

UNIT I LINKED LIST, STACK AND QUEUE 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, Inorder , Preorder , PostOrder and LevelOrder 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 AND INSTALLATION OF BLENDER 8

Installation process - 3D Cursor - Moving in 3D Space - Camera View Settings

UNIT V BLENDER INTERFACE AND WINDOW TYPES 7

The Blender Interface - Window Types : Changing window types - File Browser into Panel - User Preferences - Outliner - Properties

TOTAL : 45 PERIODS

REFERENCES:

1. Weiss, Mark. A. (2012), Data structures and algorithm analysis in Java. 3 edition. Harlow, Essex : Pearson (632 p).
2. Zobel, Justin (2014), Writing for Computer Science. 3 edition. Springer Verlag London Ltd (270 p).

ONLINE RESOURCES :

1. https://docs.blender.org/manual/en/2.79/render/blender_render/materials/index.html

COURSE OUTCOMES :

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

- 1 Illustrate abstract data types for linear data structures. (K3)
- 2 Describe the binary tree, hash function and concepts of collision and its resolution methods. (K2)
- 3 Implement different types of trees and apply them to problem solutions. (K3)
- 4 Discuss graph structure and understand various operations on graphs and their applicability. (K2)
- 5 Understand how to install blender software, camera features settings and graphics modeling using blender interface.(K3)
- 6 Demonstrate basic 3D Scenes using Blender. (K2)

CO-PO, PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	-	-	-	-	3	2	-	3	2	3	-	2	-	-
C02	-	-	-	-	3	2	-	3	2	3	-	2	-	-
C03	-	-	-	-	3	2	-	-	1	3	-	2	-	-
C04	-	-	-	-	3	2	-	3	3	3	-	2	2	2
C05	-	-	-	-	3	2	-	-	2	3	-	2	2	2
C06	-	-	-	-	3	2	-	-	2	3	-	2	2	2

SEMESTER - VII

20ITPC701 SDG NO. 4 &9	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand Cryptography Theories, Algorithms and Systems
- To understand necessary approaches and techniques to build protection mechanisms in order to secure Computer Networks
- To know the Symmetric Cryptography Techniques
- To understand the Public Key Cryptography techniques

UNIT I INTRODUCTION 9

Security Trends - Legal- Ethical and Professional aspects of Security - Need for Security at Multiple Levels - Security Policies - Model of Network Security – Security Attacks - Services and Mechanisms – OSI Security Architecture – Classical Encryption Techniques: Substitution Techniques - Transposition Techniques - Steganography - Foundations of Modern Cryptography - Perfect Security – Information Theory – Product Cryptosystem – Cryptanalysis.

UNIT II SYMMETRIC KEY CRYPTOGRAPHY 9

Mathematics of Symmetric Key Cryptography - Algebraic Structures - Modular Arithmetic - Euclid's Algorithm - Congruence and Matrices - Groups - Rings, Fields - Finite Fields - Symmetric Key Ciphers - DES – Block Cipher - Principles of DES – Strength of DES – Differential and Linear Cryptanalysis - Block Cipher Design Principles – Block Cipher Mode of Operation – Evaluation Criteria for AES – Advanced Encryption Standard - RC4 – Key Distribution.

UNIT III PUBLIC KEY CRYPTOGRAPHY 9

Mathematics of Asymmetric Key Cryptography - Primes – Primality Testing – Factorization – Euler's totient Function - Fermat's and Euler's Theorem - Chinese Remainder Theorem – Exponentiation and Logarithm - Asymmetric Key Ciphers - RSA Cryptosystem – Key Distribution – Key management – Diffie Hellman Key Exchange - ElGamal Cryptosystem – Elliptic Curve Arithmetic - Elliptic Curve Cryptography.

UNIT IV MESSAGE AUTHENTICATION AND KEY DISTRIBUTION 9

Authentication Requirement – Authentication Function – MAC – Hash Function – Security of Hash Function and MAC – SHA – Digital Signature and Authentication Protocols – DSS - Entity Authentication - Biometrics - Passwords - Challenge Response Protocols - Authentication Applications - Kerberos - X.509.

UNIT V NETWORK AND INTERNET SECURITY

Electronic Mail Security – PGP-S/MIME – IP Security – Web Security – System Security - Intruders – Malicious Software – Viruses – Firewalls - Network Access Control and Cloud Security – Transport Level Security – Wireless Network Security – Email Security.

TOTAL: 45 PERIODS

TEXT BOOK:

1. William Stallings, “Cryptography and Network Security: Principles and Practice”, PHI 7th Edition (Global Edition), Pearson 2017.

REFERENCES:

1. C K Shyamala, N Harini and Dr. T R Padmanabhan: “Cryptography and Network Security”, Wiley India Pvt. Ltd, 2011.
2. Behrouz A. Forouzan, “Cryptography and Network Security”, Tata McGraw Hill, 2007.
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, “Network Security: Private Communication in a Public World”, Prentice Hall.

WEB REFERENCES:

1. <https://nptel.ac.in/courses/106/105/106105162/>
2. <https://nptel.ac.in/courses/106/105/106105031/>

ONLINE RESOURCES:

1. <https://freevideolectures.com/course/4727/nptel-cryptography-and-network-security>

OUTCOMES:

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

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

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	2	-	-	-	-	-	-	2	-	2	2	-
C02	2	2	2	-	-	-	-	-	-	2	-	2	2	-
C03	2	2	2	-	-	-	-	-	-	2	-	2	2	-
C04	2	2	2	-	-	-	-	-	-	2	-	2	2	-
C05	2	2	2	-	-	-	-	-	-	2	-	2	2	-
C06	2	2	2	-	-	-	-	-	-	2	-	2	2	-

SEMESTER - VII

20ITPC702 SDG NO. 4 & 9	DATA SCIENCE WITH MACHINE LEARNING	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To understand about data science and its context in business
- To identify the role of R and its implementation in business analytics
- To study about the concepts of machine learning and different types of algorithms
- To understand the graphical models of machine learning algorithm

UNIT I INTRODUCTION TO DATA SCIENCE**12**

Exploring data science - Key component technologies of data science - Machine learning – Big data – Business intelligence - Programming languages for data science: MS Excel – R – Python – Hadoop – SQL database – Data science process - Loading data into R - Exploring data – Managing data.

UNIT II WORKING WITH R**12**

About the R Environment – Simple Manipulations: Numbers and Vectors – Objects - Their Modes and Attributes – Ordered and Unordered Factors – Arrays and Matrices – Lists and Data Frames – Reading Data from Files – Probability Distributions – Grouping - Loops and Conditional Execution – Writing your own Functions – Graphical Procedures – Packages.

UNIT III MACHINE LEARNING BASICS**12**

Introduction to Machine Learning – Examples of Machine Learning Applications – Types of Machine Learning – Supervised Learning – Regression – Classification - Introduction to Decision Trees – Univariate Trees.

UNIT IV CLUSTERING**12**

Unsupervised Learning - Clustering - K-means Clustering - Hierarchical Clustering - Choosing the Number of Clusters - Pruning- Multivariate Trees - Reinforcement Learning.

UNIT V DIMENSIONALITY REDUCTION AND GRAPHICAL MODELS 12

Subset Selection - Principal Component Analysis - Linear Discriminant Analysis - Factor Analysis - Multidimensional Scaling - Isomap - Locally Linear Embedding - Graphical Models - Example Graphical Models.

TOTAL: 60 PERIODS**TEXT BOOKS:**

1. Nina Zumel, John Mount, "Practical Data Science with R", Manning Publications, 2014.
2. W.N.Venables, D.M.Smith and the R Core Team, "An Introduction to R", 2013.
3. EthemAlpaydin, "Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)", Third Edition, MIT Press, 2014.

REFERENCES:

1. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, "Practical Data Science Cookbook", Packt Publishing Ltd., 2014.
2. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big Data Analytics", EMC Education Services, 2015.
3. Tom M Mitchell, "Machine Learning", First Edition, McGraw Hill Education, 2013.
4. Jason Bell, "Machine learning - Hands on for Developers and Technical Professionals", First Edition, Wiley, 2014.
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://nptel.ac.in/courses/106106139/>
2. <https://www.coursera.org/learn/machine-learning>.

ONLINE RESOURCES:

1. <https://www.proschoolonline.com/pgd-data-science-course/what-is-data-science>
2. <https://www.w3resource.com/r-programming-exercises/>

OUTCOMES:

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

1. Understand the concepts of Data Science and Machine Learning.(K2)
2. Apply Data Science concepts for Analytics using the Renvironment.(K3)
3. Discuss the Supervised, Unsupervised and Reinforcement Machine Learning Algorithms.(K2)
4. Implementation of types of machine learning algorithms for applications.(K3)
5. Explain dimensionality reduction and graphical models.(K2)
6. Demonstrate the dimensionality reduction and graphical models in machine learning applications. (K3)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	2	1	2	-	1	-	-	-	1	2	2	-
C02	2	3	3	2	2	-	-	1	-	2	-	2	2	1
C03	3	3	2	1	2	-	1	-	-	-	1	2	2	1
C04	2	3	3	2	2	-	1	-	-	-	1	2	2	-
C05	2	2	3	-	1	-	-	-	-	1	-	2	2	1
C06	2	3	3	2	2	-	1	-	--	-	1	2	3	1

SEMESTER - VII

20ITPL701	CRYPTOGRAPHY AND NETWORK SECURITY LABORATORY	L	T	P	C
SDG NO. 4		0	0	3	1.5

OBJECTIVES:

- To learn different Substitution Techniques
- To learn different Transposition Techniques
- To implement the algorithms DES, RSA, MD5, SHA-1
- To use Network Security Tools and Vulnerability Assessment Tools

LIST OF EXPERIMENTS:

1. Perform encryption, decryption using the following substitution techniques
 - i) Ceaser Cipher, (ii) Playfair Cipher (iii) Hill Cipher (iv) Vigenere Cipher
2. Perform encryption and decryption using following transposition techniques.
 - i) Rail fence (ii) Row & Column Transformation.
3. Implement DES algorithm for practical applications.
4. Implement AES algorithm for practical applications.
5. Implement RSA algorithm using HTML and JavaScript.
6. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
7. Calculate the Message Digest of a text using the SHA-1 algorithm.
8. Implement the Signature Scheme - Digital Signature Standard.
9. Demonstrate Intrusion Detection System (IDS) using any online tools.
10. Automated Attack and Penetration Tools
11. Defeating Malware
 - i) Building Trojans (ii) Rootkit Hunter

TOTAL: 45 PERIODS

LAB REQUIREMENTS:

C / C++ / Java or equivalent compiler GnuPG, Snort, N-Stalker or Equivalent

OUTCOMES:

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

1. Develop code for Classical Encryption Techniques.(K3)
2. Build Cryptosystems by applying Symmetric Encryption algorithms.(K3)
3. Build Cryptosystems by applying Public Key Encryption algorithms.(K3)
4. Construct code for Authentication algorithms.(K3)
5. Develop a Signature scheme using Digital signature standard.(K3)
6. Demonstrate the Network security system using Open source tools.(K2)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	2	-	-	-	-	-	-	2	-	2	2	-
C02	3	3	2	-	-	-	-	-	-	2	-	3	2	-
C03	3	3	2	-	-	-	-	-	-	2	-	3	2	-
C04	3	3	2	-	-	-	-	-	-	3	-	3	2	-
C05	3	3	2	-	-	-	-	-	-	2	-	3	2	-
C06	1	3	2	-	3	-	-	-	-	2	-	3	2	-

SEMESTER - VII

20ITPL702 SDG NO. 4 & 9	DATA SCIENCE LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To implement programs using R and analyze evaluation models of R
- To implement simple programs using python
- To simulate real time applications for visual analysis
- To analyze big data using machine learning techniques
- Decision tree classification and clustering

LIST OF EXPERIMENTS :

1. Install, configure and run R with necessary packages.
2. Implement simple R programs using numbers, vectors and objects.
3. Calculator application using python
 - a) Using with and without python objects on console.

- b) Using mathematical functions on console.
 - c) Write an Python script, to create python objects for calculator application and save in a specified location in disk.
4. Descriptive statistics in python
- a) Write an Python script to find basic descriptive statistics using summary, str, quartile function on mtcars & cars datasets.
 - b) Write an Python script to find subset of dataset by using subset (), aggregate () functions on iris dataset.
5. Reading and writing different types of datasets
- a. Reading different types of data sets (.txt, .csv) from Web and disk and writing to a file in specific location.
 - b. Reading Excel data sheet in Python.
 - c. Reading XML dataset in Python.
6. Visualization
- a. Find the data distributions using box and scatter plot.
 - b. Find the outliers using plot.
 - c. Plot the histogram, bar chart and pie chart on sample data.
7. Correlation and Covariance
- a. Find the correlation matrix.
 - b. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data.
- c. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.
8. Regression model
- a) Import a data from web storage. Name the dataset and now do Logistic Regression to find out relation between variables that are affecting the admission of a student in a institute based on his or her GRE score, GPA obtained and rank of the student. Also check the model is fit or not.
9. Multiple regression model
- a) Apply multiple regressions, if data have a continuous Independent variable. Apply on above dataset.
10. Regression model for prediction
- a) Apply regression Model techniques to predict the data on above dataset.

11. Classification model
 - a) Install relevant package for classification.
 - b) Choose classifier for classification problem.
 - c) Evaluate the performance of classifier.
12. Clustering model
 - a) Clustering algorithms for unsupervised classification.
 - b) Plot the cluster data using python visualizations.

TOTAL: 45 PERIODS

LAB REQUIREMENTS :

1. R Studio
2. Python 3

OUTCOMES :

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

1. Process simple experiments using R package.[K3]
2. Build and apply linear and logistic regression models.[K3]
3. Perform data analysis with machine learning methods.[K3]
4. Perform graphical data analysis.[K3]
5. Function effectively on teams to establish goals, plan tasks, meet deadlines, manage risk and produce deliverables.[K3]
6. Clear understanding on how to organize data and analyze data using real time examples.[K3]

CO- PO, PSO MAPPING :

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

SEMESTER - VII

20ITPJ701 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: 120 PERIODS****OUTCOMES:****Upon completion of the course, the students should be able to**

1. Conduct literature surveys to identify the gap and an application oriented research problem in the specific domain. (K2)
2. Define and formulate solutions to complex engineering problems. (K5)
3. Use the design standards with consideration of real world constraints in particular the environmental responsibilities of professional engineers and matters related to economic, legislation, lifespan, ethical, social etc. (K3)
4. Demonstrate effective communication skills through presentation and defence of the engineering project. (K3)
5. Demonstrate leadership skills, ability to work independently and in a team through project design, presentation and defence of project findings. (K5)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	2	2	2	2	2	2	3	2	2	3	3	3
C02	3	3	3	2	3	3	2	2	3	3	3	3	3	3
C03	2	2	2	1	2	1	1	1	3	2	3	3	3	2
C04	3	3	3	2	3	3	2	2	3	3	3	3	3	3
C05	2	2	2	1	2	1	1	1	3	2	3	3	3	2

SEMESTER - VII

20ITTP701 SDG NO. 4 & 9	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

APTITUDE REFRESHER & APTITUDE COMPANY SPECIFIC TRAINING - PHASE I

OBJECTIVES:

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

UNIT I PRODUCT COMPANY SPECIFIC TRAINING – I 10

Product Specific Training for Amazon, Microsoft, IBM, ThoughtWorks, Juspay, Paypal, Mu Sigma, Zoho Corporation, VM Ware, Directi, Oracle, Wells Fargo, Goldman Sachs, Chargebee, Coda Global, Temenos, Freshworks, Adobe Systems.

UNIT II PRODUCT COMPANY SPECIFIC TRAINING – II 10

Product Specific Training for Ernst and Young, BA Continuum, Standard Chartered, AON Hewitt, Soliton Technologies, Payoda Technologies, Infoview Technologies, Athena Health Technology.

UNIT III SERVICE COMPANY SPECIFIC TRAINING - I 10

TCS, Wipro, TechMahindra, InfoView, RobertBosch, , NTT Data, Verizon, Payoda Technologies.

UNIT IV SERVICE COMPANY SPECIFIC TRAINING - II 10

CTS, Accenture, MindTree, MPhasis, Odessa Technologies, Vuram Technologies, Hewlett Packard, HCL.

UNIT V SERVICE COMPANY SPECIFIC TRAINING - III 5

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

TOTAL PERIODS : 45

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

ONLINE RESOURCES

1. <https://www.tensorflow.org/guide/basics>
2. <https://www.javatpoint.com/tensorflow-introduction>

COURSE OUTCOMES:

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

1. Identify their quantitative ability. (K2)
2. Describe the ability of arithmetic reasoning along with creative thinking and problem solving skills. (K2)
3. Illustrate their verbal ability through vocabulary building and grammar. (K2)
4. Demonstrate coding languages to write programs, important algorithmic design paradigms and methods of analysis. to solve the problems. (K2)
5. Discuss the fundamentals of computers and networks.(K2)
6. Explain the basics of tensor flow to train and run the deep neural networks. (K2)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	-	-	-	-	3	2	-	3	2	3	-	2	-	-
C02	-	-	-	-	3	2	-	3	2	3	-	2	-	-
C03	-	-	-	-	3	2	-	-	1	3	-	2	-	-
C04	-	-	-	-	3	2	-	3	3	3	-	2	2	2
C05	-	-	-	-	3	2	-	-	2	3	-	2	2	2
C06	-	-	-	-	3	2	-	-	2	3	-	2	2	2

SEMESTER - VIII

20ITPJ801 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: 120 PERIODS

OUTCOMES :

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

1. Conduct literature surveys to identify the gap and an application oriented research problem in the specific domain. (K2)
2. Define and formulate solutions to complex engineering problems. (K5)
3. Use the design standards with consideration of real world constraints in particular the environmental responsibilities of professional engineers and matters related to economic, legislation, lifespan, ethical, social etc. (K3)
4. Demonstrate effective communication skills through presentation and defence of the engineering project. (K3)
5. Demonstrate leadership skills, ability to work independently and in a team through project design, presentation and defence of project findings. (K5)

CO- PO, PSO MAPPING :

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
C01	3	3	2	2	2	2	2	2	3	2	2	3	3	3
C02	3	3	3	2	3	3	2	2	3	3	3	3	3	3
C03	2	2	2	1	2	1	1	1	3	2	3	3	3	2
C04	3	3	3	2	3	3	2	2	3	3	3	3	3	3
C05	2	2	2	1	2	1	1	1	3	2	3	3	3	2

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 – Ad Hoc 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” 2nd Edition, Van Nostrand Reinhold, New York, 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
C01	2	1	-	-	-	-	-	-	-	-	2	-	2	3
C02	2	3	3	-	-	-	-	-	2	-	1	-	3	3
C03	2	3	3	-	-	-	-	-	3	-	1	2	3	3
C04	2	3	3	-	-	-	-	-	3	-	3	3	3	3
C05	-	2	1	-	-	-	-	-	2	-	2	-	3	3
C06	3	2	2	-	-	-	-	-	1	2	2	2	3	3

PROFESSIONAL ELECTIVES - I

20ITEL602 SDG NO. 4	COMPILER DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the various phases of the compiler
- To know about various parsing techniques
- To understand intermediate code generation and run-time environments
- To implement the front-end of the compiler and code generator

UNIT I INTRODUCTION TO COMPILERS**9**

Structure of a Compiler - Lexical Analysis - Role of Lexical Analyzer - Input Buffering - Specification of Tokens - Recognition of Tokens - Lex - Finite Automata - Regular Expressions to Automata - Minimizing DFA.

UNIT II SYNTAX ANALYSIS**12**

Role of Parser - Grammars - Error Handling - Context-Free Grammars - Writing a Grammar - Top Down Parsing - General Strategies Recursive Descent Parser

Predictive Parser - LL(1) Parser - Shift Reduce Parser - LR Parser - LR (0) Item Construction of SLR Parsing Table - Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer - YACC.

UNIT III INTERMEDIATE CODE GENERATION 8

Syntax Directed Definitions - Evaluation Orders for Syntax Directed Definitions - Intermediate Languages: Syntax Tree - Three Address Code - Types and Declarations - Translation of Expressions - Type Checking.

UNIT IV RUN-TIME ENVIRONMENT AND CODE GENERATION 8

Storage Organization - Stack Allocation Space - Access to Non - Local Data on the Stack - Heap Management - Issues in Code Generation - Design of a Simple Code Generator.

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", 2nd Edition, Pearson Education, 2009.

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. V. Raghavan, "Principles of Compiler Design", Tata McGraw Hill Education Publishers, 2010.
5. Allen I. Holub, "Compiler Design in C", Prentice-Hall Software Series, 1993.

WEB REFERENCES:

1. <https://nptel.ac.in/courses/106/105/106105190/>
2. <https://ecomputernotes.com/compiler-design/>

OUTCOMES:

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

1. Understand fundamentals of compiler and identify the relationships among different phases of the compiler.[K2]
2. Apply top down parsing algorithms to develop the parsers for a given grammar.[K3]
3. Use bottom up parsing algorithms to develop the parsers for a given grammar.[K3]
4. Summarize the techniques for intermediate code.[K2]
5. Describe the simple code generator and run-time environment.[K2]
6. Illustrate the Code Optimization techniques.[K3]

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

PROFESSIONAL ELECTIVES - I

20ITEL603 SDG NO. 4	CYBER SECURITY AND FORENSICS	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 CYBER SECURITY AND CYBER LAW**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 SAFEGUARDS

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, “Cyber security-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, “Text book on Cyber Law”, Universal Law Publishing Co Ltd, 2012.
2. RaefMeuwisse, “Cyber Security for beginners”, 2nd edition, 2016.
3. John R.Vacca, “Computer Forensics”, Cengage Learning, 2005.
4. MarjieT.Britz, “Computer Forensics and Cyber Crime: An Introduction”, 3rd Edition, Prentice Hall, 2013.
5. AnkitFadia, “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 cyber crimes, 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 cyber crime 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

20ITEL604 SDG NO. 4	NETWORK PROGRAMMING, PROTOCOLS AND STANDARDS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Learn the basics of socket programming using TCP Sockets
- To Study about Socket Options
- To develop Macros for including Objects In MIB Structure
- To Understand Network Protocols and Practical Issues

UNIT I SOCKETS AND APPLICATION DEVELOPMENT 9

Introduction to Computer Networks - The OSI Model and the TCP/IP Protocol Suite - Underlying Technologies - Introduction to Socket Programming - System Calls - Address Conversion Functions - POSIX Signal Handling - Server with Multiple Clients - Boundary Conditions - Server process Crashes - Server Host Crashes - Server Crashes and Reboots - Server Shutdown - I/O Multiplexing - I/O Models - TCP Echo Client/Server with I/O Multiplexing.

UNIT II SOCKET OPTIONS 9

Socket Options - Getsockopt and Setsockopt Functions - Generic Socket Options - IP Socket Options - ICMP Socket Options - TCP Socket Options - Multiplexing TCP and UDP Sockets - SCTP Sockets - SCTP Client/Server - Streaming Example - Domain Name System - Gethostbyname - Gethostbyaddr - Getservbyname and Getservbyport Functions - Protocol Independent Functions in TCP Client/Server Scenario.

UNIT III ADVANCED SOCKETS 9

IPv4 and IPv6 Interoperability - Threaded Servers - Thread Creation and Termination - TCP Echo Server Using Threads - Mutex - Condition Variables - Raw Sockets - Raw Socket Creation - Raw Socket Output - Raw Socket Input - Ping Program - Traceroute Program.

UNIT IV SIMPLE NETWORK MANAGEMENT 9

SNMP Network Management Concepts - SNMPv1 - Management Information - MIB Structure - Object Syntax - Standard MIB's - MIB-II Groups - SNMPv1 Protocol and Practical Issues.

UNIT V NETWORK PROTOCOLS 9

SNMP V2, V3 AND RMON - Introduction to SNMPv2 - SMI for SNMPV2 - Protocol - SNMPv3 - Architecture and Applications - Security and Access Control Model - Overview of RMON.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. W. Richard Stevens, "UNIX Network Programming Vol-I", Third Edition, PHI Pearson Education, 2003.
2. William Stallings, "SNMP, SNMPv2, SNMPv3 and RMON 1 and 2", Third Edition, Pearson Edition, 2009.

REFERENCES:

1. D.E. Comer, "Internetworking with TCP/IP Vol- III: Client-Server Programming and Application BSD Sockets Version", Second Edition, Pearson Edition, 2003.
2. Mani Subramaniam, "Network Management: Principles and practice" Addison wesely", First edition 2001.
3. Elliotte Rusty Harold, Java Network Programming, O'Reilly Media, 2013

WEB REFERENCES:

1. <https://www.twirpx.com>
2. <https://nptel.ac.in/courses/106/105/106105183/>

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

1. Visualize the different aspects of networks, protocols and network design models. (K1)
2. Describe the various Application Development. (K2)
3. Discuss the different socket options. (K2)
4. Compare and select appropriate socket program. (K2)
5. Identify the important aspects of protocol. (K2)
6. Use the functions of socket, protocols and Network Management standards. (K3)

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	-	2	-	2	1	1	-	-	-	-	1	2	1
C02	2	-	2	-	2	1	1	-	-	-	-	1	2	2
C03	-	2	-	-	1	-	1	-	-	-	-	-	2	3
C04	-	-	2	-	2	-	2	-	-	-	-	1	3	2
C05	-	-	2	-	-	2	-	-	-	-	2	-	1	3
C06	-	-	2	-	-	2	-	-	-	-	2	-	2	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

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 Han and Micheline Kamber, “Data Mining Concepts and 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://freevidelectures.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 real time data. (K3)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	3	3	2	2	1	1	-	2	2	2	2	3	3
C02	3	3	3	2	2	2	1	-	2	2	2	3	3	2
C03	3	3	3	3	2	1	1	-	2	2	2	3	3	3
C04	3	3	3	3	2	2	1	-	2	3	3	3	2	2
C05	3	2	3	2	3	2	2	-	2	2	2	3	2	3

PROFESSIONAL ELECTIVES - I

20ITEL605 SDG NO. 4,11&12	VISUALIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand visual perception and core skills for visual analysis
- To learn about visualization for Time-Series analysis and distribution analysis
- To illustrate visualization for correlation and multivariate analysis
- To understand issues and best practices in information dashboard design

UNIT I CORE SKILLS FOR VISUAL ANALYSIS

9

Information Visualization – Effective Data Analysis – Traits of Meaningful Data – Visual Perception – Making Abstract Data Visible – Building Blocks of Information Visualization – Analytical Interaction – Analytical Navigation – Optimal Quantitative Scales – Reference Lines and Regions – Trellises and Crosstabs – Multiple Concurrent Views – Focus and Context – Details on Demand – Over-Plotting Reduction – Analytical Patterns – Pattern Examples.

UNIT II TIME-SERIES, RANKING, AND DEVIATION ANALYSIS 9

Time-series Analysis – Time-series Patterns – Time-series Displays – Time-series Best Practices – Part-to-whole And Ranking Patterns – Part-to-whole and Ranking Displays – Best Practices – Deviation Analysis – Deviation Analysis Displays – Deviation Analysis Best Practices.

UNIT III DISTRIBUTION, CORRELATION, AND MULTIVARIATE ANALYSIS 9

Distribution Analysis – Describing Distributions – Distribution Patterns – Distribution Displays – Distribution Analysis Best Practices – Correlation Analysis – Describing Correlations – Correlation Patterns – Correlation Displays – Correlation Analysis Techniques And Best Practices – Multivariate Analysis – Multivariate Patterns – Multivariate Displays – Multivariate Analysis Techniques And Best Practices.

UNIT IV INFORMATION DASHBOARD DESIGN 9

Information Dashboard – Introduction- Dashboard Design Issues and Assessment of Needs – Considerations for Designing Dashboard-Visual Perception – Achieving Eloquence.

UNIT V INFORMATION GRAPHICS DESIGN 9

Advantages of Graphics - Library of Graphs – Designing Bullet Graphs – Designing Sparklines – Dashboard Display Media – Critical Design Practices – Putting it all Together- Unveiling the Dashboard.

TOTAL : 45 PERIODS

TEXTBOOKS:

1. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", CRC press,2010.
2. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly,2008.

REFERENCES:

1. Edward R. Tufte, "The visual display of quantitative information", Second Edition, Graphics Press, 2001.
2. Evan Stubbs, "The value of business analytics: Identifying the path to profitability", Wiley, 2011.
3. Gert H. N. Laursen and Jesper Thorlund, "Business Analytics for Managers: Taking business intelligence beyond reporting", Wiley, 2010.
4. Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.

5. Stephen Few, "Information dashboard design: Displaying data for at-a-glance monitoring", Second edition, Analytics Press, 2013.
6. Stephen Few, "Now you see it: Simple Visualization techniques for quantitative analysis", Analytics Press, 2009.
7. Tamara Munzner, Visualization Analysis and Design, AK Peters Visualization Series, CRC Press, Nov. 2014

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc20_mg24/preview
2. <https://nptel.ac.in/courses/110106064/>
3. <https://www.cse.iitm.ac.in/~ravi/courses/Introduction%20to%20Data%20Analytics.html>
4. <https://freevidelectures.com/university/iit-madras/>

ONLINE RESOURCES:

1. <https://bib.dbvis.de/uploadedFiles/233.pdf>
2. <http://www.cs.put.poznan.pl/jstefanowski/sed/DM14-visualisation.pdf>
3. <https://mode.com/analytics-dispatch/data-visualization-examples/>

COURSE OUTCOMES:

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

1. Interpret the core skills required for visual analysis.
2. Illustrate time series patterns and ranking patterns and experiment deviation analysis.
3. Discriminate distribution, correlation and multivariate analysis.
4. Construct an information dashboard design using Graphics
5. Analyze real time data with various visualization techniques, design patterns and its corresponding analysis.

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - I

20ITEL606 SDG NO 4 & 9	MOBILE APPLICATION DEVELOPMENT (With Laboratory Component)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Describe those aspects of mobile programming that make it unique from programming for other platforms
- Critique mobile applications on their design pros and cons
- Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces
- Deploy applications to the Android marketplace for distribution

UNIT I GETTING STARTED WITH MOBILITY 7

Architecture of Android - Mobility Landscape - Mobile Platforms - Mobile Apps Development - Overview of Android Platform - Setting up the Mobile App Development Environment along with an Emulator - A Case Study on Mobile App Development.

UNIT II APP USER INTERFACE DESIGNING 7

Mobile UI Resources (Layout, UI Elements, Drawable, Menu) - Activity- States and Life Cycle - Interaction amongst Activities.

UNIT III APP FUNCTIONALITY BEYOND USER INTERFACE 7

Notifications - Broadcast Receivers - Telephony and SMS APIs - Native Data Handling on-Device File I/O - Shared Preferences - Mobile Databases - SQLite - Enterprise Data Access (Via Internet/Intranet).

UNIT IV INTRODUCTION TO MOBILE APPS 7

Graphics and Animation- Custom Views - Canvas - Animation APIs - Multimedia-Audio Playback and Record - Location Awareness - Native Hardware Access - Sensors - Accelerometer - Gyroscope.

UNIT V PUBLISHING ANDROID APPLICATIONS 7

Creating Your Own Services- Performing Long Running Tasks in a Service - Performing Repeated Tasks in a Service - Executing Asynchronous Tasks on Separate Threads Using IntentService.

Taking Apps to Market - Versioning - Signing - Packaging Mobile Apps - Distributing Apps on Mobile Market Place.

LIST OF EXPERIMENTS:

1. Develop an Application that uses GUI components, Font and Colours.
2. Develop an Application that uses Layout Managers and Event Listeners.
3. Develop a Native Calculator Application.
4. Develop an Application that makes use of Database.
5. Write an Application that Draws Basic Graphical Primitives on the Screen.
6. Develop a Native Application that uses GPS Location Information.
7. Implement an Application that Implements Multi-threading.
8. Develop a Mobile Application to Send an Email.

LAB REQUIREMENTS:

1. Mobile Application Development Tools.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Wei-Meng Lee, "Beginning Android Application development", Wiley Publishing, 2011.
2. James C Sheusi, "Android Application Development for Java Programmers", Cengage Learning, 2013.

REFERENCES:

1. Neil Smyth, "Android 4.2 App Development Essentials", Techotopia, 2013.
2. Mark L. Murphy, "The Busy Coder's Guide to Android Development", CommonsWare, 2009.

WEB REFERENCES:

1. <https://developer.android.com/training/basics>

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

1. Explain the features and challenges of mobile application development and set up the android app development framework
2. Implement the UI components, multimedia usage, data storage mechanisms for the given problem.
3. Use native hardware. with native data connectivity and enterprise data access for mobile application development
4. Select the appropriate API to be used in mobile application for multimedia, animation, location services, accelerometer services and sensors

5. Implement sophisticated mobile applications by utilizing intent services in a multithreaded environment.
6. Use mobile applications version control techniques and there by understand the process involved in publishing applications in a market place

CO-PO, PSO MAPPING :

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

PROFESSIONAL ELECTIVES - I

20ITEL607 SDG NO. 4 & 7	EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the building blocks of Embedded System
- To Educate in various Embedded development strategies
- To Introduce bus communication in Processors, Input/Output interfacing
- To impart knowledge in various Processor Scheduling algorithms

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS**9**

Introduction to Embedded Systems – The Build Process for Embedded Systems- Structural Units in Embedded Processor - Selection of Processor & Memory Devices- DMA – Memory Management Methods- Timer and Counting Devices - Watchdog Timer - Real Time Clock - In Circuit Emulator - Target Hardware Debugging.

UNIT II EMBEDDED NETWORKING**9**

Embedded Networking: Introduction - I/O Device Ports & Buses– Serial Bus Communication Protocols – RS232 Standard – RS422 – RS485 – CAN Bus - Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) – Need for Device Drivers.

UNIT III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT 9

Embedded Product Development Life Cycle - Objectives - Different Phases of EDLC - Modelling of EDLC - Issues in Hardware - Software Co-design - Data Flow Graph - State Machine Model - Sequential Program Model - Concurrent Model - Object Oriented Model.

UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN 9

Introduction to Basic Concepts of RTOS - Task - Process & Threads - Interrupt Routines in RTOS - Multiprocessing and Multitasking - Preemptive and Non-Preemptive Scheduling - Task Communication Shared Memory - Message Passing - Inter Process Communication – Synchronization between Processes- Semaphores - Mailbox - Pipes - Priority Inversion - Priority Inheritance.

UNIT V EMBEDDED SYSTEM APPLICATION AND DEVELOPMENT 9

Case Study of Washing Machine - Automotive Application - Smart Card System Application-ATM Machine –Digital Camera.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Peckol, “Embedded System Design”, John Wiley & Sons, 2010.
2. Shibu. K.V, “Introduction to Embedded Systems”, Second Edition, Mc Graw Hill, 2017.

REFERENCES:

1. Raj Kamal, “Embedded System-Architecture, Programming, Design”, Mc Graw Hill, 2013.
2. Lyla B Das,” Embedded Systems - An Integrated Approach”, Pearson, 2013.
3. C.R.Sarma, “Embedded Systems Engineering”, University Press (India) Pvt. Ltd, 2013.
4. Tammy Noergaard, “Embedded Systems Architecture”, Elsevier, 2006.
5. Han-Way Huang, “Embedded System Design Using C8051”, Cengage Learning, 2009.

WEB REFERENCES:

- <https://nptel.ac.in/courses/108102045/>

OUTCOMES:

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

1. Understand the Building Blocks of Embedded System and Networking Concepts (K2)
2. Examine the various Embedded Development Environment (K4)

3. Explain the Basic Concepts of Realtime Operating System (K2)
4. Summarize the important aspects of multiprocessing and multitasking (K2)
5. Examine the issues in Hardware and Software CoDesign (K4)
6. State the Embedded systems applications and Development in Real time Applications (K1)

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

20ITEL608 SDG NO. 4 & 9	FUNDAMENTALS OF EDGE AND SOFT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand Soft Computing concepts, technologies, and applications
- Understand the underlying principle of soft computing with its usage in various application
- Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory
- Understand different soft computing tools to solve real life problems.
- Develop application on different soft computing techniques like Fuzzy, GA and Neural network

UNIT I INTRODUCTION TO SOFT COMPUTING

9

ARTIFICIAL NEURAL NETWORKS Basic concepts - Single layer perceptron - Multilayer Perceptron - Supervised and Unsupervised learning - Back propagation networks - Kohonen's self-organizing networks - Hopfield network.

UNIT II FUZZY SYSTEMS	9
Fuzzy sets, Fuzzy Relations and Fuzzy reasoning, Fuzzy functions - Decomposition - Fuzzy automata and languages - Fuzzy control methods - Fuzzy decision making.	
UNIT III NEURO FUZZY MODELING	9
Adaptive networks based Fuzzy inference systems - Classification and Regression Trees - Data clustering algorithms - Rule based structure identification - Neuro-Fuzzy controls - Simulated annealing – Evolutionary computation	
UNIT IV GENETIC ALGORITHMS	9
Survival of the Fittest - Fitness Computations - Cross over - Mutation - Reproduction - Rank method - Rank space method	
UNIT V ADVANCED APPLICATIONS	9
Optimization of traveling salesman problem using Genetic Algorithm, Genetic algorithm based Internet Search Techniques, Soft computing based hybrid fuzzy controller, Introduction to MATLAB	
TOTAL: 45 PERIODS	

TEXT BOOKS:

1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", Pearson Education 2004.
2. Melanie Mitchell, "An Introduction to GeneticAlgorithm", MIT Press,1999.

REFERENCES:

1. Laurene Fausett, "Fundamentals of Neural Networks", Prentice Hall,2004.
2. D.E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley,2000.

WEB REFERENCES:

1. <https://nptel.ac.in/courses/106/105/106105173/>
2. <https://www.coursera.org/lecture/machine-learning-sas/introduction-to-neural-networks-tqN4q>
3. http://www.myreaders.info/html/soft_computing.html

OUTCOMES:

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

1. Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory. (K2)
2. Realize the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic. (K2)
3. Apply basics of Fuzzy logic and neural network.(K3)
4. Describe genetic algorithms and other random search procedures useful while seeking global optimum in self learning situations. (K2)
5. Appreciate appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications. (K2)
6. Apply modern software tools to solve real problems using a soft computing approach (K3)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	2	1	0	0	0	0	0	0	0	0	0	1	2
C02	3	3	3	1	2	0	0	0	0	0	0	0	1	2
C03	3	3	3	3	3	0	0	0	0	0	0	0	2	2
C04	3	3	3	2	3	0	0	0	0	0	0	1	3	3
C05	3	3	3	3	3	0	0	0	0	0	2	1	3	3
C06	3	3	3	3	3	2	1	2	2	0	2	2	3	3

PROFESSIONAL ELECTIVES - I

20ITEL609 SDG NO. 4, 9, 11 & 12	NoSQL DATABASE TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To discuss the benefits of NoSQL database over traditional RDBMS database.
- To understand the Distribution of Databases across nodes.
- To learn about the Column based Databases.
- To analyze and understand the basics of Key/Value based Databases.
- To understand the working of Graph NoSQL databases.

UNIT I INTRODUCTION

9

Overview, and History of NoSQL Databases-Definition of the Four Types of NoSQL Database-The Value of Relational Databases-Getting at Persistent Data-Concurrency- Integration- Impedance Mismatch- Application and Integration Databases- Attack of the Clusters-The Emergence of NoSQL, Key Points-Comparison of relational databases to new NoSQL stores-MongoDB-Cassandra- HBASE- Neo4j use and deployment- Application-RDBMS approach-Challenges NoSQL approach-Key-Value and Document Data Models-Column-Family Stores-Aggregate-Oriented Databases.

UNIT II REPLICATION AND SHARDING

9

Replication and sharding-MapReduce on databases. Distribution Models-Single Server-Sharding-Master-Slave Replication- Peer-to-Peer Replication-Combining Sharding and Replication-NoSQL Key/Value databases using MongoDB- Document Databases- Document Database-Features-Consistency-Transactions- Availability- Query Features- Scaling- Suitable Use Cases- Event Logging- Content Management Systems- Blogging Platforms- Web Analytics or Real-Time Analytics- E-Commerce Applications- When Not to Use-Complex Transactions Spanning Different Operations- Queries against Varying Aggregate Structure.

UNIT III COLUMN ORIENTED DATABASE

9

Column- oriented NoSQL databases using Apache HBASE- Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, What Is a Column-Family Data Store- Features- Consistency- Transactions- Availability- Query Features- Scaling- Suitable Use Cases- Event Logging- Content Management Systems- Blogging Platforms- Counters- Expiring Usage.

UNIT IV NoSQL KEY/VALUE DATABASES

9

NoSQL Key/Value databases using Riak- Key-Value Databases- What Is a Key-Value Store- Key-Value Store Features- Consistency- Transactions- Query Features- Structure of Data, Scaling- Suitable Use Cases- Storing Session Information- User Profiles- Preferences- Shopping Cart Data- When Not to Use- Relationships among Data- Multioperation Transactions- Query by Data- Operations by Sets.

UNIT V GRAPH NOSQL DATABASES

9

Graph NoSQL databases using Neo4-NoSQL database development tools and programming languages- Graph Databases- What Is a Graph Database? Features- Consistency- Transactions- Availability- Query Features- Scaling- Suitable Use Cases- Connected Data- Routing- Dispatch and Location-Based Services- Recommendation Engines.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Sadalage, P. & Fowler, Pearson Education.

REFERENCES:

1. R Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement, edmond, E. & Wilson, 1st Edition.
2. Pramod J. Sadalage; Martin Fowler. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence. Addison-Wesley. 2012 ISBN: 0321826620 (PS)
3. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pramod J. Sadalage, Martin Fowler, Addison-Wesley.

WEB REFERENCES:

1. <https://www.couchbase.com/resources/why-nosql>
2. <https://www.geeksforgeeks.org/introduction-to-nosql/>
3. <https://www.oracle.com/in/database/technologies/related/nosql.html>

ONLINE RESOURCES:

1. <https://www.coursera.org/learn/nosql-databases>
2. <https://www.udemy.com/course/nosql-databases-for-beginners/>

OUTCOMES:

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

1. Differentiate between a relational database and a non-relational (NoSQL) database. (K2)
2. Learn about different available Databases in the light of transactions and querying. (K3)
3. Understand the basic storage architecture and distributed file systems. (K2)
4. Explore the emergence, requirements and benefits of a Column based database. (K3)
5. Understand the basic architecture and data models of a NoSQL database (key-value stores, document databases, column-family stores). (K4)
6. Site principles behind the NoSQL databases Graph NoSql Databases. (K4)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	3	2	3	3	3	-	-	-	1	2	-	2	1	2
C02	3	2	3	3	3	-	-	-	1	2	-	2	1	2
C03	3	2	3	3	3	-	-	-	1	2	-	2	1	2
C04	3	2	3	3	3	-	-	-	1	2	-	2	1	2
C05	3	2	3	3	3	-	-	-	1	2	-	2	1	2
C06	3	2	3	3	3	-	-	-	1	2	-	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, patent searching 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 for misappropriations 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 5th Edition

REFERENCES

1. Sterling, J. L. A., World copyright law, (2008) 3rd Edition, 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. Kankanala and 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 students will 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 Trade marks and Copy rights. (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
C01	1	1	1	-	1	1	1	1	1	-	-	1	2	1
C02	3	1	3	1	2	-	1	1	-	-	-	1	2	1
C03	1	1	2	2	2	-	1	1	-	-	-	1	1	1
C04	2	1	1	2	2	-	1	1	-	-	-	1	1	2
C05	1	1	1	2	2	2	1	1	-	-	-	1	2	2

PROFESSIONAL ELECTIVES - II

20ITEL701	C# AND .NET PROGRAMMING	L	T	P	C
SDG NO. 4	WITH LABORATORY	2	0	2	3

OBJECTIVES:

- To understand the foundations of CLR execution
- To learn the technologies of the .NET framework
- To know the object oriented aspects of C#
- To learn web based applications on .NET(ASP.NET)

UNIT I INTRODUCTION TO C#

7

Introducing C# - Understanding .NET - Overview of C# - Literals -Variables - Data Types - Operators - Checked and Unchecked Operators -Expressions -Branching -Looping -Methods - Implicit and Explicit Casting -Constant -Arrays -Array Class -Array List - String -String Builder -Structure -Enumerations - Boxing and Unboxing.

UNIT II OBJECT ORIENTED ASPECTS OF C#

7

Class - Objects - Constructors and its Types - Inheritance - Properties - Indexers - Index Overloading - Polymorphism - Sealed Class and Methods - Interface - Abstract Class - Abstract and Interface - Operator Overloading - Delegates- Events - Errors and Exception - Threading.

UNIT III APPLICATION DEVELOPMENT ON .NET

7

Building Windows Application -Creating Our Own Window Forms With Events and Controls - Menu Creation - Inheriting Window Forms - SDI and MDI Application -Dialog Box(Modal and Modaleless) - Accessing Data with ADO.NET - Dataset - Typed Dataset - Data Adapter - Updating Database Using Stored Procedures -SQL Server with ADO.NET - Handling Exceptions - Validating Controls - Windows Application Configuration.

UNIT IV WEB BASED APPLICATION DEVELOPMENT ON .NET

7

Programming Web Application with Web Forms - ASP.NET Introduction - Working with XML and .NET - Creating Virtual Directory and Web Application - Session Management Techniques - web.config - Web Services - Passing Datasets - Returning Datasets from Web Services - Handling Transaction - Handling Exceptions - Returning Exceptions from SQL Server.

UNIT V CLR AND .NET FRAMEWORK

Assemblies –Versioning – Attributes –Reflection -Viewing Meta Data - Type Discovery -Reflection on type –Marshalling –Remoting -Security in .NET.

LIST OF EXPERIMENTS:**10**

1. Basic Object Oriented Programs.
2. Create an Application Development on .NET .
3. Create a Web based Application Development on .NET.
4. Mini Project on .NET.

LAB REQUIREMENTS:

Visual Studio

TOTAL : 45 PERIODS**TEXT BOOKS:**

1. Herbert Schildt, "The Complete Reference: C# 4.0", Tata Mc Graw Hill, 2012.
2. Christian Nagel et al. "Professional C# 2012 with .NET 4.5", Wiley India, 2012.

REFERENCES :

1. Andrew Troelsen , "Pro C# 2010 and the .NET 4 Platform, Fifth edition, A Press, 2010.
2. Ian Griffiths, Matthew Adams, Jesse Liberty, "Programming C# 4.0", Sixth Edition, O'Reilly, 2010.

WEB REFERENCES:

1. <http://archive.oreilly.com/oreillyschool/courses/csharp2/C.NET%20%20C%20Programming%20in%20the%20.NET%20Framework%20v1.pdf>
2. <http://mocom.xmu.edu.cn/home/project/soft/CSharp/Professional%20Csharp%207%20and%20.NET%20Core%202.0.pdf>

OUTCOMES:**After completing this course, the students should be able to**

1. Understand the foundation of the .NET framework and learn the .NET technologies. (K2)
2. Understand the basic concepts and structure of object oriented concepts in c# to develop the c# applications. (K2)
3. Apply the C# concept to implement the database application in .NET framework. (K3)

- Apply the advanced techniques to implement the window based application in .NET Framework. (K3)
- Implement the web based application and web services in .NET Framework using the advanced techniques (K3)
- illustrate about CLR and .NET framework (K3)

CO- PO, PSO MAPPING :

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

PROFESSIONAL ELECTIVES - II

20ITEL702 SDG NO. 4,7&9	WIRELESS AD HOC AND SENSOR NETWORKS				L	T	P	C
					3	0	0	3

OBJECTIVES:

- To introduce the concepts of Ad Hoc network
- To address the MAC protocol and its issues
- To explain the knowledge about Routing protocol and Transport layer
- To comprehend the concepts of WSN Routing and QoS

UNIT I INTRODUCTION**9**

Fundamentals of Wireless Communication Technology - The Electromagnetic Spectrum - Radio Propagation Mechanisms - Characteristics of the Wireless Channel Mobile Ad Hoc Networks (MANETs) - Wireless Sensor Networks (WSNs): Concepts and Architectures - Applications of Ad Hoc and Sensor Networks - Design Challenges in Ad Hoc and Sensor Networks.

UNIT II MAC PROTOCOLS FOR ADHOC WIRELESS NETWORKS**9**

Issues in Designing a MAC Protocol - Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks - Design Goals of a MAC Protocol for Ad Hoc Wireless Networks - Classification of MAC Protocols - Contention Based Protocols - Contention Based Protocols with Reservation Mechanisms -

Contention Based Protocols with Scheduling Mechanisms - Multi Channel MAC - IEEE 802.11.

UNIT III ROUTING PROTOCOLS AND TRANSPORT LAYER IN AD HOC WIRELESS NETWORK

9

Routing Protocol: Issues in Designing a Routing Protocol for Ad Hoc Networks - Classification- Proactive Routing - Reactive Routing (On-Demand)- Hybridrouting-Transport Layer Protocol for Ad Hoc Networks - Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks - Classification of Transport Layer Solutions - TCP over Ad Hoc Wireless - Network Security - Security in Ad Hoc Wireless Networks - Network Security Requirements

UNIT IV WIRELESS SENSOR NETWORKS AND MAC PROTOCOLS

9

Single Node Architecture: Hardware and Software Components of a Sensor Node - WSN Network Architecture: Typical Network Architectures - Data Relaying and Aggregation Strategies - MAC Layer Protocols: Self-Organizing - Hybrid TDMA/FDMA and CSMA based MAC -IEEE 802.15.4.

UNIT V WSN ROUTING, LOCALIZATION AND QoS

9

Issues in WSN Routing – OLSR - Localization – Indoor and Sensor Network Localization - Absolute and Relative Localization- Triangulation- QoS in WSN- Energy Efficient Design–Synchronization.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", Pearson Education, 2008.
2. Labiod. H, "Wireless Ad Hoc and Sensor Networks", Wiley, 2008.

REFERENCES:

1. Carlos De MoraesCordeiro, Dharma PrakashAgrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2nd edition, 2011.
2. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005 .
3. Kazem Sohraby, Daniel Minoli & Taieb Znati, "Wireless Sensor Networks Technology, Protocols and Application", John Wiley, 2007.
4. Li, X, "Wireless Ad Hoc and Sensor Networks: Theory and Applications", Cambridge University Press, 2008.

WEB REFERENCES:

1. www.wirelessnetworksonline.com
2. www.securityinwireless.com
3. www.ida.liu.se/~petel71/SN/lecture-notes/sn.pdf

ONLINE RESOURCES:

1. <https://nptel.ac.in/courses/106105160/>
2. <https://www.classcentral.com/course/swayam-wireless-ad-hoc-and-sensor-networks-7888>

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

1. Understand the fundamental concepts and applications of Ad Hoc and wireless sensor networks. (K1)
2. Explain the MAC protocol of Ad Hoc networks. (K2)
3. Explain Routing protocols for Ad Hoc Wireless networks with respect to TCP design issues. (K3)
4. Explain the concepts of Network architecture and MAC layer protocol for WSN in different scenarios. (K3)
5. Explore the WSN routing issues by considering QoS measurements. (K3)
6. Apply Routing protocols in the different scenarios of WSN and compare the performance metrics. (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	-	-	-	-	1	1	3	1
CO2	3	2	2	1	1	2	-	-	-	-	2	1	3	1
CO3	3	2	2	2	1	1	-	-	-	-	1	1	3	1
CO4	3	2	2	2	1	2	-	-	-	-	1	1	3	1
CO5	3	2	2	2	1	1	-	-	-	-	1	1	3	1
CO6	3	3	2	3	1	2	-	-	-	-	1	1	3	1

PROFESSIONAL ELECTIVES - II

20ITEL703 SDG NO. 4	INFORMATION STORAGE AND MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic components of Storage System Environment
- To learn about the Storage Area Network Characteristics and Components
- To illustrate emerging technologies in Storage Area Network
- To learn about the different backup and recovery topologies and their role in providing disaster recovery

UNIT I STORAGE SYSTEMS

9

Introduction to Information Storage and Management: Information Storage, Evolution of Storage Technology and Architecture - Data Center Infrastructure - Key Challenges in Managing Information - Information Lifecycle - Storage System Environment - Components of the Host - RAID - Implementation of RAID - RAID Array Components - RAID Levels - RAID Comparison - RAID Impact on Disk Performance - Hot Spares - Intelligent Storage System - Components - Intelligent Storage Array.

UNIT II STORAGE NETWORKING TECHNOLOGIES

9

Direct-Attached Storage and Introduction to SCSI - Types of DAS - DAS Benefits and Limitations - Disk Drive Interfaces - Introduction to Parallel SCSI - SCSI Command Model - Storage Area Networks - Fiber Channel - SAN Evolution - SAN Components - Fiber Channel Connectivity - Fiber Channel Ports - Fiber Channel Architecture - Zoning - Fiber Channel Login Types - Fiber Channel Topologies - Network Attached Storage - Benefits of NAS - File I/O Components of NAS - NAS Implementations - NAS File Sharing Protocols - NAS I/O Operations.

UNIT III ADVANCED STORAGE NETWORKING AND VIRTUALIZATION

9

IP SAN - iSCSI - FCIP - Content - Addressed Storage - Fixed Content and Archives - Types of Archives - Features and Benefits of CAS - CAS Architecture - Object Storage and Retrieval in CAS - CAS Examples - Storage Virtualization - Forms of Virtualization - NIA Storage Virtualization Taxonomy - Storage Virtualization Configurations - Storage Virtualization Challenges - Types of Storage Virtualization.

UNIT IV BUSINESS CONTINUITY**9**

Introduction to Business Continuity - Information Availability - BC Terminology - BC Planning Lifecycle - Failure Analysis - Business Impact Analysis - BC Technology Solutions - Backup and Recovery - Backup Purpose - Considerations - Granularity - Recovery Considerations - Backup Methods and Process - Backup and Restore Operations - Backup Topologies - Backup in NAS Environments - Backup Technologies.

UNIT V REPLICATION**9**

Local Replication - Source and Target - Uses of Local Replicas - Data Consistency - Local Replication Technologies - Restore and Restart Considerations - Creating Multiple Replicas - Management Interface - Remote Replication - Modes of Remote Replication and its Technologies - Network Infrastructure.

TOTAL : 45 PERIODS**TEXT BOOK:**

1. EMC Corporation, "Information Storage and Management", Wiley Publication, India, 2009.
2. Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, Osborne, 2003

REFERENCES:

1. Marc Farley, "Building Storage Networks", Tata McGraw Hill, Osborne, 2001.
2. Meeta Gupta, "Storage Area Networks Fundamentals", Pearson Education Limited, 2002.

WEB REFERENCES:

1. <https://www.coursera.org/courses?query=data%20storage>
2. <https://www.springpeople.com/information-storage-management-training>
3. <https://nptel.ac.in/courses/106105175/>

ONLINE RESOURCES:

1. <https://www.sciencedirect.com/topics/computer-science/storage-management>
2. <https://www.communitydoor.org.au/technology/information-storage-and-management-systems>

OUTCOMES:

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

1. Understand the logical and the physical components of a Storage infrastructure with virtualization techniques. (K2)
2. Classify the different types of RAID implementations and Intelligent Storage System. (K2)
3. Discuss the architecture of storage networking technologies such as DAS, SAN, IP SAN, NAS. (K1)
4. Apply the various storage architectures and compare the key elements in classic and virtualized environments. (K3)
5. Illustrate the business continuity solutions with different backup and recovery techniques. (K3)
6. Demonstrate the Information Storage System Environment by applying various archives for managing fixed content and different replication technologies. (K3)

CO- PO, PSO MAPPING :

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

PROFESSIONAL ELECTIVES - II

20ITEL704 SDG NO. 4	FUNDAMENTALS OF BLOCKCHAIN TECHNOLOGY WITH LABORATORY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand how Blockchain systems (mainly Bitcoin and Ethereum) work
- To securely interact with the Blockchain Systems
- To design, build, and deploy smart contracts and distributed applications
- To integrate ideas from Blockchain technology into their own projects

UNIT I BASICS**7**

Distributed Database - Two General Problem - Byzantine General Problem - 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 BLOCKCHAIN**7**

Introduction - Conventional Distributed Database - Blockchain Network - Mining Mechanism - Distributed Consensus - Merkle Patricia Tree - Gas Limit- Transactions and Fee – Anonymity – Reward - Chain Policy - Life of BlockchainApplication - Soft & Hard Fork - Private and Public blockchain.

UNIT III DISTRIBUTED CONSENSUS AND CRYPTOCURRENCY**7**

Nakamoto Consensus - Proof of Work- Proof of Stake - Proof of Burn - Difficulty Level - Sybil Attack - Energy Utilization and Alternate.

UNIT IV CRYPTOCURRENCY**7**

History - Distributed Ledger -Bitcoin Protocols - Mining Strategy and Rewards - Ethereum – Construction – DAO - Smart Contract – GHOST - Vulnerability – Attacks – Sidechain – Namecoin.

UNIT V CRYPTOCURRENCY REGULATIONS**7**

Stakeholders - Roots of Bit Coin - Legal Aspects-Crypto Currency Exchange - Black Market and Global Economy – Applications - Internet of Things - Medical Record Management System - Domain Name Service and future of Blockchain.

LIST OF EXPERIMENTS :**10**

1. Naive Blockchain construction
2. Memory Hard algorithm
3. Hashcash implementation
4. Direct Acyclic Graph
5. Play with Go-ethereum
6. Smart Contract Construction
7. Toy application using Blockchain
8. Mining puzzles

LAB REQUIREMENTS :

Geth, BlockchainTestnet or any open source software.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.
2. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger", Yellow paper, 2014.

REFERENCES:

- 1 Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", First Edition, 2014
- 2 Bellaj Badr, Richard Horrocks, Xun (Brian) Wu, "Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger", Packt Publishing Limited, 2018.
- 3 Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained", 2nd Edition, Packt Publishing Ltd, March 2018
- 4 Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.

WEB REFERENCES:

1. <https://hackernoon.com/best-resources-for-learning-blockchain-develop>
2. <https://limechain.tech/the-best-blockchain-resources-2018>
3. https://www.aallnet.org/resource_guide/blockchain-resources

ONLINE RESOURCES:

1. <https://bitcoin.org/bitcoin.pdf>
2. <https://eprint.iacr.org/2016/1007.pdf>

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

1. Explain design principles of Bitcoin, Ethereum and Nakamoto consensus. (K2)
2. List and describe differences between proof-of-work and proof-of-stake consensus. (K2)
3. Explain the Simplified Payment Verification protocol. (K2)
4. Interact with a blockchain system by sending and reading transactions (K3)
5. Design, build, and deploy a distributed application. (K3)
6. Evaluate security, privacy, and efficiency of a given blockchain system. (K3)

CO- PO,PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	3	2	1	-	3	1	-	-	1	-	3	2
C02	3	3	3	3	1	-	2	1	-	-	-	1	3	2
C03	3	3	3	2	1	3	3	1	2	-	1	1	3	3
C04	3	3	3	2	1	3	3	1	2	-	1	1	3	3
C05	3	3	3	2	-	2	2	1	-	1	-	1	3	3
C06	3	3	3	1	1	2	2	1	2	1	2	2	3	3

PROFESSIONAL ELECTIVES - II

20ITEL705 SDG NO. 4	APPLIED MACHINE LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of Machine Learning and Classification Procedures
- To study speech recognizing and synthesizing
- To elucidate about Dissecting Time Series and Sequential Data
- To learn about image content analysis and Facial recognition

UNIT I INTRODUCTION**9**

Text Feature Engineering Introduction - Cleaning Text Data - Preprocessing Data Using Tokenization-Tagging and Categorizing Words-Creating Features from Text Data-Stemming- Lemmatizing-Bagging Using Random Forests-Implementing Bag of Words-Testing Prepared Data-Analyze the Results-Building a Text Classifier-Sentiment Analysis-Identifying and Implementing Patterns in Text Using Topic Modeling- Case Study – Twitter Data.

UNIT II SPEECH RECOGNIZING AND SYNTHESIZING**9**

Speech Recognition- Introduction-Reading -Plotting -Transforming Audio Signals - Fourier Transform Signal -Generating Audio Signals -Generate Time Axis Synthesizing Music-Construct the Audio Sample -Amplitude and Frequency-Synthesizer Function-Extracting Frequency Domain Features-MFCC and Filter Bank Features-Hidden Markov Models-HMM Training - Prediction-Building a Speech Recognizer-MFCC Features.

UNIT III DISSECTING TIME SERIES AND SEQUENTIAL DATA**9**

Introduction-Transforming Data into the Time Series Format Pandas -Numpy to Convert Time Series Data-Plotting and Operation on Time Series Data-Slicing - Plotting and Operation on Time Series Data-Extracting Statistics - Correlation Coefficients-Plotting and Understanding Correlations-Building Hidden Markov Models for Sequential Data-Prepare the Time Series Data-Train Gaussian HMM-Building Conditional Random Fields for Sequential Text Data-CRF Model-Analyzing Stock Market Data using Hidden Markov Models - Train the HMM and Visualize the Model.

UNIT IV IMAGE CONTENT ANALYSIS**9**

Image Content Analysis-Computer Vision-Operating on Images Using OpenCV- Python- Learn to Extract and Load the Image - Detecting Edges-Histogram Equalization- Sobel Filter - Laplacian Edge Detector-Canny Edge Detector- Histogram Equalization - Visualize Gray Scale Image- Detecting Corners-Understand the Output Corner Detection Image- Detecting SIFT Feature Points- SIFT Feature Detection- Visualize the Feature - Detected Image Building - Star Feature Detector- Detect Features using the Star Feature Detector- Visualize Key points on the Input Image- Creating Features using Visual Codebook and Vector Quantization-Method to Quantize the Data Points.

UNIT V FACIAL RECOGNITION**9**

Biometric Face Recognition- Face Detection from the Image and Video-Capturing and Processing Video from a Webcam -Resizing -Scaling- Building a Face Detector using HaarCascades- Determine the Location of a Face -Face Detector on the Grayscale Image- Building Eye and Nose detectors-Face Cascade Classifier- Visualize Eye and Nose Detector- Performing Principal Components Analysis- PCA in Face Recognition Systems- Convert the Dataset from a Five- Dimensional Set to a Two Dimensional Set- Kernel Principal Components Analysis Perform Kernel PCA- Plot the PCA-Transformed Data-Plot Kernel PCA-Transformed Data- Performing Blind Source Separation-Independent Components Analysis.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Prateek Joshiandco, "Python: Real World Machine Learning", Packt Publishing, 2016.
2. Sebastian Raschka, "Python Machine Learning", Packt Publishing, 2013.

REFERENCES:

1. Sebastian Raschka, "Python Machine Learning", Packt Publishing, 2013.

2. Richert Coelho, “Building Machine Learning Systems with Python”, Packt Publishing, 2016.
3. Michael Bowles, “Machine Learning in Python”, Wiley & Sons, 2015.

WEB REFERENCES:

1. <https://b-ok.cc/book/5216152/451497>

ONLINE RESOURCES:

1. <https://nptel.ac.in/courses/108/104/108104112/>
2. <https://nptel.ac.in/courses/106/106/106106202/>

OUTCOMES:

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

1. Understand the basics of Machine Learning and Classification Procedures [K2]
2. Interpret the speech recognizing and synthesizing models [K2]
3. Apply Learning models to dissect time Series and Sequential Data [K3]
4. Analyze the image content to extract essential features for learning models [K4]
5. Compare the performance of various models for facial recognition [K4]
6. Describe the machine learning models for image classification [K2]

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	3	3	3	3	-	-	-	-	2	2	2	1
C02	3	3	1	3	1	3	-	-	-	-	2	2	2	1
C03	2	2	3	2	1	3	-	-	-	-	2	2	2	1
C04	2	2	2	2	3	3	-	-	-	-	2	2	2	1
C05	3	3	3	3	3	3	-	-	-	-	2	2	2	1
C06	3	3	3	3	3	3	-	-	-	-	2	2	2	1

PROFESSIONAL ELECTIVES - II

20ITEL705	INFORMATION RETRIEVAL	L	T	P	C
SDG NO. 4 & 12	TECHNIQUES	3	0	0	3

OBJECTIVES:

- To understand the basics of Information Retrieval
- To apply Machine Learning techniques for Text Classification and Clustering
- To implement various Search engine system operations
- To learn different techniques of Recommender system

UNIT I INTRODUCTION

9

Information Retrieval – Early Developments – The IR Problem – The Users Task – Information Vs Data Retrieval - The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes - The Web – The e-Publishing Era – How the Web Changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

UNIT II MODELING AND RETRIEVAL EVALUATION

9

Basic IR Models - Boolean Model - TF / IDF (Term Frequency/Inverse Document Frequency) Weighting - Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-Based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.

UNIT III TEXT CLASSIFICATION AND CLUSTERING

9

A Characterization of Text Classification – Unsupervised Algorithms - Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – KNN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation Metrics – Accuracy and Error – Organizing the Classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-Dimensional Indexing.

UNIT IV WEB RETRIEVAL AND WEB CRAWLING

9

The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations - Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web

Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

UNIT V RECOMMENDER SYSTEM

9

Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-Based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-Based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, “Modern Information Retrieval: The Concepts and Technology behind Search”, Second Edition, ACM Press Books, 2011.
2. Ricci, F, Rokach, L. Shapira, B.Kantor, “Recommender Systems Handbook”, First Edition, 2011.

REFERENCES:

1. C. Manning, P. Raghavan, and H. Schütze, “Introduction to Information Retrieval”, Cambridge University Press, 2008.
2. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, “Information Retrieval: Implementing and Evaluating Search Engines”, The MIT Press, 2010.
3. ChengXiang Zhai, “Statistical Language Models for Information Retrieval (Synthesis Lectures Series on Human Language Technologies)”, Morgan & Claypool Publishers, 2008.
4. Gerald J. Kowalski, Mark T. Maybury, “Information Storage and Retrieval Systems – Theory and Implementation”, Second Edition, Springer 2013.
5. Frakes, W.B., Ricardo Baeza-Yates, “Information Retrieval Data Structures and Algorithms”, Prentice Hall, 2007.

WEB REFERENCES:

1. <https://libguides.lamk.fi/informationretrieval/techniques>

ONLINE RESOURCES:

1. www.informationretrieval.org
2. <https://nlp.stanford.edu/IR-book/html/htmledition/irbook.html>

OUTCOMES:

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

1. Identify and design the various components of an Information Retrieval system. (K1)
2. Use an open source Search engine framework and explore its capabilities. (K3)
3. Apply appropriate method of Classification or Clustering. (K3)
4. Design and implement innovative features in a Search engine. (K2)
5. Design and implement a Recommender system. (K2)
6. Demonstrate Information visualization technologies like Cognition and perception in the Internet or Web search engine.(K3)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	3	2	3	1	1	1	2	1	1	2	1	2
C02	3	3	3	3	3	1	2	2	3	2	1	2	1	2
C03	3	3	3	3	3	1	1	1	1	2	1	2	1	2
C04	3	3	3	2	3	1	2	2	2	2	1	2	2	2
C05	3	3	3	3	3	1	2	2	3	3	2	2	2	2
C06	3	3	-	-	2	2	-	-	-	-	1	1	2	2

PROFESSIONAL ELECTIVES - II

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 – Ontological Representation of Social Individuals – Ontological 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. BorkoFurht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.

REFERENCES:

1. GuandongXu, Yanchun Zhang and Lin Li, "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 students should be able to

1. Understand a broad 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 - II

20ITEL605 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 Two/Three Dimensional Graphics and their Transformations
- To get knowledge about various Object representation methods and Visible Surface Detection methods
- To study the Multimedia concepts and various I/O technologies

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 - Case Study: Blender Graphics -Blender Fundamentals–Drawing Basic Shapes – Modelling – Shading & Textures

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

1. Judith Jeffcoate, "Multimedia in practice: Technology and Applications", PHI, 1998.
2. Foley, Vandam, Feiner and Hughes, "Computer Graphics: Principles and Practice", 2nd Edition, Pearson Education, 2003.
3. Jeffrey McConnell, "Computer Graphics: Theory into Practice", Jones and Bartlett Publishers, 2006.
4. Hill F S Jr, "Computer Graphics", Maxwell Macmillan, 1990.
5. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, "Fundamentals of Computer Graphics", CRC Press, 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 hypermedia 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 - II

20ITEL707 SDG NO 4,9, 11 &12	ROBOTIC PROCESS AUTOMATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the RPA Basics and the underlying logic and architecture.
- To learn about the data manipulation and the controlflow structures in RPA Tools.
- To gain knowledge on using the various plugins and user interaction modules.
- To understand the exception handling and the deploying techniques in the context of RPA
- To develop RPA system for the popular applications.

UNIT I PROGRAMMING BASICS & RPA CONCEPTS

9

Processes-SoftwareDesign-SDLC Programming Concepts -Scripting- HTML - .Net Framework-.Net Fundamentals-CSS-XML-RPA Basics - History of Automation - What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Workloads which can be automated.

UNIT II RPA TOOL BASICS & CONTROL FLOW

9

Sequence, Flowchart & Control Flow: Sequencing the Workflow – Activities – Flowchart - Control Flow for Decision making.

Data Manipulation:Variables-Collection-Arguments-DataTable-Clipboard management-File operations-Controls-Finding the control-waiting for a control-Act on a control-UiExplorer.

UNIT III PLUGINS & USER INTERACTION

9

Plugins and Extensions:Terminal plugin-Java plugin-Java plugin with UiPath Studio-Citrix automation-Citrix environment-Mail plugin-PDF plugin-Web integration-Excel and Word plugins-Credential management. Extensions Handling User Events and Assistant Bots: What are assistant bots-Monitoring system event triggers-Hotkey trigger-Mouse trigger-System trigger-Monitoring image and element triggers- Launching an assistant bot on a keyboard event.

UNIT IV EXCEPTION HANDLING & PROJECT BUILDING

9

Exception handling-Common exceptions and ways to handle them-Logging and taking screenshots Debugging techniques-Setting breakpoints-Slow step-Highlighting- Break-Collecting crash dumps- Enabling crash dumps- Disabling

crash dumps-Error reporting: Enterprise Edition customers- Community Edition users. Managing and Maintaining the Code: Project organization-Picking an appropriate layout for each workflow- Breaking the process into smaller parts-Using exception handling- Making your workflow readable-Keeping it clean- Nesting workflows- Reusability of workflows- Templates-Commenting techniques- State Machine- When to use Flowcharts State Machines or Sequences.

UNIT V DEPLOYING AND MAINTAINING THE BOT

9

Publishing using publish utility-Overview of Orchestration Server- Using Orchestration Server to control bots- Using Orchestration Server to deploy bots- License management- Activating and uploading a license to Orchestrator-Publishing and managing updates-Packages-Managing packages.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: O'Reilly Publishing, 2018.
2. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018.

REFERENCES:

1. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018.
2. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation, 1st Edition, Consulting Opportunity Holdings LLC, 2018.
3. Olivier Hersent, David Boswarthick, Omar Elloumi , –The Internet of Things – Key applications and Protocols||, Wiley, 2012.

WEB REFERENCES:

1. <https://www.edx.org/learn/robotic-process-automation>.
2. <https://www.nice.com/rpa/rpa-guide/>.

ONLINE RESOURCES:

1. <https://www.uipath.com/rpa/robotic-process-automation>.
2. <https://www.udemy.com/robotic-process-automation/>
3. <https://www.uipath.com/landing/academic-studio-download>

OUTCOMES:

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

1. Understand Basic Programming concepts and to describe the various components of RPA development. (K2)
2. Understand the user interface and to manage the interaction modules and activities. (K2)
3. Demonstrate the various plugins for Image, Text and Data Tables Automation. (K3)
4. Describe automation process to Email and various types of Exceptions and strategies to handle. (K2)
5. Analyze various case studies and application of RPA in real time scenarios. (K4)
6. Explain and deploy the applications based on the orchestration concepts. (K4)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	1	-	-	-	-				-	-	-	-	3	2
C02	2	3	3	3	3				2	2	2	2	3	2
C03	1	3	-	-	-				-	-	-	-	3	2
C04	2	3	3	3	3				2	2	2	2	3	2
C05	1	2	3	3	3				2	2	2	3	3	2
C06	2	-	-	-	-				-	-	-	1	3	2

PROFESSIONAL ELECTIVES - II

20ITEL708 SDG NO 4, 9	FULL STACK SOFTWARE DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gain knowledge on front-end and back-end technologies
- To become proficient in JQuery and Bootstrap
- To build strong expertise on Typescript, React and Node.js
- To implement MVC and responsive design to provide unified and intuitive user experience
- To Use Docker and Kubernetes platform for building, running, managing and distributing applications

UNIT I INTRODUCTION TO FULL STACK DEVELOPMENT 9

Introduction – Full Stack Development – Front-end – Back-end, Technologies essential for Full Stack Development – Introduction to Web Application Development – Front-end Technologies – Back-end Technologies – Introduction to MVC – Introduction to Web Services – Communication between front-end and back-end – Build responsive websites with HTML5 and CSS3 – Javascript basic building blocks – Object oriented JS – Functional JS.

UNIT II JQUERY AND BOOTSTRAP 9

Overview of Bootstrap – Structure of a Bootstrap-enabled Webpage – Grids – Typography – Colors – Images – Jumbotron – Alerts – Buttons – Button Groups – Progress Bars – Pagination – Navigation menu and bar – Forms – Media Objects – Overview of jQuery – Configuration of jQuery – Selectors – Events – Effects – Working with HTML – jQuery with CSS – Traversing.

UNIT III TYPE SCRIPT, REACT, NODEJS 9

Node and NPM – NPM commands – Standard modules - React – Components – JSX – TypeScript – Configuring Typescript Compilation – Types – Block scope – Functions – Spread and Rest – Destructuring – Classes – Interfaces – Namespaces and Modules.

UNIT IV SPRING, SPRING MVC AND HIBERNATE 9

Spring Framework – Spring Architecture – Spring MVC – Interception – Chain of resolvers – Multiple view page and controllers – Model Interface – Forms – CRUD – File Upload – Validation – Hibernate Introduction – Architecture – Java objects in Hibernate – Inheritance Mapping – Collection Mapping – HCQL – Caching – Spring Integration.

UNIT V CONTAINERS 9

Kubernetes and Container Operations – Overview – Microservices and orchestration – Kubernetes Architecture – Core constructs – Health checks – Application Scheduling - Docker – Introduction to Containers and Containerization – Building Docker Images – Deploying to Docker hub.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Mayuir Ramgir, “Full Stack Java Development with Spring MVC, Hibernate, jQuery and Bootstrap”, Wiley India Pvt. Ltd., 2020.
2. Frank Zammetti, “Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack and Docker”, Apress, 2020.

REFERENCES:

1. Chris Northwood, “The Full Stack Developer”, Apress, 2018.

- Adam Bretz, Colin J. Ihrig, "Full Stack Javascript Development with MEAN", SitePoint Pty.Ltd., 2014.
- Dinesh Rajput, "Designing Applications with Spring Boot 2.2 and React JS", BPB Publications, 2019.
- Juha Hinkula, Hands-on Full Stack Development with Spring Boot 2 and React, Packt Publishing, 2019.
- Jonathan Baier, "Getting Started with Kubernetes", Packt Publishing, 2015.

WEB REFERENCES:

- <https://docs.spring.io/spring-framework/docs/3.2.x/spring-framework-reference/html/index.html>
- <https://www.w3spoint.com/hibernate-tutorial>
- <https://www.w3schools.com/>
- <https://docs.docker.com/get-started/>
- <https://kubernetes.io/docs/tutorials/>

OUTCOMES:

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

- Understand the basic principles of full stack software development. (K2)
- Classify the libraries, user interfaces and runtime environments for data communication. (K2)
- Architect solutions to real time problems by combining visual components and classes. (K3)
- Use the frameworks for developing enterprise class applications. (K3)
- Design and develop interactive and responsive web pages. (K3)
- Build and manage container orchestration for elastic web server framework. (K3)

CO- PO, PSO MAPPING :

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

PROFESSIONAL ELECTIVES - II

20MGEL601 SDG NO. 4 & 9	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts and philosophies of Quality Management
- To know the impact and significance of TQM principles on organizations in recent times.

UNIT 1 INTRODUCTION

8

Need and Evolution of Quality, Quality-Definitions, statements and dimensions of product and service quality TQM-concepts, Elements and Framework, Benefits & Obstacles of TQM , TQM-Culture, Strategic Quality Management, Costs of Quality.

UNIT II CONTRIBUTIONS AND APPROACHES TO QUALITY MANAGEMENT

9

Renowned quality gurus- Deming, Juran, Crosby and Ishikawa, Contributions of Taguchi – Loss Function, Signal to Noise Ratio and design of experiments, Kaizen -principles and practices-5 S tools, Poka Yoke-8Discipline Methodology, Just in time, Continuous process improvement-PDCA cycle and 5 why analysis

UNIT III CUSTOMER FOCUS AND TEAMWORK

8

Identifying Customer Needs, QFD - Process, Building HoQ, Customer Satisfaction Measurement Techniques. Employee Involvement Practices. Individual Participation - Suggestion Systems & Empowerment, Motivation, Leadership, Partnerships - Cross-Functional Teams, Supplier/Customer Partnerships, Problem-Solving Teams - Quality Circles.

UNIT IV STATISTICAL TOOLS & TECHNIQUES

11

SQC - Tools For Data Collection And Analysis – Seven tools(old and new),Statistical Process Control (SPC) – Construction of Control Chart – Variables and Attributes. Process Capability – concepts and measurement. Six Sigma models,Lean six sigma, BPR, TPM, FMEA and Benchmarking.

UNIT V QUALITY SYSTEMS AND STANDARDS

9

Need for ISO 9000- ISO 9001: 2015 quality system-guidelines and clausewise requirements,Quality audits-types and responsibilities,ISO 14001:2004 EMS,

ISO / TS 16949:2002, ISO 27001:2005 ISMS, SEI – CMMI and Awards - Demings Prize, MBNQA and criteria.

TOTAL:45PERIODS

TEXT BOOKS:

1. Besterfield, Total Quality Management, 3rd Edition, Pearson India
2. Shridhara K Bhat, Total Quality Management. Himalaya Publishing House, 2010.

REFERENCE BOOKS:

1. Bedi Kanishka, Quality Management, Oxford University Press
2. Kiran D.R., Total Quality Management - Key Concepts and Case Studies, Butterworth-Heinemann, 2016.
3. Poornima M Charantimath, Total Quality Management. Pearson India, 2017
4. Sharma DD, Total Quality Management, Principles, Practice and Cases, Sultan Chand and Sons.
5. Douglas C. Montgomery, Introduction to Statistical Quality Control, Wiley Student Edition, 4 th Edition, Wiley India Pvt Limited, 2008

MOOC REFERENCES:

1. <https://www.coursera.org/lecture/supply-chain-management/total-quality-management-wLrvy>
2. https://swayam.gov.in/nd1_noc20_mg34/preview
3. <https://www.openlearning.com/courses/total-quality-management/>
4. <https://www.udemy.com/course/tqm-in-academics/>

MOOC REFERENCES:

1. https://www.unido.org/sites/default/files/2009-04/A_roadmap_to_quality_volume_1_0.pdf
2. <https://www.investopedia.com/terms/t/total-quality-management-tqm.asp>
3. https://www.researchgate.net/publication/237006071_Total_Quality_Management_in_Academic_Libraries_A_Study
4. <https://www.isixsigma.com/methodology/total-quality-management-tqm/introduction-and-implementation-total-quality-management-tqm/>
5. <https://study.com/academy/lesson/five-principles-of-total-quality-management-tqm.html>

OUTCOMES:

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

1. Understand quality concepts and philosophies of TQM. (K2)
2. Apply TQM principles and concepts of continuous improvement. (K3)
3. Explain the quality tools, management tools and statistical fundamentals to improve quality. (K2)
4. Demonstrate the various TQM tools as a means to improve quality. (K2)
5. Illustrate quality tools and procedures for better quality output. (K3)

CO- PO, PSO MAPPING :

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

PROFESSIONAL ELECTIVES - III

20MEPC702 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 - Denavit Hartenberg Representation - Inverse Kinematics - Linearization of Robot Dynamics, State Variable Continuous and Discrete Models.

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, 2nd Edition, McGraw-Hill Publishers.

- John J. Craig, "Introduction to Robotics, Mechanics and Control", 2010, 3rd Edition, Pearson Education.

REFERENCES:

- M.W. Spong and M. Vidyasagar, "Robot Dynamics and Control," 2nd Edition, John Wiley & Sons, New York, 2012.
- Lorenzo Sciavicco Bruno Siciliano, "Modelling and Control of Robot Manipulators", 1st Edition, Springer Science & Business Media, Berlin, 2012.
- Deb.S.R and Sankha Deb, "Robotics Technology and Flexible Automation", Tata McGraw Hill Publishing Company Limited, 2010.
- Klafter.R.D, Chmielewski.T.A, and Noggin's., "Robot Engineering: An Integrated Approach", Prentice Hall of India Pvt. Ltd., 1994.

WEB REFERENCES:

- <https://nptel.ac.in/courses/112/105/112105249/>
- <https://www.coursera.org/learn/mobile-robot>

OUTCOMES:

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

- Understand the necessity and basics of Robotics in real time applications.(K2)
- Explain the components and working principle in Robots. (K2)
- Apply the use of Image Processing, Obstacle detection and Path planning in Robotic applications. (K3)
- Demonstrate the mathematical model of Robotic systems. (K3)
- 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
C01	3	2	2	2	-	2	-	-	-	-	-	1	2	2
C02	3	2	2	2	-	-	-	-	-	-	-	1	2	2
C03	3	3	3	3	2	-	-	-	-	-	-	1	3	2
C04	3	3	3	3	1	-	-	-	-	-	-	2	3	2
C05	3	3	3	3	1	-	-	-	-	-	-	1	2	2

PROFESSIONAL ELECTIVES - III

20ITEL709 SDG NO. 4,9,11&12	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand Smart Objects, IoT Architectures and IoT protocols
- To build simple IoT Systems using Arduino and Raspberry Pi
- To understand Data Analytics and Cloud in the context of IoT
- To develop IoT infrastructure for popular applications

UNIT I FUNDAMENTALS OF INTERNET OF THINGS

9

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M - IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack - Fog, Edge and Cloud in IoT – Functional Blocks of an IoT Ecosystem – Sensors - Actuators - Smart Objects and Connecting Smart Objects.

UNIT II IOT PROTOCOLS

9

IoT Access Technologies - Physical and MAC Layers - Topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer - IP Versions - Constrained Nodes and Constrained Networks – Optimizing IP for IoT - From 6LoWPAN to 6Lo - Routing Over Low Power and Lossy Networks – Application Transport Methods - Supervisory Control and Data Acquisition – Application Layer Protocols - CoAP and MQTT.

UNIT III DESIGN AND DEVELOPMENT

9

Design Methodology - Embedded Computing Logic - Microcontroller - System on Chips - IoT System Building Blocks - Arduino - Board Details - IDE Programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

UNIT IV DATA ANALYTICS AND SUPPORTING SERVICES

9

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG

UNIT V CASE STUDIES/INDUSTRIAL APPLICATIONS

Cisco IoT System - IBM Watson IoT Platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities - Layered Architecture - Smart Lighting - Smart Parking Architecture and Smart Traffic Control

TOTAL: 45 PERIODS**TEXT BOOK:**

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2017.
2. Rajkamal,"Internet of Things: Architecture, Design Principles And Applications",McGraw Hill HigherEducation,2017.

REFERENCES:

1. ArshdeepBahga, VijayMadiseti, "Internet of Things – A Hands-on approach", Universities Press, 2011.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key Applications and Protocols", Wiley, 2012.
3. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand and David Boyle, "From Machine-to-Machine to the Internet of Things and Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
5. Michael Margolis, Arduino Cookbook, "Recipes to Begin, Expand and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.

WEB REFERENCES:

1. <https://www.arenasolutions.com/blog/10-valuable-iot-web-resources/>
2. <https://nevonprojects.com/iot-projects/>
3. <https://www.skyfilabs.com/blog/list-of-latest-iot-projects-for-engineering-students>

ONLINE RESOURCES:

1. <https://www.arenasolutions.com/blog/10-valuable-iot-web-resources/>
2. <https://nevonprojects.com/iot-projects/>

OUTCOMES:

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

1. Interpret the concept of IoT, its Components and its architecture.(K2)
2. Learn the design methods of various protocols(K2)
3. Build the design methodology for a IoT system using Raspberry(K3)
4. Apply the Data analytics and Support servicing tool related to IoT(K3)
5. Experiment the case study and application of IoT in real time scenario(K3)
6. Illustrate the solutions for various distributed applications using the Big data technologies.(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	0	0	0	0	0	2	3	2	2
CO2	2	3	1	2	1	0	0	0	0	0	2	3	2	2
CO3	3	2	3	0	3	0	0	0	0	0	2	1	3	3
CO4	2	3	2	3	2	0	0	0	0	0	1	1	3	3
CO5	2	3	3	3	2	2	2	2	1	2	1	2	3	3
CO6	2	3	3	3	3	2	3	2	1	2	1	2	3	3

PROFESSIONAL ELECTIVES - III

20ITEL710 SDG NO. 4 & 9	SERVICE ORIENTED ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic principles of Service Oriented Architecture
- To learn the fundamentals of XML
- To implement API using XML, JSON and REST
- To study about web services technology elements of SOA

UNIT I INTRODUCTION TO XML AND XML BASED APPLICATIONS 9

XML Document Structure – Well Formed and Valid documents – Name Spaces – DTD – XML Schema – X-Files - Parsing XML using DOM - SAX – XML Transformation and XSL – XSL Formatting – Modeling Databases in XML.

UNIT II DESIGN OF API USING JSON AND REST 9

Introduction to JSON - REST- Comparison of XML , JSON and REST - HTTP Methods using RESTful Services - REST Architectural Constraints - Richardson Maturity Model - JSON and REST Based Service Provider and Requestor API Examples.

UNIT III SERVICE ORIENTED ARCHITECTURE 9

Characteristics of SOA - Comparing SOA with Client/Server and Distributed Architectures – Benefits of SOA - Principles of Service Orientation – Service Layers.

UNIT IV WEBSERVICES 9

Service Descriptions – WSDL – Messaging with SOAP – Service Discovery – UDDI – Message Exchange Patterns – Orchestration – Choreography –WS Transactions.

UNIT V BUILDING SOA - BASED APPLICATIONS 9

Service Oriented Analysis and Design – Service Modeling – Design Standards and Guidelines - Composition – WS-BPEL – WS-Coordination – WS-Policy – WS-Security – SOA support in J2EE.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ron Schmelzer et al. “XML and Web Services”, Pearson Education, 2002
2. Thomas Erl, “Service Oriented Architecture: Concepts, Technology, and Design”, Pearson Education, 2005.

REFERENCES:

1. Frank P.Coyle, “XML, Web Services and the Data Revolution”, Pearson Education, 2002.
2. Eric Newcomer, GregLomow, “Understanding SOA with Web Services”, Pearson Education, 2005.
3. Sandeep Chatterjee and James Webber, “Developing Enterprise Web Services: An Architect's Guide”, Prentice Hall, 2004.
4. James McGovern, Sameer Tyagi, Michael E.Stevens, Sunil Mathew, “Java Web. Services Architecture”, Morgan Kaufmann Publishers, 2003.
5. Thomas Erl, “Service-oriented Architecture: Concepts, Technology, and Design”, 2016

WEB REFERENCES:

1. <https://www.coursera.org/learn/service-oriented-architecture>
2. <https://restfulapi.net/json-schema/>

3. https://www.w3schools.com/js/js_json_intro.asp

ONLINE RESOURCES:

1. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106105167/lec10.pdf

OUTCOMES:

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

1. Demonstrate the basic concepts of XML and XML based applications. (K3)
2. Construct the design of API using JSON & REST. (K3)
3. Discuss the basics concepts of SOA, its Principles and Benefits. (K2)
4. Interpret the Web services using technology elements. (K2)
5. Analyse the SOA based applications for intra-enterprise and inter-enterprise applications. (K4)

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

PROFESSIONAL ELECTIVES - III

20CSEL704 SDG NO. 4 & 9	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- POS Tagger- Research Corpora.

TOTAL: 45 PERIODS

TEXT BOOK:

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 H Martin, "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.html
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=PLoROMvodv4rOhcuXMZkNm7j3fVwBBY4z>

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

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 –AlexNet – Visual Geometry Group –Inception– Residual Network.

UNITIV 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
C01	3	-	1	-	2	-	-	-	2	1	-	3	3	1
C02	2	-	1	-	3	-	-	-	2	1	-	2	3	1
C03	3	-	1	-	2	-	-	-	2	1	-	3	3	1
C04	3	-	1	-	2	-	-	-	2	1	-	2	3	1
C05	3	-	1	-	3	-	-	-	2	1	-	2	3	1
C06	3	-	1	-	2	-	-	-	2	1	-	2	2	1

PROFESSIONAL ELECTIVES - III

20CSEL502 SDG NO. 4 & 16	AGILE METHODOLOGIES	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 development and testing

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-agile-practices>

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
C01	3	3	2	2	1	-	1	1	-	-	-	1	2	2
C02	2	2	1	2	2	-	3	1	-	-	-	1	2	2
C03	2	2	3	2	2	1	1	2	-	-	-	1	2	3
C04	1	1	3	2	2	-	1	1	-	-	1	1	2	2
C05	3	3	1	2	2	-	1	1	-	-	-	1	2	2
C06	3	2	2	1	-	-	-	1	1	2	-	1	2	2

PROFESSIONAL ELECTIVES - III

20CSEL702 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 WAREHOUSING 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 MICRO ARRAY 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 – Tradeoffs.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Yi-Ping Phoebe Chen (Ed), “BioInformatics Technologies”, First Indian Reprint, Springer Verlag, 2007.
2. Jin Xiong, “Essential Bioinformatics”, Cambridge University Press, 2012.

REFERENCES:

1. Bryan Bergeron, “Bio Informatics Computing”, Second Edition, Pearson Education, 2003.
2. Arthur M Lesk, “Introduction to Bioinformatics”, 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.

- Mitchell L Model, "Bioinformatics Programming Using Python", O'Reilly Media, 2009.

ONLINE RESOURCES:

- <https://www.classcentral.com/subjects/bioinformatics>
- https://mooc-list.com/tags/bioinformatism?_cf_chi_jschi_tk
- https://www.udemy.com/topic/bioinformatics/?utm_source=adwords?

OUTCOMES:

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

- Understand the basic concepts of Bioinformatics and its significance in biological data analysis. (K2)
- Describe the history, scope and importance of Bioinformatics and role of the internet in bioinformatics. (K1)
- Elaborate the methods to characterize and manage the different types of biological data. (K2)
- Discuss the classification of biological databases. (K1)
- Explore the basics of sequence alignment and analysis. (K3)
- 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
C01	2	2	2	1	1	2	1	-	1	-	-	2	2	2
C02	2	3	3	2	2	2	2	1	1	-	1	2	2	2
C03	3	3	3	3	3	2	2	1	3	1	2	3	2	2
C04	3	3	3	3	3	2	2	1	3	1	2	3	2	2
C05	2	3	1	2	3	2	2	1	3	1	2	3	2	2
C06	3	1	1	2	-	-	-	-	1	2	-	1	2	1

PROFESSIONAL ELECTIVES - III

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 – Effort and Cost Estimation Techniques – COSMIC Full Function Points - COCOMO II - a Parametric Productivity Model.

UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9

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

UNIT IV PROJECT MANAGEMENT AND CONTROL 9

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

UNIT V STAFFING IN SOFTWARE PROJECTS

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

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Bob Hughes, Mike Cotterell and Rajib Mall, "Software Project Management" Fifth Edition, Tata McGraw Hill, New Delhi, 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 Management in Practice", 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://nptel.ac.in/courses/106/105/106105218/>

ONLINE RESOURCES:

1. <https://www.edx.org/learn/project-management>
2. <https://www.oxfordhomestudy.com/courses/project-management-courses-online/free-online-courses-with-certificates-in-project-management>

OUTCOMES:

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

1. Understand Project Management principles while developing software. (K2)
2. Gain extensive knowledge about the basic project management concepts, framework and the process models. (K3)

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

CO- PO, PSO MAPPING :

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

PROFESSIONAL ELECTIVES - III

20ITEL711 SDG NO. 4 & 9	STORAGE AREA NETWORK				L	T	P	C
					3	0	0	3

OBJECTIVES:

- To understand the basics of the storage networking environment.
- To describe the different SAN architecture.
- To understand the networking for SAN.
- To understand the software to drive the SAN.
- To understand the implementation and managing SAN.

UNIT I UNDERSTANDING STORAGE NETWORKING

9

What Storage Networking Is and What It Can Mean to You: What Is a Storage Area Network? - Why Connect Storage to a Network? - The Secret to SANs' Success: Software - The Best Is Yet to Come: Radical Changes in Information Storage and Processing - A Couple of Closing Clarifications - Benefits: What to

Expect from SAN: The SAN Paradigm Shift - A Model for Enterprise Information Processing - Ten Ways the SAN Paradigm Shift Changes Information Processing for the Better.

UNIT II TECHNOLOGY LEADING TO SAN & KILLER APPS FOR SAN 9

Leading Up to SANs: One View of Data Center Evolution: Killer Apps for SANs: Killer App 1: Backup - The Application Everyone Loves to Hate - Killer App 2: - Highly Available Data - Killer App 3: Disaster Recoverability - Killer App 4: Clusters - Continuous Computing - Killer App 5: Data Replication.

UNIT III SAN NETWORKING & SOFTWARE FOR SAN 9

The Network in Storage Networking: Fibre Channel: The 800-Pound Gorilla of SANs - Emerging SAN Interconnect Technologies -

Basic Software for Storage Networking: Software for SANs, Shared Access Data Managers - Computer System I/O Performance - Volumes: Resilience - Performance - and Flexibility - File Systems and Application Performance

UNIT IV ADVANCED SOFTWARE FOR SAN 9

Advanced Software for Storage Networking: Data Replication - Types of Data Replications - Using Data Replication - Clusters: The Processing in Data Processing - Cluster Data Models.

Enterprise Backup Software for Storage Area Networks: Backup Management for SANs - Enterprise Data Protection - Enterprise Backup Architecture & policies - Minimizing the Impact of Backup - LAN-free and Serverless Backup.

UNIT V SAN IMPLEMENTATION & MANagements 9

Adopting Storage Networking: Developing a SAN Deployment Strategy - Nine Steps to Successful SAN Deployment - Critical Success Factors - SAN Adoption Alternatives.

Managing SANs: Basics: What's Special about Managing a SAN - Different types of SAN Management Environment and its tools.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Richard Barker, Paul Massiglia, "Storage Area Network Essentials: A Complete Guide to Understanding and Implementing SANs", Wiley India, 2008.

REFERENCES :

1. Ulf Troppens, Rainer Erkens, Wolfgang Muller-Friedt, Rainer Wolafka, Nils Hausteil, "Storage Networks Explained: Basics and Application of Fibre

Channel SAN, NAS, iSCSI, InfiniBand and FCoE”, Second Edition, Wiley Publication, 2009.

2. G. Somasundaram, Alok Shrivastava, “Information Storage and Management”, EMC Education services, Wiley Publication, 2012.

WEB REFERENCES:

1. https://www.snia.org/education/storage_networking_primer/san/what_san.

ONLINE RESOURCES:

1. <https://www.netapp.com/data-storage/what-is-san-storage-area-network/>

OUTCOMES:

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

1. Understand the basics of SAN and its data processing. (K2)
2. Describe the different ways of paradigm shift changes in SAN. (K2)
3. Compare and contrast different architectures of Storage Area Networking(K2).
4. Illustrate the various ways of networking in Storage Area Networking(K3).
5. Construct Storage Area Networks using the Software(K3).
6. Compare the various SAN implementations and explain how SAN is managed. (K3)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	2	-	-	-	-	-	-	-	-	-	-	1	2
C02	3	3	-	1	-	-	-	-	-	-	-	2	3	1
C03	3	3	-	1	-	-	-	-	-	-	-	2	2	3
C04	1	2	-	2	-	-	-	-	-	-	-	-	1	1
C05	2	1	-	3	-	-	-	-	-	-	-	2	2	2
C06	2	-	-	-	-	-	-	-	-	-	-	3	1	2

PROFESSIONAL ELECTIVES - III

20ITEL712 SDG NO. 4 & 16	DIGITAL FORENSICS AND CYBER LAWS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
- To study the fundamentals of Computer Forensics
- To familiarise the tools and tactics associated with Digital Evidence
- To examine digital evidences such as the data acquisition, identification analysis.
- To learn, analyse and expose cyber laws.

UNIT I INTRODUCTION TO DIGITAL FORENSICS

9

Introduction-Role Of Digital Forensic Investigator - Trends And Challenges In Digital Forensics - Resources Available To Digital Forensic - Digital Forensic Approaches and Best Practices - Tools Used In Digital Forensics - Incident Response – Report Writing and Presentation - Social Engineering Forensics – Anti-Forensics – Psychological, Ethical and Cultural Implications of Digital Forensics.

UNIT II COMPUTER FORENSICS

9

Cyber Forensic-Disk Forensics-Network Forensics-Wireless Forensics-Database Forensics-Malware Forensics-Mobile Forensics-GPS Forensics-Email Forensics-Memory Forensics-Incident and Incident handling-Computer Security Incident-Cyber Forensics—The Present and Future.

UNIT III HANDLING OF DIGITAL EVIDENCE

9

Introduction to Digital Evidence and Digital Evidence Collection Procedure-Source of Evidence-Storage Medium-File System-Windows Registry-Evidence from Mobile Devices-Digital evidence on the Internet-Acquisition and Handling of Digital Evidence-Preliminaries of Electronic or Digital Evidence-Acquisition and Seizure of Evidence-Chain of Custody and Digital Evidence Collection Form-Fourth Amendment and Seizure-Acquisition of Computer and Electronic Evidence-Acquisition of Evidence from Mobile-Acquisition of Evidence from Optical and Removable Media - Digital cameras-Acquisition of Evidence from Third Party - External Agency or Organisation-Handling of Digital Evidence-Precautions Involved in Handling Digital Evidence.

UNIT IV ANALYSIS AND ADMISSIBILITY OF DIGITAL EVIDENCE 9

Introduction to Analysis of Digital Evidence-Capturing of Forensic Copy of Memory and Hard Drive with Toolkit Forensic Imager-RAM Analysis with Volatility-Analysing Hard Drive with WinHex-Working with Autopsy-Email Tracking and Tracing-Role of Forensic Analyst in Analysis-Digital Evidence—Electronic Record- Section 5 of ITA 2000 - Legal Recognition of Digital Signatures-Pre-trial Preparation-Presenting Digital Evidence-Summary of Investigation Process Involving Digital Evidence

UNIT V CYBER CRIME AND CYBER LAWS 9

Cybercrime Case Studies-Cybercrime against Individuals-Cybercrime against Property-Introduction to Cyber Laws-Cyber Laws and Legal Issues-Cyber Security-Cyber Laws in India and Case Studies-International Cyber laws and Case Studies

TOTAL: 45 PERIODS**TEXT BOOK:**

1. Greg Gogolin, "Digital Forensics Explained", CRC Press, 2013 by Taylor & Francis Group, 2013.
2. Deje, S. Murugan, " Cyber Forensics", Oxford University Press, 2018.

REFERENCES :

1. Bill Nelson, Amelia Phillips, Christopher Steuart, " Guide to Computer Forensics and Investigations", Fourth Edition, CENGAGE Learning, 2010.
2. Marie, Helen Maras, "Computer Forensics: Cybercriminals, Laws, and Evidence", Jones & Bartlett Learning; 2nd Edition, 2014.
3. Kevin Mandia, Chris Prosis, "Incident Response and computer forensics", Tata McGraw Hill, 2006.
4. John R. Vacca, "Computer Forensics: Computer Crime Scene Investigation", Cengage Learning, 2nd Edition, 2005.
5. Keith J. Jones, Richard Bejtich, Curtis W. Rose "Real Digital Forensics: Computer Security and Incident Response" Addison-Wesley, 1st edition, 2005
6. Robert M Slade, "Software Forensics: Collecting Evidence from the Scene of a Digital Crime", Tata McGraw Hill, 1st Edition, 2004

WEB REFERENCES:

1. https://onlinecourses.swayam2.ac.in/cec20_lb06/preview
2. <https://www.simplilearn.com/what-is-computer-forensics-article>
3. <https://www.guru99.com/digital-forensics.html>

ONLINE RESOURCES:

1. https://www.researchgate.net/publication/300474145_Digital_Forensics/link/579898ba08aec89db7bb5831/download
2. <http://indexof.es/Varios2/Computer%20Forensics%20and%20Cyber%20Crime%20An%20Introduction.pdf>

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

1. Understand various problems and proper forensics tools for investigation of digital forensics. (K1)
2. Apply proper evidence collection procedure and tools to acquire data. (K3)
3. Apply forensic analysis tools to recover important evidence for identifying computer crime. (K3)
4. Identify and evaluate the validation of forensics data. (K3)
5. Demonstrate well-trained next-generation computer crime investigators (K2)
6. Model case studies to educate the impact of Cyber Crime. (K3)

CO-PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - III

20MGEL701	FOUNDATION SKILLS IN	L	T	P	C
SDG NO. 9 & 12	INTEGRATED PRODUCT DEVELOPMENT	3	0	0	3

OBJECTIVES:

- To understand the global trends and development methodologies of various types of products and services.
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems.
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification.
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics.
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer.

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT 9

Global Trends Analysis and Product decision - Social Trends - Technical Trends- Economical Trends - Environmental Trends - Political/Policy Trends - Introduction to Product Development Methodologies and Management - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle - Product Development Planning and Management.

UNIT II REQUIREMENTS AND SYSTEM DESIGN 9

Requirement Engineering - Types of Requirements - Requirement Engineering - traceability Matrix and Analysis - Requirement Management - System Design & Modeling - Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design.

UNIT III DESIGN AND TESTING 9

Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques - Challenges in Integration of Engineering Disciplines - Concept Screening & Evaluation - Detailed Design - Component Design and Verification - Mechanical, Electronics and Software Subsystems -

High Level Design/Low Level Design of S/W Program - Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing – Prototyping - Introduction to Rapid Prototyping and Rapid Manufacturing - System Integration, Testing, Certification and Documentation

UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT 9

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation - Sustenance -Maintenance and Repair – Enhancements - Product EoL - Obsolescence Management – Configuration Management - EoL Disposal.

UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY 9

The Industry - Engineering Services Industry - Product Development in Industry versus Academia –The IPD Essentials - Introduction to Vertical Specific Product Development processes -Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Book specially prepared by NASSCOM as per the MoU.
2. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, 5th Edition, 2011.
3. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, 11th Edition, 2005.

REFERENCES :

1. Hiriappa B, "Corporate Strategy – Managing the Business", Author House, 2013.
2. Peter F Drucker, "People and Performance", Butterworth – Heinemann [Elsevier], Oxford, 2004.
3. Vinod Kumar Garg and Venkita Krishnan N K, "Enterprise Resource Planning – Concepts", 2nd Edition, Prentice Hall, 2003.
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, 7th Edition, 2013.

WEB REFERENCES:

1. <https://www.udemy.com/course/strategic-product-management-and-leadership/>
2. <https://www.udemy.com/course/building-insanely-great-products/>
3. <https://www.coursera.org/learn/customer-insights-orientation>

ONLINE RESOURCES:

1. https://pursuite-production.s3-ap-southeast-1.amazonaws.com/media/cms_page_media/162/FSIPD+OBF+-+2012+F0_1.pdf
2. <https://futureskillsnasscom.edcast.com/pathways/product-management-primer-pathway/cards/5603673#>

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

1. Explain the basic essentials of product development. (K2)
2. Discuss the learnings to incorporate effective design for product development. (K2)
3. Describe the various tools of innovation & product development process in the Business context. (K2)
4. Identify the various process and choose the appropriate tools for designing, development and testing. (K2)
5. Discuss disruptive models / process to manage a product development from start to finish. (K2)

CO-PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - IV

20ITEL801	FREE AND OPEN SOURCE SOFTWARE TOOLS	L	T	P	C
SDG NO. 4		3	0	0	3

OBJECTIVES:

- To be exposed to the context and operation of free and open source software (FOSS) communities and associated software projects
- To be familiar with participating in a FOSS project
- To get acquaintance of Programming Tools and Techniques
- To learn the language Perl

UNIT I PHILOSOPHY 9

Notion of Community - Guidelines for Effectively Working with FOSS Community - Benefits of Community Based Software Development - Requirements for being Open - Free Software - Open Source Software – Four Degrees of Freedom - FOSS Licensing Models - FOSS Licenses – GPL - AGPL - LGPL - FDL - Implications - FOSS Examples.

UNIT II LINUX 9

Linux Installation and Hardware Configuration – Boot Process-The Linux Loader (LILO) - The Grand Unified Bootloader (GRUB) - Dual-Booting Linux and other Operating System Options - X Windows System Configuration-System Administration – Backup and Restore Procedures - Strategies for Keeping a Secure Server.

UNIT III PROGRAMMING LANGUAGES 9

Programming using Perl - Program Structure – Types of Data – Operators – Variable Interpolation – Lists and Hashes – Loops and Decisions - Files and Data – References – Subroutines – Error Handling – Modules – Object Oriented Perl- CGI - Databases – Networking.

UNIT IV PROGRAMMING TOOLS AND TECHNIQUES 9

Usage of Design Tools Like Argo UML or Equivalent - Version Control Systems Like Git or Equivalent – Bug Tracking Systems- Package Management Systems.

UNIT V FOSS CASE STUDIES 9

Open Source Software Development - Case Study – Libreoffice – Samba.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, "Linux in a Nutshell", Sixth Edition, O'Reilly Media, 2009.
2. Tom Phoenix, Randal Schwartz, Brian Foy "Learning Perl", 6th Edition, O'Reilly Media, 2011.

REFERENCES:

1. Linux Labs and Open Source Technologies Paperback by Dayanand Ambawade (Author), Deven Shah (Author), Kogent Learning Solutions Inc. (Author)
2. Linux Apache Web Server Administration (Craig Hunt Linux library) Paperback – Import, 23 Nov 2000

WEB REFERENCES:

1. <http://www.gnu.org/philosophy/>
2. <http://www.tldp.org/LDP/lame/LAME/linux-admin-made-easy/>
3. <http://www.perl.org/books/beginning-perl/>
4. <http://git-scm.com/>
5. <http://www.samba.org/>
6. <http://www.libreoffice.org/>

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

1. Execute and run open-source operating systems. (K3)
2. Sketch information about Free and Open Source Software projects from software releases and from sites on the internet. (K3)
3. Describe and modify one or more Free and Open Source Software packages. Use a version control system. (K2)
4. Use software to and interact with Free and Open Source Software development projects. (K3)
5. Gather information about Open Source Software Development (K2)
6. Learn programming language and scripting language. (K1)

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

PROFESSIONAL ELECTIVES - IV

20ITEL802 SDG NO. 4 & 9	VIRTUAL 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 - The Three 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 - Java 3D - 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, Philippe Coiffet, "Virtual Reality Technology", Wiley, Second Edition, 2006
2. BorkoFurht, "Handbook of Augmented Reality", Springer, 2011.

REFERENCE:

1. C. Burdea & Philippe Coiffet, "Virtual Reality Technology", Second Edition, Gregory, John Wiley & Sons, Inc., 2008
2. Jason Jerald. 2015. The VR Book: Human-Centred Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool, New York, NY, USA.
3. Augmented Reality: Principles and Practice (Usability) by Dieter Schmalstieg & Tobias Hollerer, Pearson Education (US), Addison-Wesley

Educational Publishers Inc, New Jersey, United States, 2016. ISBN: 9780321883575

4. Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability), Steve Aukstakalnis, Addison-Wesley Professional; 1 edition, 2016.
5. The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything, Robert Scoble & Shel Israel, Patrick Brewster Press; 1 edition, 2016.

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 toolkits 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
C01	2	1	-	-	-	-	-	-	-	-	-	1	-	1
C02	2	1		-	-	-	-	-	-	-	-	1	-	1
C03	3	2	1	-	1	-	-	1	-	1	1	1	2	1
C04	2	1	-	-	-	-	-	-	-	-	-	1	-	1
C05	2	1	-	-	-	-	-	-	-	-	-	1	-	1
C06	3	2	1	-	1	-	-	1	-	1	1	1	2	1

PROFESSIONAL ELECTIVES - IV

20ITEL803 SDG NO. 4 & 9	INTRUSION DETECTION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Compare alternative tools and approaches for Intrusion Detection through quantitative analysis
- To determine the best tool or approach to reduce risk from intrusion.
- To Identify and describe the parts of all intrusion detection systems and characterize new
- To merge IDS technologies according to the basic capabilities all intrusion detection systems share.

UNIT I INTRODUCTION 9

The state of threats against computers, and networked systems-Overview of computer security solutions and why they fail-Vulnerability assessment, firewalls, VPN's -Overview of Intrusion Detection and Intrusion Prevention, Network and Host-based IDS

UNIT II CLASSES OF ATTACKS AND ITS LAYERS 9

Classes of attacks - Network layer: scans, denial of service, penetration Application layer: software exploits, code injection-Human layer: identity theft, root access-Classes of attackers-Kids/hackers/sophisticated groups-Automated: Drones, Worms, Viruses

UNIT III IDS MODELS 9

A General IDS model and taxonomy, Signature-based Solutions, Snort, Snort rules, Evaluation of IDS, Cost sensitive IDS

UNIT IV DETECTION SYSTEMS AND VULNERABILITIES 9

Anomaly Detection Systems and Algorithms-Network Behaviour Based Anomaly Detectors (ratebased)-Host-based Anomaly Detectors-Software Vulnerabilities-State transition, Immunology, Payload Anomaly Detection

UNIT V ATTACKS AND THREATS 9

Attack trees and Correlation of alerts- Autopsy of Worms and Botnets-Malware detection -Obfuscation, polymorphism- Document vectors.Email/IM security issues-Viruses/Spam-From signatures to thumbprints to zero day

detection-InsiderThreat issues-Taxonomy-Masquerade and Impersonation Traitors, Decoys and Deception-Future:Collaborative Security

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Peter Szor, "The Art of Computer Virus Research and Defense", Symantec Press,2005
2. Markus Jakobsson and Zulfikar Ramzan, "Crimeware, Understanding New Attacks and Defenses",2008

REFERENCES:

1. Saiful Hasan, "Intrusion Detection System, Kindle Edition",2018
2. Ankit Fadia, "Intrusion Alert: An Ethical Hacking Guide to Intrusion Detection",2007
3. Ali A. Ghorbani, Wei Lu, "Network Intrusion Detection and Prevention:Concepts and Techniques", Springer,2010.
4. Carl Enrolf, Eugene Schultz, Jim Mellander, "Intrusion detection and Prevention", McGraw Hill, 2004
5. Paul E. Proctor, "The Practical Intrusion Detection Handbook ",Prentice Hall, 2001.

WEB REFERENCES:

1. <https://www.intechopen.com/books/intrusion-detection-systems/>
2. <https://www.sans.org/course/intrusion-detection-in-depth>
3. <https://www.cybrary.it/skill-certification-course/ids-ips-certification-training-course>

OUTCOMES:

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

1. Understand fundamental knowledge of Cyber Security.[K2]
2. Analyze various vulnerability and its implementation.[K2]
3. Understand basic and fundamental risk management principles as it relates to Cyber Security and Mobile Computing.[K2]
4. Implement safer computing to safeguard information using Digital Forensics.[K3]
5. Describe basic technical controls in use today, such as firewalls and Intrusion Detection Systems. [K2]
6. Illustrate legal perspectives of Cyber Crimes and Cyber Security.[K3]

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	1	1	-	-	3	2	-	-	-	-	-	2	3	3
C02	2	2	2	2	3	1	-	-	-	-	-	2	3	3
C03	2	2	2	2	3	1	-	-	-	-	-	2	3	3
C04	2	2	2	2	3	2	-	-	-	-	-	2	3	3
C05	2	2	2	2	3	2	2	2	1	-	-	2	3	3

PROFESSIONAL ELECTIVES - IV

20CSEL702 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 OPENFLOW 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 Networks - Traffic Engineering for service providers - Enabled Switching Chips.

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 Open Flow", 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. Fei Hu, 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 students 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 Openflow 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 - IV

20ITEL804 SDG NO. 4 & 9	DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To get exposed to simple Image Enhancement techniques in Spatial and Frequency domain
- To learn concepts of Degradation function and Restoration techniques
- To study the Image Segmentation and Representation techniques
- To become familiar with Image Compression and Recognition methods

UNIT I DIGITAL IMAGE FUNDAMENTALS 9

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships Between Pixels - Color Image Fundamentals - RGB - HSI Models - Two Dimensional Mathematical Preliminaries - 2D transforms - DFT- DCT.

UNIT II IMAGE ENHANCEMENT 9

Spatial Domain: Gray Level Transformations – Histogram Processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering - Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening Frequency Domain Filters – Ideal - Butterworth and Gaussian Filters - Homomorphic Filtering - Color Image Enhancement.

UNIT III IMAGE RESTORATION 9

Image Restoration - Degradation Model - Properties - Noise Models – Mean Filters – Order Statistics – Adaptive Filters – Band Reject Filters – Band Pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener Filtering.

UNIT IV IMAGE SEGMENTATION 9

Edge Detection - Edge Linking Via Hough Transform – Thresholding - Region Based Segmentation – Region Growing – Region Splitting and Merging – Morphological Processing - Erosion and Dilation - Segmentation by Morphological Watersheds – Basic Concepts – Dam Construction – Watershed Segmentation Algorithm.

UNIT V IMAGE COMPRESSION AND RECOGNITION

9

Need For Data Compression - Huffman - Run Length Encoding - Shift Codes - Arithmetic Coding - JPEG Standard - MPEG - Boundary Representation - Boundary Description - Fourier Descriptor - Regional Descriptors - Topological Feature, Texture - Patterns and Pattern Classes - Recognition Based on Matching.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson, Third Edition, 2010.
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson, 2002

REFERENCES:

1. Kenneth R. Castleman, "Digital Image Processing", Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, "Digital Image Processing using MATLAB", Pearson Education, Inc., 2011.
3. D.E. Dudgeon and R.M. Mersereau, "Multidimensional Digital Signal Processing", Prentice Hall Professional Technical Reference, 1990
4. William K. Pratt, "Digital Image Processing", John Wiley, New York, 2002
5. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", Fourth Edition, Cengage Learning, 2013.
6. S. Sridhar, "Digital Image Processing", Oxford University Press, 2016.

WEB REFERENCES:

1. <https://www.geeksforgeeks.org/digital-image-processing-basics/>
2. <https://towardsdatascience.com/introduction-to-images-c9c7abe6bfd2>

OUTCOMES:

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

1. Summarize the fundamentals of Digital Image Processing. (K2)
2. Use spatial domain and frequency domain filters for Image Enhancement. (K3)
3. Distinguish all the image restoration methods (K2)
4. Demonstrate various image segmentation algorithms (K3)
5. Interpret various image compression and recognition techniques. (K3)
6. Experiment the real world images with all the digital image processing techniques (K3)

CO- PO, PSO MAPPING :

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

PROFESSIONAL ELECTIVES - IV

20ITEL802 SDG NO. 4	INFORMATION SYSTEM AUDIT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know about Information System
- To learn the models of system audit
- To impart knowledge of security control and database access
- To Manage and evaluate the audit function

UNIT I OVERVIEW OF INFORMATION SYSTEM**5**

Auditing-Conducting an Information Systems Audit - Overview and steps in an Audit.

UNIT II MANAGEMENT CONTROL FRAMEWORK**12**

Introduction - Systems Development Management Controls - Approaches to Auditing Systems Development - Normative Models of the Systems Development Process - Evaluating the Major Phases in the Systems Development Process - Security Management Controls - Operations Management Controls - Quality Assurance Management Controls.

UNIT III APPLICATION CONTROL FRAMEWORK**9**

Boundary Controls - Input Controls- Processing Controls - Database Controls - Output Controls.

UNIT IV EVIDENCE COLLECTION**10**

Audit Software - Code Review - Test Data and Code Comparison - Concurrent

Auditing Techniques – Interviews -Questionnaires - Control Flowcharts-Performance Management tools -Evaluating Asset Safeguarding and Data Integrity - Evaluating System Effectiveness - Evaluating System Efficiency.

UNIT V INFORMATION SYSTEM AUDIT AND MANAGEMENT 9

Managing the Information Systems Audit Function - Planning Function - Organizing Function - Staffing Function - Leading Function - Controlling Function - Some Features of Information Systems Auditing – Trouble shooting the Audit Service- Contemporary Information Systems Auditing Challenges.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. CA. Manoj Agarwal, "Information Systems Control and Audit", Fifth Edition, Bharat Law House, 2017
2. Angel R. Otero," Information Technology Control and Audit", Fifth Edition, Taylor & Frances Group,2019.

REFERENCES:

1. James A.Hall, "Information Technology Auditing and Assurance", Fourth Edition, South-Western College Pub, 2015.
2. David L Cannon, Timothy S Beigmann, Brandy Pamplin, "Certified Information System", Auditor study guide, Wiley Publications, 2011.
3. Jack J. Champlain, "Auditing Information Systems", Second Edition, John Wiley & Sons, Inc., 2003
4. Ron Weber, "Information Systems Control and Audit", Pearson Education, 2002.
5. M.Revathy Sriram, "Systems Audit", TMH, New Delhi, 2001.

WEB REFERENCES:

1. https://ag.ap.nic.in/GSSA/PDF_Files/ITAM%20Vol_I.pdf
2. <http://www.iibf.org.in/documents/ceisb-module2.pdf>

OUTCOMES:

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

1. Infer the steps and models of system audit. (K2)
2. Understand the approaches to management control framework (K2)
3. Analyze all the controls such as database and output. (K4)
4. Understand the concurrent auditing and performance management tools.(K2)
5. Comprehend data integrity and system efficiency. (K2)

6. Select and analyze features of information systems auditing and management. (K4)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	1	1	-	-	3	2	-	-	-	-	-	2	3	3
C02	3	2	-	2	3	3	2	2	3	3	3	-	-	3
C03	2	2	2	2	3	1	-	-	-	-	-	2	3	3
C04	2	2	2	2	3	1	-	-	-	-	-	2	3	3
C05	2	2	2	2	3	2	2	2	2	2	2	2	3	3
C06	2	2	2	2	3	-	-	-	-	-	-	-	3	3

PROFESSIONAL ELECTIVES - IV

20ITEL806 SDG NO. 4	PATTERN RECOGNITION TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand about Unsupervised algorithms suitable for pattern classification
- To familiarize with the Feature Selection algorithms and method of implementing them in applications
- To learn about the basis of algorithm used for training and testing the dataset
- To learn basic Fuzzy System and Neural Network architectures, for applications in Pattern Recognition, Image Processing and Computer Vision

UNIT I PATTERN CLASSIFIER

9

Overview of Pattern Recognition – Discriminant Functions – Supervised Learning – Parametric Estimation – Maximum Likelihood Estimation – Bayes Theorem – Bayesian Belief Network–Naive Bayesian Classifier.

UNIT II CLUSTERING

9

Clustering Concept – Hierarchical Clustering Procedures – Partitional Clustering – Clustering of Large Data Sets – EM Algorithm – Grid Based

Clustering– Density Based Clustering.

UNIT III FEATURE SELECTION AND GENERATION

9

Feature Selection-Introduction-Preprocessing -The Peaking Phenomenon-Feature Selection Based on Statistical Hypothesis Testing-The Receiver Operating Characteristics (ROC) Curve-Class Separability Measures-Feature Subset Selection-Feature Generation - Introduction - Regional Features - Features for Texture Characterization - Moments - Parametric Models-Optimal Feature Generation.

UNIT IV HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINE

9

State Machines – Hidden Markov Models - Maximum Likelihood for the HMM, Forward-Backward Algorithm - Sum and Product Algorithm for the HMM-Scaling Factors - Viterbi Algorithm - Extensions of the Hidden Markov Model – Support Vector Machines - Maximum Margin Classifiers - Relevance Vector Machines.

UNIT V RECENT ADVANCES

9

Fuzzy Classification - Fuzzy Set Theory - Fuzzy and Crisp Classification - Fuzzy Clustering - Fuzzy Pattern Recognition – Introduction to Neural Networks: Elementary Neural Network for Pattern Recognition - Hebbnet - Perceptron - ADALINE and Back Propagation.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R O Duda, P.E. Hart and D.G. Stork, "Pattern Classification and Scene Analysis", John Wiley, First Edition, 2000.
2. Rajasekaran, G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications", Prentice Hall, 2010.

REFERENCES:

1. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. M. Narasimha Murthy, V. Susheela Devi, "Pattern Recognition", Springer, 2011.
3. Andrew Webb, "Statistical Pattern Recognition", Arnold Publishers, 1999.
4. Robert J. Schalkoff, "Pattern Recognition : Statistical, Structural and Neural Approaches", John Wiley & Sons Inc., 2007.
5. S.Theodoridis and K.Koutroumbas, "Pattern Recognition", Fourth Edition, Academic Press, 2009.

WEB REFERENCES:

1. <https://nptel.ac.in/courses/106106046>
2. https://www.cse.iitm.ac.in/course_details.php?arg=Mjc=

ONLINE REFERENCES :

1. <https://freevideolectures.com/course/3194/pattern-recognition>

OUTCOMES:

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

1. Understand basic Pattern Classification algorithms (K2)
2. Discuss different types of Clustering techniques (K2)
3. Perceive the recent advancement in Pattern Recognition (K3)
4. Acquire knowledge about various Feature Extraction techniques (K2)
5. Apply SVM and HMM algorithms for Real time applications (K3)
6. Describe basic Fuzzy System and Neural Network architectures, for applications in Pattern Recognition, Image Processing and Computer Vision (K2)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	3	3	1	1	1	-	1	-	1	-	2	2
C02	3	3	3	3	3	1	1	-	2	-	1	-	2	2
C03	3	3	3	3	3	1	1	-	2	-	1	-	2	2
C04	3	3	3	3	3	1	1	-	2	-	1	-	2	2
C05	3	3	3	3	3	1	1	1	2	3	1	-	2	2
C06	3	3	2	3	3	2	-	-	-	-	-	-	1	1

PROFESSIONAL ELECTIVES - IV

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. learn to develop games

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 - Culling and Clipping - Character Animation - Physics - Based Simulation - Scene Graphs.

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 FRAMEWORKS 9

2D and 3D Game Development Using Flash - DirectX - Java - Python - Game Engines - Unity - DX Studio,

UNIT V GAME DEVELOPMENT 9

Developing 2D and 3D Interactive Games Using DirectX or Python – Isometric and Tile Based Games - Puzzle Games - Single Player Games - Multi-Player Games.

TOTAL: 45 PERIODS.

TEXT BOOKS:

1. Mike Mc Shaffrfy and David Graham, "Game Coding Complete", Fourth Edition, Cengage Learning, PTR, 2012.

- Jason Gregory, "Game Engine Architecture", CRC Press / A K Peters, 2009.

REFERENCES:

- Eric Lengyel, "Mathematics for 3D Game Programming and Computer Graphics", 3rd Edition, Course Technology PTR, 2011.
- David H. Eberly, "3D Game Engine Design - A Practical Approach to Real-Time Computer Graphics", Second Edition, Morgan Kaufmann, 2006.
- Ernest Adams and Andrew Rollings, "Fundamentals of Game Design", 2nd Edition, Prentice Hall /NewRiders,2009.
- Jesse Schell, "The Art of Game Design: A book of lenses", First Edition, CRC Press, 2008.
- Rod Afshar, Cliff Jones, Duke Banerjee, "Advergaming Developer's Guide: Using Macromedia Flash MX 2004 and Director MX (Game Development Series)", Charles River Media, Feb, 2004.

ONLINE RESOURCES:

- <https://www.youtube.com/watch?v=GfwpRU0cT10>

OUTCOMES:

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

- Understand the concepts of Game design and development (K2).
- Design the processes and use mechanics for game development (K3).
- Study the Core architectures of Game Programming (K1).
- Implement Game programming platforms, frameworks and engines (K3).
- Develop Interactive Games(K3).
- 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 - IV

20ITEL807 SDG NO. 4, 9 & 11	IOT BASED SMART SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts and perspectives of Internet of Things
- To build a small low-cost embedded system using Single Board Computers
- To acquire Knowledge about IoT Framework and Industrial IoT
- To design Internet of Things with Embedded systems using data analytics
- To learn the various case study of IoT systems

UNIT I IOT CONCEPTS AND ENABLING TECHNOLOGIES 9

Introduction – Definition and Characteristics of IoT – Benefits of IoT –Physical design of IoT – Logical design of IoT –IoT Enabling Technologies–Resource Management – Resource Partitioning – Computation Offloading – Identification and Resource/Service Discovery – IoT Levels

UNIT II IOT ARCHITECTURE AND ITS CORE MODULES 9

Reference architecture for IoT – SOA based & API oriented architecture – Four layer architecture – Seven Layer architecture – fog computing – Open stack cloud architecture – Gateways, Edge Devices, Data acquisition systems, Cloud services.

UNIT III EMBEDDED PROTOTYPING OF IOT 9

Overview of Raspberry Pi – General-Purpose Input/Outputs – Sensors with Raspberry Pi – Actuators with RaspberryPi –Web Server with Raspberry Pi – Raspberry Pi as a Database Server – ESP8266 WiFi Module – Block Diagram,Features,applications

UNIT IV IOT FRAMEWORK & INDUSTRIAL IOT 9

IoT Value Chain – IoT Platforms – Cisco, Salesforce, Azure IoT, Eclipse IoT, Thingworx, GE Predix, AWS IoT, WatsonIoT, Kaa – Introduction to Industrial Internet of Things & Industry 4.0 – IIoT Architecture – Applications and Challenges

UNIT V DATA ANALYTICS & IOT CASE STUDIES 9

IoT Data Management – Analytics –Apache Hadoop Programming Model,Job Execution,Hadoop Cluster – Case Studies – Smart Parking, Smart Irrigation Control, Air Pollution Monitoring, Forest Fire Detection, Weather Forecasting.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Arshdeep Bahga, Vijay Madiseti, "Internet of Things, A Hands-on-Approach", 1st Edition, Universities press Pvt. Ltd, India, 2015.
2. Mayur Ramgir, "Internet of Things- Architecture, Implementation, and Security", 1st Edition, Pearson Education, India, 2019

REFERENCES:

1. Rajkumar Buyya, Amir Vahid Dastjerdi, "Internet of Things: Principles and Paradigms", 1st Edition, Elsevier, USA, 2016
2. Dimitrios Serpanos, Marilyn Wolf, "Internet-of-things (IoT) systems: architectures, algorithms, methodologies", 1st Edition, Springer, UK, 2017.
3. Charles Bell, "Beginning Sensor Networks with Arduino and Raspberry Pi", 1st Edition, Apress Publishers, USA, 2013.

WEB REFERENCES:

1. <https://www.raspberrypi.org/>
2. https://nurdspace.nl/images/e/e0/ESP8266_Specifications_English.pdf
3. https://swayam.gov.in/nd1_noc20_cs24

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

1. Understand the design concepts, architecture, modules and resource management of Internet of Things. (K2)
2. Identify the methods of data acquiring, organizing and analytics using Cloud platform for IoT applications. (K2)
3. Build IoT applications using Raspberry Pi board. (K3)
4. Illustrate the necessary framework required for IoT. (K2)
5. Infer the applications and challenges of Industrial IOT. (K2)
6. Develop IOT based smart systems using data analytics. (K3)

CO - PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVES - IV

20ITEL808 SDG NO. 4 & 9	WEB SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamentals of networks, architecture, Threats and Vulnerabilities
- To apply the various Authentication schemes
- To analyze the different Protocols and standards for various layers and wireless networks
- To analyze the various types of Intrusions by detection and prevention mechanisms
- To apply and analyze different firewalls for different kind of networks

UNIT I INTRODUCTION TO WEB SECURITY 9

Fundamentals: Network Security, Open Source Security Architecture, Security Threats, Vulnerabilities, Authentication - Elements, types, Methods, Identification Schemes - Federated Identity Management, Entity Authentication - Key Distribution - PKI - Key Agreement Schemes - Secret Sharing Schemes - Kerberos - E-Passports

UNIT II PROTOCOLS AND STANDARDS 9

Network Layer: IP Security - Architecture, Authentication Header, Encapsulating Security Payload, Security Policy, IKE, ISAKMP and Virtual private Networks - Tunneling Technologies, Security Considerations. Transport Layer: SSL and TLS - Protocols, HTTPS, SSH. Application Layer: Email Security - PGP, S/MIME, DKIM. Electronic Payments - SET, Web Services Security.

UNIT III INTRUSION DETECTION AND PREVENTION 9

Intrusion Detection: Host, Network, and Hybrid based systems, SIV, LFM, Honeypots, and Intrusion Prevention: Host and Network based systems. Denial of Service, DDoS - Prevention, Detection, IP Trace back, Malicious Software, Malware Detection - Worm Detection, Worm Signature extraction, Virus Detection. Case Study: Intrusion Detection Tools

UNIT IV FIREWALLS 9

Characteristics, Types - Packet Inspection, VPN, SOHO, NAT Firewalls, NAT Implementation and Classification, NAT Hairpinning, Basing - DMZ - Single Firewall, Dual Firewall, DMZ Host, DMZ Design and Architecture- Forensics, Services and Limitations

UNIT V WIRELESS SECURITY**9**

Network infrastructure, Wi-Fi, Standards: IEEE 802.11, Bluetooth, GSM Security, Mobile Station Authentication, Subscriber Identity confidentiality, Security in UMTS, Signaling data integrity and origin authentication, User traffic confidentiality, Network domain security

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. William Stallings, "Network Security Essentials: Applications and Standards", Pearson, 2017
2. Chris Sanders, Jason Smith, "Applied Network Security Monitoring", Elsevier Science, 2013

REFERENCES:

1. Keith J. Jones, Richard Bejtlich, Curtis W. Rose, Dan Farmer, Wietse Venema, Brian Carrier, "Real Digital Forensics- Computer Security and Incident Response", Addison-Wesley, 2015
2. Sherri Davidoff, Jonathan Ham, "Network Forensics - Tracking Hackers Through Cyberspace", Prentice Hall, 2014
3. Richard Bejtlich, "The Practice of Network Security Monitoring: Understanding Incident Detection and Response", No Starch Press, 2015

WEB REFERENCES:

1. <https://portswigger.net/web-security> - Web Security Academy - Content with hands on training
2. <https://www.toptal.com/security/10-most-common-web-security-vulnerabilities>
3. <http://csc.columbusstate.edu/summers/NOTES/CS559/Syl-459.htm>

ONLINE RESOURCES:

1. <https://www.udemy.com/course/new-web-security-2020/> - Free Udemy Certification Course
2. <https://www.softwaretestinghelp.com/firewall-security/>
3. <https://www.omnisecu.com/security/index.php>

OUTCOMES:

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

1. Understand the fundamentals of networks, architecture, Threats and Vulnerabilities. (K2)
2. Comprehend the various Authentication schemes and standards to secure the variety of applications. (K2)

3. Illustrate the use of different Protocols and standards used in various network layers and wireless networks. (K3)
4. Classify the various types of Intrusions corresponding to the security threats and to apply the preventive scheme. (K3)
5. Examine the types of firewalls and map the usage of firewalls with respective network. (K3)
6. Summarize the wireless security standards and its applications. (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	-	-	2	-	-	-	-	3	3
CO2	3	3	3	2	1	-	-	2	-	-	-	-	3	3
CO3	3	3	3	3	3	-	-	3	-	-	-	-	3	3
CO4	3	3	3	3	2	-	-	3	-	-	-	-	3	3
CO5	3	3	3	3	2	-	-	3	-	-	-	-	3	3
CO6	3	3	3	3	3	-	-	3	-	-	-	-	3	3

PROFESSIONAL ELECTIVES - IV

20HSMG801 SDG NO. 3,4,5,8,10, 13,14,15,16	PROFESSIONAL ETHICS AND VALUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objectives of this course are to provide students of engineering with:

- An understanding of their duties and responsibilities as professionals through gaining knowledge of the philosophies of ethics, professional practice, and world culture.
- Basic knowledge to make informed ethical decisions when confronted with problems in the working environment.
- Improved awareness of potential ethical issues within an engineering context.
- Team skills through working in teams on assignments and in-class assignments.
- Subjective analytical skills through investigation and evaluation of ethical problems in engineering settings using accepted tests for moral problem solving.
- An understanding of how societal morals vary with culture and its influence

on ethical thought and action.

- Improved communications skills with regard to ethical and professional issues in engineering.
- Know some of the classic cases as well as contemporary issues in engineering ethics.

UNIT I HUMAN VALUES

Morals, Values, and Ethics – Integrity –Trustworthiness – Work Ethics – Service-Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value Time – Co-operation – Commitment – Empathy – Self-confidence – Spirituality- Character.

UNIT II PRINCIPLES FOR HARMONY

Truthfulness – Customs and Traditions -Value Education – Human Dignity – Human Rights – Fundamental Duties – Aspirations and Harmony (I, We & Nature) – Gender Bias – Emotional Intelligence – Salovey – Mayer Model – Emotional Competencies – Conscientiousness.

UNIT III ENGINEERING ETHICS AND SOCIAL EXPERIMENTATION

History of Ethics – Need of Engineering Ethics – Senses of Engineering Ethics- Profession and Professionalism --Self Interest – Moral Autonomy – Utilitarianism – Virtue Theory – Uses of Ethical Theories – Deontology- Types of Inquiry –Kohlberg's Theory – Gilligan's Argument – Heinz's Dilemma – Comparison with Standard Experiments -- Learning from the Past – Engineers as Managers – Consultants and Leaders – Balanced Outlook on Law – Role of Codes – Codes and Experimental Nature of Engineering.

UNIT IV ENGINEERS' RESPONSIBILITIES TOWARDS SAFETY AND RISK

The concept of Safety – Safety and Risk – Types of Risks – Voluntary v/sInvoluntary Risk – Consequences – Risk Assessment –Accountability – Liability – Reversible Effects – Threshold Levels of Risk – Delayed v/sImmediate Risk – Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.

UNIT V ENGINEERS' DUTIES AND RIGHTS

Concept of Duty – Professional Duties – Collegiality – Techniques for Achieving Collegiality – Senses of Loyalty – Consensus and Controversy – Professional and Individual Rights – Confidential and Proprietary Information – Conflict of Interest-Ethical egoism – Collective Bargaining – Confidentiality – Gifts and Bribes – Problem solving-Occupational Crimes- Industrial Espionage- Price Fixing-Whistle Blowing.

UNIT VI GLOBAL ISSUES

Globalization and MNCs – Cross Culture Issues – Business Ethics – Media Ethics – Environmental Ethics – Endangering Lives – Bio Ethics – Computer Ethics – War Ethics – Research Ethics -Intellectual Property Rights.

TEXT BOOKS:

1. M.Govindarajan, S.Natarajan and V.S.SenthilKumar, “Engineering Ethics & Human Values”, PHI Learning Pvt. Ltd., 2009.
2. Mike W. Martin and Roland Schinzinger, “Ethics in Engineering”, Tata McGraw-Hill – 2003

REFERENCE BOOKS:

1. Sekhar, R.C., “Ethical Choices in Business Response Books”, New Delhi, Sage Publications, 1997.
2. Kitson, Alan and Campebell, Robert, “The Ethical Organisation”, Great Britain Macmillan Press Ltd., 1996.
3. Pinkus, Rosa Lyun B., Larry J Shulman, Norman Phummon, Harvey Wolfe, “Engineering Ethics”, New York, Cambridge Uty., Press, 1997.
4. R. Subramaniam, “Professional Ethics”, Oxford Publications, New Delhi.
5. Mike W. Martin and Roland Schinzinger, “Ethics in Engineering”, Tata McGraw-Hill – 2003.
6. Prof.A.R.Aryasri, Dharanikota Suyodhana, “Professional Ethics and Morals” Maruthi Publications.
7. Harris, Pritchard, and Rabins, “Engineering Ethics”, Cengage Learning, New Delhi.
8. S.B. Gogate, “Human Values & Professional Ethics”, Vikas Publishing House Pvt. Ltd., Noida.
9. A. Alavudeen, R.Kalil Rahman and M. Jayakumaran, “Professional Ethics and Human Values”, University Science Press.
10. Prof.D.R.Kiran, “Professional Ethics and Human Values” Tata McGraw-Hill – 2013.
11. Jayshree Suresh and B. S. Raghavan, “Human Values and Professional Ethics”, S.Chand Publications.

WEB RESOURCES:

1. Ethos Education provides a concise guide on developing a code of ethics for primary and secondary schools.
2. The Ethics Resource Center has a toolkit available for use. When used for commercial purposes, a nominal license fee is required.
3. Creating A Code Of Ethics for Your Organization, with many suggested books, by Chris MacDonald

- The Deloitte Center for Corporate Governance offers a variety of resources for those who are active in governance, including a variety of resources and a set of suggested guidelines for writing a code of ethics or a code of conduct.

MOOC REFERENCES:

- <https://www.udemy.com/course/workplace-ethics-and-attitude/>
- <https://www.udemy.com/course/business-ethics-how-to-create-an-ethical-organization/>
- [https://nptel.ac.in/courses/110/105/110105097/Ethics in Engineering Practice](https://nptel.ac.in/courses/110/105/110105097/Ethics%20in%20Engineering%20Practice)
- [https://nptel.ac.in/courses/109/104/109104068/Human Values](https://nptel.ac.in/courses/109/104/109104068/Human%20Values)
- <https://www.coursera.org/learn/ethics-technology-engineering>
- <https://www.classcentral.com/course/ethics-technology-engineering-10485>

OUTCOMES:

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

- Classify between ethical and non-ethical situations. (K2)
- Discuss and practice moral judgment in conditions of dilemma. (K2)
- Explain and relate the code of ethics to social experimentation and real world scenarios. (K2)
- Describe risk and safety measures in various engineering fields. (K2)
- Explain the impact of engineering solutions in a global/societal / professional context. (K2)

CO- PO MAPPING:

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

Imagine the Future and Make it happen!



1 NO POVERTY



2 ZERO HUNGER



3 GOOD HEALTH AND WELL-BEING



4 QUALITY EDUCATION



5 GENDER EQUALITY



6 CLEAN WATER AND SANITATION



7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE, JUSTICE AND STRONG INSTITUTIONS



17 PARTNERSHIPS FOR THE GOALS



Together let's build a better world where there is **NO POVERTY** and **ZERO HUNGER**.

We have **GOOD HEALTH AND WELL BEING**, **QUALITY EDUCATION** and full **GENDER EQUALITY** everywhere.

There is **CLEAN WATER AND SANITATION** for everyone. **AFFORDABLE AND CLEAN ENERGY** which will help to create **DECENT WORK AND ECONOMIC GROWTH**. Our prosperity shall be fuelled by investments in **INDUSTRY, INNOVATION AND INFRASTRUCTURE** that will help us to **REDUCE INEQUALITIES** by all means. We will live in **SUSTAINABLE CITIES AND COMMUNITIES**.

RESPONSIBLE CONSUMPTION AND PRODUCTION will help in healing our planet.

CLIMATE ACTION will reduce global warming and we will have abundant, flourishing **LIFE BELOW WATER**, rich and diverse **LIFE ON LAND**.

We will enjoy **PEACE AND JUSTICE** through **STRONG INSTITUTIONS** and will build long term **PARTNERSHIPS FOR THE GOALS**.



For the goals to be reached, everyone needs to do their part: governments, the private sector, civil society and **People like you**.

Together we can...

Sai Prakash Leo Muthu

Chairman & CEO - Sairam Institutions

We build a Better nation
through Quality education.



Sri

SAI RAM ENGINEERING COLLEGE

An Autonomous Institution

Affiliated to Anna University & Approved by AICTE, New Delhi

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