PANIMALAR ENGINEERING COLLEGE

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai

B.TECH - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

REGULATION 2021

CURRICULUM & SYLLABUS

PANIMALAR ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Bangalore Trunk Road, Varadharajapuram,
Poonamallee, Chennai – 600 123.

B.TECH – ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

CURRICULUM AND SYLLABUS

REGULATION-2021

VISION

To produce high quality creators and ethical engineers for innovative technology in the field of Artificial Intelligence and Data Science.

MISSION

- To develop the department as a center of Artificial Intelligence for significant breakthroughs in advancing the promise of human-machine systems that can address complex cognitive tasks.
- To impart quality and value-based education and contribute towards the innovation of computing Data Science for the translation of data into information to support and improve decision making.
- To produce ethical engineers and researchers by inculcate the values of humanity and courage in producing relevant solutions to address business and societal challenges.

PROGRAMME EDUCATIONAL OBJECTIVES

1. To provide graduates with the proficiency to utilize the fundamental knowledge of Basic Sciences, mathematics and statistics to build systems that require management and analysis of large volume of data.
2. To inculcate the students to focus on augmenting the knowledge to improve the performance for the AI era and also to serve the analytical and data-centric needs of a modern workforce.
3. To enable graduates to illustrate the core AI and Data Science technologies, applying them in ways that optimize human-machine partnerships and providing the tools and skills to understand their societal impact for product development.
4. To enrich the students with necessary technical skills to foster interdisciplinary research and development to move the community in an interesting direction in the field of AI and Data Science.
5. To enable graduates to think logically, pursue lifelong learning and collaborate with an ethical attitude to become an entrepreneur.

PROGRAM OUTCOMES (PO)

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information.
5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communicate effectively on complex engineering activities with the engineering community and with society at large. Some of them are, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one ‘s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1: Graduates should be able to evolve AI based efficient domain specific processes for effective decision making in several domains such as business and governance domains.

PSO2: Graduates should be able to arrive at actionable Fore sight, Insight, hind sight from data for solving business and engineering problems

PSO3: Graduates should be able to create, select and apply the theoretical knowledge of AI and Data Analytics along with practical industrial tools and techniques to manage and solve wicked societal problems

PANIMALAR ENGINEERING COLLEGE

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B.TECH. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

CHOICE BASED CREDIT SYSTEM

CURRICULA AND SYLLABI- R 2021

SEMESTER I

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21HS1101	Communicative English & Language Skills I Integrated	HS	5	3	0	2	4
2.	21MA1101	Engineering Mathematics-I	BS	4	3	1	0	4
3.	21PH1101	Engineering Physics	BS	3	3	0	0	3
4.	21CY1101	Engineering Chemistry	BS	3	3	0	0	3
5.	21ES1101	Problem Solving andPython Programming	ES	3	3	0	0	3
6.	21ES1102	Engineering Graphics	ES	5	3	0	2	4
PRACTICALS								
7.	21ES1111	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
8.	21BS1111	Physics and Chemistry Laboratory	BS	4	0	0	4	2
			TOTAL	**31**	**18**	**1**	**12**	**25**

SEMESTER II

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21HS1201	Communicative English & Language Skills II Integrated	HS	5	3	0	2	4
2.	21MA1202	Linear Algebra & Numerical Methods	BS	4	3	1	0	4
3.	21ES1201	Basic Electrical, Electronics and Measurements Engineering	ES	4	4	0	0	3
4.	21AD1201	Problem Solving and Programming in C (Lab Integrated)	PC	5	3	0	2	4
5.	21AD1202	Data Structures and Algorithms	PC	3	3	0	0	3
6.		Mandatory Course – I	MC	2	2	0	0	0
PRACTICALS								
7.	21ES1211	Engineering Practices Laboratory	ES	4	0	0	4	2
8.	21AD1211	Data Structures and Algorithms Laboratory	PC	4	0	0	4	2
			TOTAL	**31**	**18**	**1**	**12**	**22**

SEMESTER III

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21MA1304	Mathematical Foundations for Data Science	BS	4	3	1	0	4
2.	21AD1301	Internals of Computer Systems	PC	3	3	0	0	3
3.	21AD1302	Artificial Intelligence and Expert Systems	PC	3	3	0	0	3
4.	21AD1303	Object Oriented Programming Paradigm	PC	3	3	0	0	3
5.	21CS1401	Database Management Systems	PC	3	3	0	0	3
6.		Mandatory Course-II	MC	2	2	0	0	0
PRACTICALS								
7.	21AD1311	Artificial Intelligence and Expert Systems Laboratory	PC	4	0	0	4	2
8.	21AD1312	Object Oriented Programming Paradigm Laboratory	PC	4	0	0	4	2
9.	21CS1411	Database Management Systems Laboratory	PC	4	0	0	4	2
			TOTAL	**31**	**18**	**1**	**12**	**22**

SEMESTER IV

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21MA1406	Probability and Statistical Modeling for data science	BS	4	3	1	0	4
2.	21AD1401	Machine Learning	PC	3	3	0	0	3
3.	21AD1402	Basics of Data Science	PC	3	3	0	0	3
4.	21CS1303	Software Engineering	PC	3	3	0	0	3
5.	21AD1403	System Software and Operating Systems (Lab Integrated)	PC	5	3	0	2	4
6.		Open Elective I	OE	3	3	0	0	3
PRACTICALS								
6.	21AD1411	Machine Learning Laboratory	PC	4	0	0	4	2
7.	21AD1412	Data Science Laboratory	PC	4	0	0	4	2
			TOTAL	**29**	**18**	**1**	**10**	**24**

SEMESTER V

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21AD1501	Formal Language and Automata Theory	PC	3	3	0	0	3
2.	21AD1502	Data Communication & Network Security	PC	3	3	0	0	3
3.	21AD1503	Data Exploration and Visualization	PC	3	3	0	0	3
4.	21AD1504	Data Analytics	PC	3	3	0	0	3
5.	21AD1505	Knowledge Engineering and Intelligent Systems	PC	3	3	0	0	3
6.		Professional Elective I	PE	3	3	0	0	3
PRACTICALS								
7.	21AD1511	Knowledge Engineering and Intelligent Systems Laboratory	PC	4	0	0	4	2
8.	21AD1512	Data Analytics Laboratory	PC	4	0	0	4	2
9.	21AD1513	Innovation Practices *	EEC	2	0	0	2	1
			TOTAL	**28**	**18**	**0**	**10**	**23**

SEMESTER VI

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21AD1601	Deep Learning	PC	3	3	0	0	3
2.	21AD1602	Augmented Reality, Virtual Reality with AI	PC	3	3	0	0	3
3.	21AD1603	Digital Image Processing	PC	3	3	0	0	3
4.	21ML1601	Natural Language Processing	PC	3	3	0	0	3
5.		Professional Elective II	PE	3	3	0	0	3
6.		Open Elective – II	OE	3	3	0	0	3
PRACTICALS								
7.	21AD1611	Augmented Reality, Virtual Reality with AI Laboratory	PC	4	0	0	4	2
8.	21AD1612	Deep Learning Laboratory	PC	4	0	0	4	2
9.	21AD1613	Socially Relevant Project	EEC	2	0	0	2	1
			TOTAL	**28**	**18**	**0**	**10**	**23**

*This course enables students to think innovatively in providing possible solutions to identify industry/academic /societal problem or issue

SEMESTER VII

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	21AD1701	Business Analytics	PC	3	3	0	0	3
2.	21AD1702	Computer Vision	PC	3	3	0	0	3
3.	21AD1703	AI and Robotics (Lab Integrated)	PC	5	3	0	2	4
4.		Professional Elective III	PE	3	3	0	0	3
5.		Professional Elective IV	PE	3	3	0	0	3
PRACTICALS								
6.	21AD1711	Computer Vision Laboratory	PC	4	0	0	4	2
7.	21AD1712	Mini Project on Analytics	PC	4	0	0	4	2
			TOTAL	**25**	**15**	**0**	**10**	**20**

SEMESTER VIII

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.		Professional Elective V	PE	3	3	0	0	3
2.		Professional Elective VI	PE	3	3	0	0	3
PRACTICALS								
3.	21AD1811	Project Work	EEC	16	0	0	16	8
			TOTAL	**22**	**6**	**0**	**16**	**14**

TOTAL NO. OF CREDITS: 173

HUMANITIES AND SOCIAL SCIENCES (HS)

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21HS1101	Communicative English & Language Skills Integrated	HS	5	3	0	2	4
2.	21HS1201	Communicative English & Language Skills II Integrated	HS	5	3	0	2	4

BASIC SCIENCES (BS)

Sl. NO	COURSE CODE	COURSETITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21MA1101	Engineering Mathematics - I	BS	4	3	1	0	4
2.	21PH1101	Engineering Physics	BS	3	3	0	0	3
3.	21CY1101	Engineering Chemistry	BS	3	3	0	0	3
4.	21BS1111	Physics and Chemistry Laboratory	BS	3	0	0	3	2
5.	21MA1202	Linear Algebra & Numerical Methods	BS	4	3	1	0	4
6.	21MA1304	Mathematical Foundations for Data Science	BS	4	3	1	0	4
7.	21MA1406	Probability and Statistical Modeling for DataScience	BS	4	3	1	0	4

ENGINEERING SCIENCES (ES)

Sl. NO	COURSE CODE	COURSETITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21ES1102	Engineering Graphics	ES	5	3	0	2	4
2.	21ES1101	Problem Solving and Python Programming	ES	3	3	0	0	3
3.	21ES1111	Problem Solving and Python Programming Laboratory	ES	3	0	0	3	2
4.	21ES1201	Basic Electrical, Electronics and Measurement Engineering	ES	4	4	0	0	3
5.	21ES1211	Engineering Practices Laboratory	ES	4	0	0	4	2

PROFESSIONAL CORE (PC)

Sl. NO	COURSE CODE	COURSETITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21AD1202	Data Structures and Algorithms	PC	3	3	0	0	3
2.	21AD1201	Problem Solving and Programming in C (Lab Integrated)	PC	5	3	0	2	4
3.	21AD1211	Data Structures and Algorithms Laboratory	PC	4	0	0	4	2
4.	21AD1301	Internals of Computer Systems	PC	3	3	0	0	3
5.	21AD1302	Artificial Intelligence and Expert Systems	PC	3	3	0	0	3
6.	21AD1303	Object Oriented Programming Paradigm	PC	3	3	0	0	3
7.	21CS1401	Database Management Systems	PC	3	3	0	0	3
8.	21AD1311	Artificial Intelligence and Expert Systems Laboratory	PC	4	0	0	4	2
9.	21AD1312	Object Oriented Programming Paradigm Laboratory	PC	4	0	0	4	2
10.	21CS1411	Database Management Systems Laboratory	PC	4	0	0	4	2
11.	21AD1401	Machine Learning	PC	3	3	0	0	3
12.	21AD1402	Basics of Data Science	PC	3	3	0	0	3
13.	21AD1403	System software and Operating Systems (Lab Integrated)	PC	5	3	0	2	4
14.	21CS1303	Software Engineering	PC	5	3	0	0	3
15.	21AD1411	Machine Learning Laboratory	PC	4	0	0	4	2
16.	21AD1412	Data Science Laboratory	PC	4	0	0	4	2
17.	21AD1501	Formal Language and Automata Theory	PC	3	3	0	0	3
18.	21AD1502	Data Communication and Network Security	PC	5	3	0	2	3
19.	21AD1503	Data Exploration and Visualization	PC	3	3	0	0	3
20.	21AD1504	Data Analytics	PC	3	3	0	0	3
21.	21AD1505	Knowledge Engineering and Intelligent Systems	PC	3	3	0	0	3
22.	21AD1511	Knowledge Engineering and Intelligent Systems Laboratory	PC	4	0	0	4	2
23.	21AD1512	Data Analytics Laboratory	PC	4	0	0	4	2

24.	21AD1601	Deep Learning	PC	3	3	0	0	3
25.	21AD1602	Augmented Reality, Virtual Reality with AI	PC	3	3	0	0	3
26.	21AD1603	Digital Image Processing	PC	3	3	0	0	3
27.	21ML1601	Natural Language Processing	PC	3	3	0	0	3
28.	21AD1611	Augmented Reality, Virtual Reality with AI Laboratory	PC	4	0	0	4	2
29.	21AD1612	Deep Learning Laboratory	PC	4	0	0	4	2
30.	21AD1701	Business Analytics	PC	3	3	0	0	3
31.	21AD1702	Computer Vision	PC	3	3	0	0	3
32.	21AD1703	AI and Robotics (Lab Integrated)	PC	5	3	0	2	4
33.	21AD1711	Computer Vision Laboratory	PC	4	0	0	4	2

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical for AI&DS - I	**Vertical II** **Full Stack Development**	**Vertical III** **Cloud Computing and Data Center Technologies**	**Vertical IV** **Cyber Security and Data Privacy**	**Vertical V** **Creative Media**	**Vertical VI** **Cutting Edge Technologies**	**Vertical for AI&DS - II**
Exploratory Data Analysis **21AD1901**	Open Source Technologies **21IT1901**	Cloud Tools and Techniques **21CS1901**	Ethical Hacking **21IT1908**	Image and Video Analytics **21AD1906**	Image and Video Analytics **21AD1906**	Data Warehousing and Data Mining **21AD1911**
Recommender Systems **21AD1902**	App Development **21IT1902**	Virtualization **21CS1902**	Digital and Mobile Forensics **21IT1909**	Multimedia and Animation **21CS1909**	Robotic Process Automation and Development **21AD1910**	Speech Processing and Analytics **21AD1912**
Soft Computing **21AD1903**	Cloud Services Management **21CS1903**	Cloud Services Management **21CS1903**	Social Network Security **21IT1910**	Web and Social Media Analytics **21AD1909**	Data Warehousing and Data Mining **21AD1911**	Health Care Analytics **21AD1913**
Text Analytics **21AD1904**	UI and UX Design **21IT1903**	Storage Technologies **21CS1904**	Modern Cryptography **21IT1911**	UI and UX Design **21IT1903**	Cyber Security **21IT1915**	Optimization Techniques **21AD1914**
Engineering Predictive Analytics **21AD1905**	Software Testing and Automation **21IT1904**	Software Defined Networks **211T1919**	Engineering Secure Software Systems **21IT1912**	Digital Marketing **21CS1911**	Quantum Computing **21CS1916**	Bio Inspired Optimization Computing **21AD1915**
Image and Video Analytics **21AD1906**	Web Application Security **21IT1905**	Stream Processing **21CS1906**	Crypto currency and Block chain Technologies **21IT1913**	Multimedia Data Compression and Storage **21C1914**	Crypto currencyand Block chain Technologies **21IT1913**	Game Theory **21AD1916**
Ethics and AI **21AD1907**	DevOps **21IT1906**	DevOps **21IT1906**	Cyber Physical Systems Security **21IT1914**	Game Development **21CS1913**	Game Development **21C1913**	Cognitive Science **21AD1917**
Big Data Management **21AD1908**	Principles of Programming Languages **21IT1907**	Security and Privacy in Cloud **21CS1907**	Security and Privacy in Cloud **21CS1907**	Visual Effects **21CS1912**	3D Printing and Design **21CS1917**	Ethics And AI **21AD1907**

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V and VI.

These courses are listed in groups called verticals that represent a particular area of specialization / diversified group.

Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, providedone course is enrolled in Semester V and another in semester VI.

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL I: VERTICALS FOR A&IDS I

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	21AD1901	Exploratory Data Analysis	PE	2	0	2	4	3
2.	21AD1902	Recommender Systems	PE	2	0	2	4	3
3.	21AD1903	Soft Computing	PE	2	0	2	4	3
4.	21AD1904	Text Analytics	PE	2	0	2	4	3
5.	21AD1905	Engineering Predictive Analytics	PE	2	0	2	4	3
6.	21AD1906	Image and Video Analytics	PE	2	0	2	4	3
7.	21AD1907	Ethics and AI	PE	2	0	2	4	3
8.	21AD1908	Big Data Management	PE	2	0	2	4	3

VERTICAL II: FULL STACK DEVELOPMENT

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	21IT1901	Open Source Technologies	PE	2	0	2	4	3
2.	21IT1902	App Development	PE	2	0	2	4	3
3.	21CS1903	Cloud Services Management	PE	2	0	2	4	3
4.	21IT1903	UI and UX Design	PE	2	0	2	4	3
5.	21IT1904	Software Testing and Automation	PE	2	0	2	4	3
6.	21IT1905	Web Application Security	PE	2	0	2	4	3
7.	21IT1906	DevOps	PE	2	0	2	4	3
8.	21IT1907	Principles of Programming Languages	PE	2	0	2	4	3

VERTICAL III : CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	21CS1901	Cloud Tools and Techniques	PE	2	0	2	4	3
2.	21CS1902	Virtualization	PE	2	0	2	4	3
3.	21CS1903	Cloud Services Management	PE	2	0	2	4	3
4.	21CS1904	Storage Technologies	PE	2	0	2	4	3
5.	21IT1919	Software Defined Networks	PE	3	0	0	3	3
6.	21CS1906	Stream Processing	PE	2	0	2	4	3
7.	21IT1906	DevOps	PE	2	0	2	4	3
8.	21CS1907	Security and Privacy in Cloud	PE	2	0	2	4	3

VERTICAL IV: CYBER SECURITY AND DATA PRIVACY

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	21IT1908	Ethical Hacking	PE	2	0	2	4	3
2.	21IT1909	Digital and Mobile Forensics	PE	2	0	2	4	3
3.	21IT1910	Social Network Security	PE	2	0	2	4	3
4.	21IT1911	Modern Cryptography	PE	2	0	2	4	3
5.	21IT1912	Engineering Secure Software Systems	PE	2	0	2	4	3
6.	21IT1913	Cryptocurrency and Blockchain Technologies	PE	2	0	2	4	3
7.	21IT1914	Cyber Physical Systems Security	PE	2	0	2	4	3
8.	21CS1907	Security and Privacy in Cloud	PE	2	0	2	4	3

VERTICAL V: CREATIVE MEDIA

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	21AD1906	Image and Video Analytics	PE	2	0	2	4	3
2.	21CS1909	Multimedia and Animation	PE	2	0	2	4	3
3.	21AD1909	Web and Social Media Analytics	PE	2	0	2	4	3
4.	21IT1903	UI and UX Design	PE	2	0	2	4	3
5.	21CS1911	Digital Marketing	PE	2	0	2	4	3
6.	21C1914	Multimedia Data Compression and Storage	PE	2	0	2	4	3
7.	21CS1913	Game Development	PE	2	0	2	4	3
8.	21CS1912	Visual Effects	PE	2	0	2	4	3

VERTICAL VI: CUTTING EDGE TECHNOLOGIES

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	21AD1906	Image and Video Analytics	PE	2	0	2	4	3
2.	21AD1910	Robotic Process Automation and Development	PE	2	0	2	4	3
3.	21AD1911	Data Warehousing and Data Mining	PE	2	0	2	4	3
4.	21IT1915	Cyber Security	PE	2	0	2	4	3
5.	21CS1916	Quantum Computing	PE	2	0	2	4	3
6.	21IT1913	Crypto currency and Block chain Technologies	PE	2	0	2	4	3
7.	21C1913	Game Development	PE	2	0	2	4	3
8.	21CS1917	3D Printing and Design	PE	2	0	2	4	3

VERTICAL VII: VERTICALS FOR AIDS II

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	21AD1911	Data Warehousing and Data Mining	PE	2	0	2	4	3
2.	21AD1912	Speech Processing and Analytics	PE	2	0	2	4	3
3.	21AD1913	Health Care Analytics	PE	2	0	2	4	3
4.	21AD1914	Optimization Techniques	PE	2	0	2	4	3
5.	21AD1915	Bio Inspired Optimization Computing	PE	2	0	2	4	3
6.	21AD1916	Game Theory	PE	2	0	2	4	3
7.	21AD1917	Cognitive Science	PE	2	0	2	4	3
8.	21AD1907	Ethics And AI	PE	2	0	2	4	3

OPEN ELECTIVES

SEMESTER IV

OPEN ELECTIVE I

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21CE1010	Air Pollution and Control Engineering	OE	3	3	0	0	3
2.	21CE1001	Energy Conservation and Management	OE	3	3	0	0	3
3.	21GE1004	Hospital Waste Management	OE	3	3	0	0	3
4.	21CY1001	Industrial Nanotechnology	OE	3	3	0	0	3
5.	21EE1003	Logic and Distributed Control Systems	OE	3	3	0	0	3
6.	21EC1011	TeleHealth Technology	OE	3	3	0	0	3

SEMESTER VI
OPEN ELECTIVE II

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21EE1001	Basic Circuit Theory	OE	3	3	0	0	3
2.	21CY1002	Energy Technology	OE	3	3	0	0	3
3.	21EC1004	Electronic Devices						
4.	21CE1009	Environmental and Social Impact Assessment	OE	3	3	0	0	3
5.	21GE1003	Hospital Management	OE	3	3	0	0	3
6.	21EC1002	Medical Electronics	OE	3	3	0	0	3
7.	21EC1006	Signals and Systems	OE	3	3	0	0	3
8.	21ME1006	Systems Engineering	OE	3	3	0	0	3
9.	21ME1008	Supply Chain Management	OE	3	3	0	0	3
10.	21CY1003	Waste Water Treatment	OE	3	3	0	0	3

MANDATORY COURSES

Sl. NO	COURSE CODE	COURSETITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21MC1001	Environmental Science	MC	2	2	0	0	0
2.	21MC1002	Constitution of India	MC	2	2	0	0	0
3.	21MC1003	Human Values	MC	2	2	0	0	0
4.	21MC1006	Soft Skill Development	MC	2	2	0	0	0
5.	21MC1005	Essence of Indian Traditional Knowledge	MC	2	2	0	0	0

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Sl. NO	COURSE CODE	COURSETITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	21AD1513	Innovation Practices	EEC	2	0	0	2	1
2.	21AD1613	Socially Relevant Project	EEC	2	0	0	2	1
3.	21AD1811	Project Work	EEC	18	0	0	18	8

CREDIT DISTRIBUTION

S.No.	Subject Area / Semester	Credits Per Semester I	II	III	IV	V	VI	VII	VIII	Credits Total	Percentage %
1.	Humanities and Social Studies (HS)	4	4							8	4.62
2.	Basic Sciences(BS)	12	4	4	4					24	13.87
3.	Engineering Sciences (ES)	9	5							14	08.09
4.	Professional Core (PC)		9	18	17	19	16	14		93	53.76
5.	Professional Electives (PE)					3	3	6	6	18	10.41
6.	Open Electives (OE)				3		3			6	3.47
7.	Project Work (PR/EEC)					1	1		8	10	5.78
8.	Non-Credit/ (Mandatory)		0	0						0	0
	TOTAL	**25**	**22**	**22**	**24**	**23**	**23**	**20**	**14**	**173**	**100**

21HS1101	COMMUNICATIVE ENGLISH& LANGUAGE SKILLS LAB I INTEGRATED	L	T	P	C
		3	0	2	4

OBJECTIVES

- To induce the basic reading and writing skills among the first year engineering and technologystudents.
- To assist the learners to develop their listening skills, which will enable them listening to lectures and comprehend them by asking questions and seeking clarifications
- To succor the learners to develop their speaking skills and speak fluently in real contexts.
- To motivate the learners to develop vocabulary of a general kind by developing their reading skills for meeting the competitive exams like GATE, TOFEL, GRE, IELTS, and other exams conducted by Central and State governments.

UNIT - I INTRODUCING ONESELF 9

Listening: Listening and filling details, Listening to Speeches by Specialists and Completing Activities suchas Answering Questions, Identifying the Main Ideas, Style, etc. Speaking: Introducing Oneself – Introducing Friend/ Family. Reading: Descriptive Passages (From Newspapers / Magazines).Writing: Writing a Paragraph (Native Place, School Life), Developing Hints. Grammar: Noun, Pronoun & Adjective. Vocabulary Development: One Word Substitution

UNIT - II DIALOGUE WRITING 9

Listening: Listening to Conversations (Asking for and Giving Directions).Speaking: Making Conversation Using (Asking for Directions, Making an Enquiry), Role Plays, and Dialogues. Reading: Reading a Print Interview and Answering Comprehension Questions. Writing: Writing a Checklist, Dialogue Writing Grammar: Tenses and Voices. Vocabulary Development: Prefix &Suffix, Word formation.

UNIT - III DRAFTING OFFICIAL COMMUNICATIONS 9

Listening: Listening for specific information. Speaking: Giving Short Talks on a given Topic. Reading: Reading Motivational Essays on Famous Engineers and Technologists (Answering Open – Ended and Closed Questions).Writing: Writing Formal Letters / Emails. Grammar: Adverb, Prepositions & Conjunctions. Vocabulary Development: Collocations – Fixed Expressions.

UNIT -IV WRITTEN COMMUNICATION 9

Listening: Listening to Short Talks (5 Minutes Duration and Fill a Table, Gap-Filling Exercise) Note Taking/Note Making .Speaking: Small Group Discussion, Giving Recommendations .Reading: Reading Problem – Solution Articles/Essays Drawn From Various Sources .Writing: Making Recommendations Note Making – Complaint Letters. Grammar: Subject-Verb Agreement, Framing Questions. Vocabulary Development: Connectives, Reference Words, Technical Vocabulary.

UNIT -V WRITING DEFINITIONS AND PRODUCT DESCRIPTION 9

Listening: Listening to a Product Description (Labeling and Gap Filling) Exercises. Speaking: Describing a Product and Comparing and Contrasting it with Other Products. Reading: Reading Graphical Material for Comparison (Advertisements).Writing: Writing Definitions (Short and Long) – Compare and Contrast Paragraphs, Essay writing. Grammar:– Phrasal Verbs – Cause and Effect Sentences –Compound Nouns Vocabulary Development: Use of Discourse Markers.

TOTAL: 45 PERIODS

OUTCOMES

1. The students will be able to comprehend conversations and short talks delivered in English
2. Participate effectively in informal conversations; introduce themselves and their friends and express opinions English
3. Read articles of a general kind in magazines and newspapers
4. Write short essays of a general kind and personal letters and emails in English
5. Recognize the use of grammar in speech and writing

TEXT BOOKS

1. N P Sudharshana& C Savitha. *English for Technical Communication* Delhi: CUP, 2019.
2. Board of Editors. *English for Engineers and Technologists* Volume 1 Orient Black Swan Limited, 2020.

REFERENCES

1. Board of Editors. Using English-A course book for Undergraduate engineers and Technologists Orient Black SwanLimited, 2017
2. Bailey, Stephen. Academic Writing: *A Practical Guide for Students*. New York: Rutledge, 2011. 3.Comfort, Jeremy, et al. *Speaking Effectively: Developing Speaking Skills for Business English*. CambridgeUniversity Press, Cambridge: Reprint 2011
3. Means,L. Thomas and Elaine Langlois. *English & Communication For Colleges*. Cengage Learning ,USA:2007
4. Redston, Chris & Gillies Cunningham *Face2Face* (Pre-intermediate Student's Book& Workbook)Cambridge University Press, New Delhi: 2005.

WEB REFERENCES

1. https://learnenglishteens.britishcouncil.org/exams/grammar-and-vocabulary-exams/word-formation
2. https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/2018031621.pdf
3. http://xn--englishclub-ql3f.com/grammar/parts-of-speech.htm
4. https://www.edudose.com/english/grammar-degree-of-comparison-rules/

ONLINE COURSES / RESOURCES

1. https://basicenglishspeaking.com/wh-questions/
2. https://agendaweb.org/verbs/modals-exercises.html
3. https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/2018031621.pdf
4. https://www.ego4u.com/en/cram-up/grammar/prepositions

LANGUAGE SKILLS LAB

List of exercises **MINIMUM OF EXERCISES TO BE CONDUCTED** **15**

1. Reading: Different text type
2. Reading: Predicting content using pictures and title.
3. Reading: Use of graphic organizers to review
4. Reading: Aid comprehension.
5. Reading: Understanding reference words
6. Reading: Use of connectors in a passage-
7. Reading: Speed reading Techniques.
8. Reading and Comprehending the passages in the competitive exams like GATE, TOFEL, GRE,IELTS, and other exams conducted by Central and State governments.
9. Reading: Sentence Completion: Exercises used in competitive exams.
10. Writing- Error Detection:
11. Writing-Spotting and reasoning the errors found from the passages in competitive exams.
12. Writing-Email writing
13. Writing: Job Application: Resume
14. Writing- Elements of a good essay-
15. Writing: Types of essays- Descriptive-Narrative- issue based.
16. Writing: Statement of Purpose
17. Writing: Letter of recommendation
18. Writing: Vision statement
19. Writing- Verbal Analogy,
20. Writing- Phrases, and Idioms associated with competitive exams.

TOTAL: 30 PERIODS

SOFTWARE REQUIRED:

Globarena

REFERENCES

1. SureshKumar.E and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan: Hyderabad, 2012
2. Davis, Jason and Rhonda Liss. Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006
3. Withrow, Jeans and et al. Inspired to Write. Readings and Tasks to develop writing skills. Cambridge UniversityPress: Cambridge, 2004
4. Goatly, Andrew. Critical Reading and Writing. Routledge: United States of America, 2000

21MA1101	ENGINEERING MATHEMATICS- I	L	T	P	C
		3	1	0	4

OBJECTIVES:

- Matrix transforms are very useful within the world of computer graphics. A matrix algebra can be readily applied to the structural properties of graphs from an algebraic point of view.
- The aim of this course to get depth knowledge about calculus.
- Familiarize the functions of two variables and finding its extreme points.
- To make the students understand various techniques of integration.
- Apply multiple integral ideas in solving areas, volumes and other practical problems

UNIT – I MATRICES 9+3

Eigen values and Eigen vectors of a real matrix —Rank of the matrix – Characteristic equation — Properties of Eigenvalues and Eigen vectors — Cayley Hamilton theorem — Diagonalization of matrices— Reduction of a quadratic form to canonical form by orthogonal transformation and similarity transformation —Nature of quadratic forms.

UNIT – II DIFFERENTIAL CALCULUS 9+3

Representation of functions – Limit of a function – Continuity – Derivatives – Differentiation rules (Sum, Product & Quotient rule, Chain rule, logarithmic and implicit differentiation) – Maxima and Minima of functions of one variable-Rolle‘s theorem- Mean value theorem.

UNIT – III FUNCTIONS OF SEVERAL VARIABLES 9+3

Partial differentiation – Homogeneous functions and Euler‘s theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor‘s series for functions of two variables – Maxima and minima of functions of two variables –Lagrange‘s method of undetermined multipliers.

UNIT –IV INTEGRAL CALCULUS 9+3

Definite and Indefinite integrals – Substitution rule – Techniques of Integration – Integration by parts – Bernoulli‘s formula- Trigonometric integrals – Trigonometric substitutions – Integration of rational functions by partial fraction – Integration of irrational functions – Improper integrals.

UNIT –V MULTIPLE INTEGRALS 9+3

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

TOTAL: 60 PERIODS

OUTCOMES:

1. Able to find eigenvalues and eigen vectors, diagonalization of a matrix, symmetric matrices, positive definite matrices and similar matrices.
2. Apply limit definition and rules of differentiation to differentiate functions.
3. Understand familiarity in the knowledge of Maxima and Minima, Jacobian, Taylor series and apply the problems involving Science and Engineering
4. Understand the knowledge of Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction.
5. Understand the knowledge of Area enclosed biplane curves, Change of variables in double integrals, Triple integrals, Volume of Solids.

TEXT BOOKS:

1. Grewal B.S., ―Higher Engineering Mathematics‖, Khanna Publishers, NewDelhi,43rd Edition, 2014.
2. James Stewart, -Calculus: Early Transcendentals‖, Cengage Learning,7th Edition, NewDelhi, 2015.
3. Bali N., Goyal M. and Walkins C., ―Advanced Engineering Mathematics‖, Firewall Media (An imprint of Lakshmi Publications Pvt. Ltd.,), New Delhi, 7th Edition, 2009

REFERENCES:

1. Anton, H, Bivens, I and Davis, S, -Calculus‖, Wiley, 10th Edition, 2016.
   Jain R.K. and Iyengar S.R.K., ―Advanced Engineering Mathematics‖, Narosa
2. Publications,NewDelhi, 3rd Edition, 2007.
   Narayanan, S. and Manicavachagom Pillai, T. K., ―Calculus‖ Volume I and II, S. Viswanathan
3. Publishers Pvt. Ltd., Chennai, 2007
4. Srimantha Pal and Bhunia, S.C, -Engineering Mathematics‖ Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, -Thomas Calculus‖, 12th Edition, Pearson India, 2016.
6. B.V. Ramana, ― Higher Engineering Mathematics‖, McGraw Hill Education, India.
7. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley sons,10thedition,2015

ONLINE COURSES / RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_ma60/preview
2. https://onlinecourses.nptel.ac.in/noc21_ma58/preview

21PH1101	ENGINEERING PHYSICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

UNIT – I MECHANICS 9

System of particles: centre of mass in one and two dimensions – rotational motion of continues system – torque – moment of inertia – conservation of angular momentum – Newton‘s laws for rotation – equations of rotational motion – work energy theorem for rotational motion. Stress, strain, Hooke‘s law and elastic moduli – twisting couple per unit twist for solid and hollow cylinders – torsional pendulum theory – bending moment of beam – cantilever and non-uniform bending theory – uniform bending theory – I shape girder.

UNIT – II ELECTROMAGNETIC THEORY 9

Divergence – curl – integral calculus – Gauss divergence theorem – Stake’s theorem – equation of continuity – displacement current – Maxwell‘s equations – Gauss‘s laws – Faraday‘s law –Ampere-Maxwell law – mechanism of electromagnetic wave propagation – Hertz observation – production and detection of electromagnetic wave – electromagnetic waves in free space and matter – energy carried by electromagnetic wave – momentum and radiation pressure – properties of electromagnetic waves.

UNIT – III THERMAL PHYSICS 9

Mode of heat transfer: conduction, convection and radiation – thermal expansion of solids – bimetallic strips – thermal conductivity – heat conduction through compound media (series & parallel) – Force’s and Lee‘s disc method; theory and experiment – thermal insulation – applications – heat exchangers – refrigerators, solar water heater.

UNIT –IV OSCILLATORY MOTION, LASERS AND FIBER OPTICS 9

Spring mass system – differential equation-simple harmonic motion-damped oscillation-forced oscillation –analogy with LCR circuits and mechanical oscillation – plane wave equation – equations of wave motion in a rope and velocity of wave. Population of energy levels, Einstein‘s A and B coefficients derivation – optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction –components and principle of fiber optics – numerical aperture and acceptance angle derivation – types of optical fibers (material, refractive index, mode) – losses associated with optical fibers – fiberas pressure and displacement sensors.

UNIT –V QUANTUM MECHANICS 9

Blackbody radiation – Planck‘s hypothesis and derivation – wave particle duality of light: concepts of photon – Compton effect: theory and experiment – de Broglie hypotheses - concept of wave function and its physical significance – Schrödinger‘s wave equation – time independent and time dependent equations – particle in a one-dimensional box – tunnelling (qualitative) – scanning tunnelling microscope.

TOTAL: 45 PERIODS

OUTCOMES:

1. Upon completion of this course, the students will understand the basics of mechanics and especially elastic properties of materials.
2. Upon completion of this course, the students will gain knowledge on the basic concepts of electromagnetic waves and its properties.
3. Upon completion of this course, the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in heat exchangers
4. Upon completion of this course, the students will acquire knowledge on the concepts of oscillations, lasers and fiber optics and their technological applications
5. Upon completion of this course, the students will get knowledge on advanced physics concepts of quantum theory and its applications in modeling microscopes.

TEXT BOOKS:

1. Gaur, R.K. & Gupta, S.L. -Engineering Physics‖. Dhanpat Rai Publishers, 2012.
2. Santhosam, K. Russel Raj, K. & Maheswaran, A. ―Engineering Physics, KRAM Publications, 2021
3. Pandey, B.K. & Chaturvedi, S. ―Engineering Physics‖. Cengage Learning India, 2012.

REFERENCES:

1. Halliday, D., Resnick, R. & Walker, J. ―Principles of Physics‖. Wiley, 2015.
2. Tipler, P.A. & Mosca, G. ―Physics for Scientists and Engineers with Modern Physics'. W.H.Freeman, 2007.
3. Arthur Beiser, ―Concepts of Modern Physics‖, Mc Graw Hill, Sixth edition, 1994.
4. Douglas. C., Giancoli. ―Physics: Principles with applications‖, Pearson, 2014.

WEB REFERENCES:

1. https://kluniversity.in/physics/pdfs/crypdf.pdf
2. https://mrcet.com/downloads/digital_notes/ECE/III%20Year/FIBER%20OPTICAL%20COMMUNICATIONS.pdf
3. https://nptel.ac.in/content/storage2/courses/117101002/downloads/Lec01.pdf
4. https://nptel.ac.in/content/storage2/courses/117101002/downloads/Lec19.pdf
5. https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/lecture-notes/MIT8_04S16_LecNotes3.pdf
6. https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/lecture-notes/MIT8_04S16_LecNotes5.pdf

ONLINE COURSES / RESOURCES:

1. https://nptel.ac.in/courses/115/102/115102023/
2. https://nptel.ac.in/courses/115/106/115106066/

21CY1101	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know about the importance of Chemistry inEngineering domain
- To understand the Chemistry background ofindustrial process.
- To apply Chemistry knowledge for Engineering disciplines.

UNIT – I WATER TECHNOLOGY 9

Hardness –Types of hardness – Estimation by EDTA method – Boiler troubles- scale, sludge, priming, foaming, caustic embrittlement, Boiler corrosion – Internal Conditioning – Carbonate, phosphate, Calgon conditioning – External Conditioning – Zeolite and Demineralization process – Desalination, Reverse Osmosis Method – Domestic water treatment.

UNIT – II HIGH POLYMERS AND NANOCHEMISTRY 9

Polymers – Introduction – Classification of Polymers (Origin/Source, Structure, Monomers, Inter-molecular Forces, Synthesis) – Commercial Polymers (Poly Vinyl Chloride (PVC), Polytetrafluoroethylene (PTFE), Nylon-6 6, Nylon-6, Polyethylene Terephthalate (PET) – Conducting Polymers – Polyaniline, Polythiophene, Trans-Polyacetylene – Basic definition – FRP – General Engineering applications of FRP (Civil Engineering Structures).**Nanomaterial's –** Introduction, size dependent properties (Surface area, Electrical, Optical, Catalytic and Thermal properties). Synthesis of nanomaterials: Top-down and bottom-up approaches, Chemical Synthesis – Co precipitation, Sol-Gel process and Chemical vapor deposition, Nanoscale materials: Fullerenes, Carbon nanotubes and 8odellin – Characterization, properties and applications. Green synthesis of Nanoparticles.

UNIT – III INSTRUMENTAL METHODS AND ANALYSIS 9

Introduction to Spectroscopy – Types of spectroscopy – Absorption spectra – Emission spectra – Wave length and Wave number- Electromagnetic radiation – Flame Photometry, Atomic Absorption Spectroscopy, UV-Visible spectrum. Introduction – basic principles – Instrumentation& Applications – Infrared Spectroscopy. Chromatographic methods – Types (column, Thin layer, paper, Gas, High Performance Liquid Chromatographic methods) – principle- Separation and quantification of Organic compounds by GC and HPLC. Conductometric Titrations: Instrumentation – Advantages – Applications Potentiometric Titrations: Instrumentation –Advantages-Applications. Measurement of pH: pH metry – Instrumentation – Applications.

UNIT –IV ELECTROCHEMISTRY AND CORROSION 9

Introduction- Electrode potentials-Electrochemical series-Electrochemical cell-redox reaction – measurement and applications – Nernst Equation Derivation- Electrochemical extraction of metals – Electrolytic refining of metals –Nano electrochemical Sensors. Corrosion – causes, factors, types, Chemical and Electrochemical Corrosion (Galvanic, Differential aeration) – Corrosion Control, Electrochemical protection – Sacrificial Anodic method – Impressed Current Cathodic Protection – Corrosion Inhibitors – Biocorrosion.Protective Coatings – Paints, Constituents, Functions- Surface preparation for metallic coatings, Electroplating and Electroless Plating.

UNIT –V ENERGY SOURCES AND STORAGE DEVICES 9

Introduction – Nuclear energy – Nuclear fission – Controlled Nuclear fission – Nuclear Fusion – Differences – Nuclear chain reactions –Nuclear Reactor – Classification of Nuclear Reactor – Light WaterNuclear Reactor, Breeder Reactor – Solar Energy, Conversion, Solar Cells – Wind Energy.

Batteries and Fuel Cells – Types of batteries — Zinc – carbon dry cell –Lead Storage battery– Nickel-Cadmium Battery – Lithium battery – Battery Engineering – Battery hazards – Biological Batteries.Fuel Cells – Hydrogen-Oxygen Fuel Cell – Hondas cell- Supercapacitors (elementary idea)

TOTAL: 45 PERIODS

OUTCOMES:

1. Analyze the water quality parameters in purification and significance in industries, daily life.
2. Explain the types, fabrication and engineeringapplications of polymers. Develop economically ne methods ofsynthesizing nanomaterials and their applications.
3. Demonstrate the knowledge of analytical techniques using spectroscopy.
4. Relate the electrode potential for its feasibility inelectrochemical reaction. Illustrate the causes, co corrosion and to achieve itsprotection.
5. Compare the economic and efficient usage ofnon-conventional and conventional energy source and various storage devices.

TEXT BOOKS:

1. P.C.Jain and Monika Jain, ―Engineering Chemistry‖, Dhanpat Rai Publishing Company(P) LTD., New Delhi.
2. S. S. Dara and S.S. Umare, ―A Textbook of Engineering Chemistry‖ S. Chand and Company Ltd, New Delhi.
3. V.R.Gowariker, N.V.Viswanathan and JayadevSreedhar, ―Polymer Science‖, New Age International P (Ltd.,), Chennai, 2006
4. P. Kannan and A. Ravikrishnan, ―Engineering Chemistry‖, Sri Krishna Hitech Publishing Company Pvt. Ltd. Chennai, 2009. 16
5. S. Vairam, P. Kalyani and Suba Ramesh, ―Engineering Chemistry‖, Wiley India, 2011

REFERENCES:

1. Friedrich Emich, ―Engineering Chemistry‖, Scientific International Pvt. Ltd., NewDelhi.
2. PrasanthaRath, ―Engineering Chemistry‖, Cengage Learning India Pvt., Ltd., Delhi.
3. P.W. Atkins and de Paula Julio, ―Physical Chemistry‖, Oxford University Press, 8th Ed.,(Indian Student Edition) (2009).
4. K. K. Rohatgi-Mukherjee, ―Fundamental of Photochemistry‖ New Age International (P) Ltd., New Delhi, 1986.
5. G.A. Ozin and A.C. Arsenault, ―Nanochemistry: A Chemical Approach toNanomaterials‖, RSC Publishing, 2005 Nanomaterials, B.Viswanathan, Alpha Science , ISBN: 9781842654941

WEB REFERENCES:

http://www.mhhe.com/engcs/compsci/forouzan/dcn/student/olc

ONLINE COURSES / RESOURCES:

1. https://nptel.ac.in/courses/103/108/103108100
2. https://nptel.ac.in/courses/121/106/121106014
3. https://nptel.ac.in/courses/104/105/104105039

21ES1101	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know the basic programming constructs –data types, decision structures, and control structures in python
- To know how to use libraries for string manipulation
- To Use python data structures – Lists, Tuples and Dictionary
- To know the basic concepts of Object-Oriented Programming
- To learn about input/output with files in Python.

UNIT – I ALGORITHMIC PROBLEM SOLVING 9

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language); Python: Data types, variables, expressions, precedence of operators, algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, and guess an integer number in a range, Towers of Hanoi.

SUGGESTED ACTIVITIES:

- Developing Pseudo codes and flowcharts for real life activities such as railway ticket Booking using IRCTC, admission process to undergraduate course, academic schedules during a semester etc.
- Developing algorithms for basic mathematical expressions using arithmetic Operations
- Installing Python.
- Simple programs on print statements, arithmetic operations.

SUGGESTED EVALUATION METHODS:

- Quizzes on algorithm and basic python.
- Assignments on illustrative problems.
- Quizzes on simple python programs.

UNIT – II CONTROL FLOW, STRINGS & FUNCTIONS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; functions, function definition and use; Fruitful functions: return values, parameters and arguments, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module. Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

SUGGESTED ACTIVITIES:

- Simple Python program implementation using Operators, Conditionals, Iterative Constructs and Functions
- Developing simple applications like calculator, calendar, phone directory, to-do lists etc.
- Flow charts for GCD, Exponent Functions, Fibonacci Series using conditionals and
- Recursion vs. Iteration.

SUGGESTED EVALUATION METHODS:

- Quizzes on strings.
- Assignments on illustrative problems.
- Quizzes on control flow and functions.

UNIT – III LISTS, TUPLES, DICTIONARIES 9

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; Lists as arrays. Illustrative programs: selection sort, insertion sort, merge sort, histogram.

SUGGESTED ACTIVITIES:

- Implementing python program using lists, tuples, sets for the following scenario:

- Simple sorting techniques
- Student Examination Report
- Billing Scheme during shopping.
- Implementing any application using List and Tuple data structures.

SUGGESTED EVALUATION METHODS:

- Quizzes on list slices.
- Assignments on illustrative problems.
- Quizzes on tuples and dictionaries.

UNIT – IV OBJECT ORIENTED PROGRAMMING WITH PYTHON 9

Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data 11odelling; persistent storage of objects – inheritance, polymorphism, operator overloading; abstract classes; exception handling, try block. Illustrative programs: demonstrate the concept of class and objects.

SUGGESTED ACTIVITIES:

- Features of OOP.
- Persistent storage of objects
- Operators and its usage.
- Simple programs using OOP concepts.

SUGGESTED EVALUATION METHODS:

- Quizzes on basic OOP concepts.
- Assignments on illustrative problems.
- Quizzes on inheritance and exception handling.

UNIT – V FILES, MODULES, PACKAGES 9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

SUGGESTED ACTIVITIES:

- Developing modules using Python to handle files and apply various operations on files
- Usage of exceptions, multiple except blocks – for applications that use delimiters likeage, range of numerals etc.
- Implementing Python program to open a non-existent file using exceptions.

SUGGESTED EVALUATION METHODS:

- Quizzes on basic file operations.
- Assignments on illustrative problems.
- Quizzes on packages and modules.

TOTAL: 45 PERIODS

OUTCOMES:

1. Develop algorithmic solutions to simple computational problems.
2. Write and execute simple Python programs.
3. Familiarize with python string handling techniques and user defined functions.
4. Represent compound data using Python lists, tuples and dictionaries.
5. Understand the concept of object oriented programming techniques.
6. Read and write data from/to files in Python Programs.

TEXT BOOKS:

1. Reema Thareja, ``Problem Solving and Programming with Python‘‘, 2nd edition, OXFORD University Press, New Delhi, 2019.(UNIT 1,2,3,4(Exception Handling) and 5).

2. Bill Lubanovic, ―Introducing Python-Modern Computing in Simple Package‖, 2nd edition, O‘REILLY, 2019.(UNIT 4(Object Oriented Programming)).

REFERENCES:

1. Steven F. Lott, –Modern Python Cookbook‘‘, 2nd Edition, O‘REILLY, 2020.
2. Ryan Marvin, Mark Ng‘ang‘a, Amos Omondi, ―Python Fundamentals, Packt Publishing., 2018.
3. Paul J. Deitel, Python for Programmers, Pearson India Education Services Pvt. Ltd,2020.
4. Martin C. Brown, Python: The Complete Reference, McGraw Hill Education; Forth edition, 2018.

WEB REFERENCES:

1. https://greenteapress.com/thinkpython2/thinkpython2.pdf
2. https://freecomputerbooks.com/An-Introduction-to-Python-Guido-van-Rossum.html#downloadLinks
3. http://marvin.cs.uidaho.edu/Teaching/CS515/pythonTutorial.pdf

ONLINE COURSES / RESOURCES:

1. https://docs.python.org/3/tutorial/
2. https://www.w3schools.com/python/
3. https://www.tutorialspoint.com/python/index.htm
4. https://www.javatpoint.com/python-tutorial
5. https://nptel.ac.in/courses/

21ES1102	ENGINEERING GRAPHICS	L	T	P	C
		3	0	2	4

OBJECTIVES:

- Drawing free hand sketches of basic geometrical shapes and multiple views of objects.
- Drawing orthographic projections of lines and planes.
- Drawing orthographic projections of solids.
- Drawing development of the surfaces of objects.
- Drawing isometric and perspective views of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination): 2

Importance of graphics in engineering applications – Use of drafting instruments.BIS conventions and specifications. Size, layout and folding of drawing sheets – Lettering and dimensioning. Introduction to drafting packages like CAD and demonstration of their use in engineering fields.

UNIT – I PLANE CURVES AND FREEHAND SKETCHING 14

Basic Geometrical constructions, Curves used in engineering practices-Conics: Construction of Ellipse, Parabola and Hyperbola by eccentricity method – Construction of cycloid, Involutes of square, pentagon and circle – Drawing of tangents and normal to the above curves. Free Hand sketching-Orthographic projection – Orthographic views of simple three-Dimensional objects.

UNIT – II PROJECTION OF POINTS, LINES AND PLANE SURFACES 15

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

UNIT – III PROJECTION OF SOLIDS 15

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

UNIT –IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 15

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

UNIT –V ISOMETRIC AND PERSPECTIVE PROJECTIONS 14

Principles of isometric projection – isometric scale –Isometric projections of simple solids and frustum and truncated solids – Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions.Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

TOTAL: 75 PERIODS

OUTCOMES:

1. Draw free hand sketching of basic geometrical shapes and multiple views of objects.
2. Draw orthographic projections of lines and planes
3. Draw orthographic projections of solids
4. Draw development of the surfaces of objects
5. Draw isometric and perspective views of simple solids.

TEXT BOOKS:

1. Natarajan, K. V., ―A text book of Engineering Graphics‖, 28th Ed., Dhanalakshmi Publishers, Chennai, 2015.
2. Venugopal, K. and Prabhu Raja, V., ―Engineering Graphics‖, New Age, 2008.

REFERENCES:

1. Bhatt, N.D.,Panchal V M and Pramod R. Ingle, ―Engineering Drawing‖, Charotar Publishing House, 53rd Edition, 2014.
2. Parthasarathy, N. S. and Vela Murali, ―Engineering Drawing‖, Oxford University Press, 2015
3. Agrawal, B. and Agrawal C.M., ‑Engineering Drawing‖, Tata McGraw, N.Delhi, 2008.

WEB REFERENCES:

1. https://nptel.ac.in/courses/105/104/105104148/
2. https://www.youtube.com/channel/UCkCk0nvNyWhEOLge9JtDLDg

ONLINE COURSES / RESOURCES:

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

21ES1111	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To write, test, and debug simple Python programs.
- To implement Python programs with conditions and loops.
- To use functions for structuring Python programs.
- To represent compound data using Python lists, tuples, dictionaries.
- To use OOPS concepts in Python.
- To read and write data from/to files in Python

LIST OF EXPERIMENTS

1. Basic Python Programs.
2. Write programs to demonstrate different number data types in python.
3. Develop python programs to demonstrate various conditional statements.
4. Implement user defined functions using python.
5. Develop python scripts to demonstrate functions.
6. Develop python programs to perform various string operations like slicing, indexing & formatting.
7. Develop python programs to perform operations on List & Tuple.
8. Demonstrate the concept of Dictionary with python programs.
9. Develop python codes to demonstrate concept of class and objects.
10. Demonstrate OOPS concepts like inheritance and polymorphism with python programs.
11. Demonstrate python codes to print try, except and finally block statements.
12. Implement python programs to perform file operations.
13. Implement python programs using modules and packages.
14. Simulate bouncing ball using Pygame.

Mini Project :Suggested Topics(but not limited to)

1. Dice roll simulator.
2. Guess the number game.
3. Sending emails using python.
4. Random password generator.
5. Alarm clock.
6. URL shortener.

TOTAL: 60 PERIODS

OUTCOMES:

1. To write, test, and debug simple Python programs.
2. To implement Python programs with conditions and loops.
3. To use functions for structuring Python programs.
4. To represent compound data using Python lists, tuples, dictionaries.
5. To use OOPS concepts in Python.
6. To read and write data from/to files in Python

WEB REFERENCES:

1. https://www.programiz.com/python-programming/examples
2. https://www.geeksforgeeks.org/python-programming-examples/
3. https://beginnersbook.com/2018/02/python-programs/
4. https://www.javatpoint.com/python-programs
5. https://www.w3schools.com/python/python_examples.asp
6. https://www.sanfoundry.com/python-problems-solutions/

21BS1111	PHYSICS AND CHEMISTRY LABORATORY	L	P	T	C
		0	0	4	2

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LIST OF EXPERIMENTS(Minimum of experiments to be conducted: 5 Experiments)

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

TOTAL: 30 PERIODS

OUTCOME:

- Upon completion of the course, the students will be able to apply principles of elasticity, optics and thermal properties for engineering applications.

TEXT BOOKS

1. Ruby Das, C.S. Robinson, Rajesh Kumar, Prashant Kumar Sahu, A Textbook of Engineering Physics Practical, University Science Press, Delhi, II Edition (2016), ISBN 978-93-80386-86-7
2. Harnam Singh, Dr.P.S. Hemne, B.Sc., Practical Physics, S.Chand & Company Ltd, New Delhi, Edition 2011, ISBN 81-219-0469-2

WEB REFERENCES:

1. https://www.vlab.co.in/broad-area-physical-sciences
2. https://vlab.amrita.edu/?sub=1

CHEMISTRY LABORATORY

OBJECTIVES:

- To inculcate experimental skills to test basic understanding of water quality parameters such as, alkalinity, hardness, DO and chloride.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry,potentiometry and conductometry in the determination of aqueous solutions.

LIST OF EXPERIMENTS(Minimum of experiments to be conducted: 5 Experiments)

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in Water sample.
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. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Determination of total, temporary & permanent hardness of water by EDTA method.
10. Estimation of iron content of the water sample using spectrophotometer (1, 10-26, Phenanthroline / thiocyanate method).
11. Estimation of sodium and potassium present in water using flame photometer.
12. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
13. Pseudo first order kinetics-ester hydrolysis.
14. Corrosion experiment-weight loss method.
15. Phase change in a solid.

TOTAL: 30 PERIODS

OUTCOMES:

- To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO
- To quantitatively analyse the aqueous solution by electroanalytical techniques

TEXT BOOKS

1. Laboratory Manual- Department of Chemistry, CEGC, Anna University (2014).
2. Vogel‘s Textbook of Quantitative Chemical Analysis (8th edition, 2014).

21HS1201	COMMUNICATIVE ENGLISH & LANGUAGE SKILLS LAB II INTEGRATED	L	T	P	C
		3	0	2	4

OBJECTIVES

1. To develop linguistic and strategic competence in workplace context and to enhance language proficiency and thereby the employability of budding engineers and technologists.
2. To improve the relevant language skills necessary for professional communication.
3. To help learners to develop their listening skills, which will, enable them to listen to lectures and comprehend them by asking questions; seeking clarification and developing their speaking skills and to speak fluently in real contexts.
4. To Introduce them to life skills, their importance in leading Personal & professional life, key concepts of business communication and Communicative skills.

UNIT - I INTERPERSONAL COMMUNICATION 9

Listening: Listening to Telephone Conversations. **Speaking**: Role Play Exercises Based on Workplace Contexts, Introducing Oneself - PEP Talks. **Reading:** Reading the Interview of an Achiever and Completing Exercises (Skimming, Scanning and Predicting). **Writing:** Writing a Short Biography of an Achiever Based on Given Hints, **Grammar:** Adjective, Sentence pattern. **Vocabulary** Development: Idioms and Phrases.

UNIT - II TECHNICAL COMMUNICATION 9

Listening: Listening to Talks/Lectures Both General and Technical and Summarizing the Main Points. **Speaking:** Participating in Debates ,TED Talks **Reading:** Reading Technical Essays/ Articles and Answering Comprehension Questions **Writing:** Summary Writing ,Minutes of the meeting **Grammar:** Participle Forms, Relative Clauses **Vocabulary Development:** Compound Words, Abbreviations and Acronyms.

UNIT - III PROCESS DESCRIPTION 9

Listening: Listening to a Process Description and Drawing a Flowchart **Speaking:** Participating in Group Discussions, Giving Instructions, Presentation **Reading:** Reading Instruction Manuals **Writing:** Process Descriptions – Writing Instructions **Grammar:** Use of Imperatives, Active and Passive Voice, Sequence Words **Vocabulary Development:** Misspelt words , Homophones and Homonyms.

UNIT - IV REPORT WRITING 9

Listening: Listening to a Presentation and Completing Gap-Filling Exercises **Speaking:** Making Formal Presentations **Reading:** Reading and Interpreting Charts/Tables and diagrams **Writing:** Interpreting Charts/Tables and Diagrams, Writing a Report **Grammar:** Direct into Indirect Speech, Use of Phrases **Vocabulary Development:** Reporting Words, Technical Jargon.

UNIT - V APPLYING FOR JOBS 9

Listening: Listening to a Job Interview and Completing Gap-Filling Exercises **Speaking:** Mock Interview, Telephone Interviews, GD **Reading:** Reading a Job Interview, SOP, Company Profile and Completing Comprehension Exercises **Writing:** Job Applications and Resumes **Grammar:** Conditional Clauses, Modal verbs **Vocabulary Development:** Technical Vocabulary, Purpose Statement.

TOTAL: 45 PERIODS

OUTCOMES:

1. Read and comprehend technical texts effortlessly.
2. Write thoughts and insights of their own.
3. Recognize the need for life skills, apply them to different situations, the basic communication
4. practices in different types of communication.
5. Gain confidence to communicate effectively in

6. various situations to acquire employability skills.
7. Become an active listener of professional contexts.

TEXT BOOK

1. Richards, C. Jack. *Interchange*, New Delhi: CUP, 2017
2. Board of Editors. *English for Engineers and Technologists* Volume 2 Orient Black Swan Limited, 2020

REFERENCES

1. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
2. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice.Oxford University Press: New Delhi, 2014.
3. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007.
4. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. CengageLearning, USA: 2007.
5. Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.

WEB REFERENCES:

1. https://learnenglishteens.britishcouncil.org/exams/grammar-and-vocabulary-exams/word-formation
2. https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/2018031621.pdf
3. http://xn--englishclub-ql3f.com/grammar/parts-of-speech.htm
4. https://www.edudose.com/english/grammar-degree-of-comparison-rules/

ONLINE COURSES / RESOURCES:

1. https://basicenglishspeaking.com/wh-questions/
2. https://agendaweb.org/verbs/modals-exercises.html
3. https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/2018031621.pdf
4. https://www.ego4u.com/en/cram-up/grammar/prepositions

LIST OF EXERCISES MINIMUM OF EXERCISES TO BE CONDUCTED: 15

1. Listen to lectures - articulate a complete idea as opposed to producing fragmented utterances – Ted talks, Science Fiction – My fair lady
2. Listening to a process information – General Competitive Examinations, GRE
3. Listening for specific information: accuracy and fluency – BEC
4. Listening - following, responding to explanations, giving directions and instructions in academic and business contexts – IELTS, TOEFL.
5. Listening to transcripts and answer to the questions.
6. Listening: Read aloud in class and gap - filling.
7. Listening: Recognizing and interpreting non - verbal cues.
8. Listen first, speak second - Having the mind set of a listener.
9. Speaking – sharing personal information - Self introduction
10. Speaking – Small talk or Pep Talk
11. Speaking – Group discussion, Visume –visual presentation of resume
12. Speaking – Presentation – Formal and Informal
13. Speaking – Mock interview
14. Speaking – FAQ‟S on Job interview

15. Speaking : Simulations - (show and tell)
16. Speaking: News brief - Ripped from today's headlines.
17. Speaking: Who's telling the truth?
18. Speaking: JAM
19. Speaking: Debate
20. Speaking: Story Narration

SOFTWARE REQUIRED:

Globarena.

TEXT BOOKS:

1. Brooks, Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford:2011.
2. Richards, C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

REFERENCES:

1. Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.
2. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014.
3. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
4. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.
5. E. Suresh Kumar et al. Communication for Professional Success, Orient Blackswan: Hyderabad, 2015.
6. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014.

21MA1202	LINEAR ALGEBRA AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To test the consistency and solve system of linear equations by matrix and also by different numerical methods.
- To find the numerical solution of Eigen value problems by Numerical techniques and to perform matrix decomposition.
- To understand the basics of Groups, Rings, Vector spaces, Subspaces and Dimension of vector space.
- To apply the linear transformation concepts in Diagonalization of a matrix.
- To study Inner product and norms and apply it in Gram- Schmidt procedure and least square approximation

UNIT - I SYSTEM OF SIMULTANEOUS LINEAR EQUATIONS 12

Basic definitions and properties of Matrices - System of linear equations - Consistency - Gauss elimination method - Gauss Jordon method.

UNIT - II EIGEN VALUE PROBLEMS AND MATRIX DECOMPOSITION 12

Eigen value Problems: Power method, Jacobi rotation method – Singular value decomposition – QR decomposition.

UNIT - III VECTOR SPACES 12

Basic Definitions of Groups, Rings (with simple examples) - Real and Complex fields - Vector spaces - Subspace - Linear space - Linear independent and Linear dependent-Spanning of a subspace- Basis and dimension.

UNIT - IV LINEAR TRANSFORMATION 12

Linear transformation - Rank space and null space - Rank and nullity - Dimension theorem - Matrix representation of linear transformation - Eigenvalues and eigenvectors of linear transformation, Diagonalization.

UNIT - V INNER PRODUCT SPACES 12

Inner product and norms - Properties –Orthogonal vectors and Orthonormal vectors - Gram Schmidt ortho normalization process - Least square approximation.

TOTAL: 60 PERIODS

OUTCOMES:

1. Demonstrate understanding of common matrices and numerical methods and how they are used to obtain approximate solutions to the linear system of equations
2. Decompose the matrix using different methods such as QR and singular value decomposition.
3. Solve the problems using the concepts of vector spaces, Subspaces and linear transformation.
4. Apply linear transformation to diagonalise a given matrix and hence to find the eigen values of the given matrix.
5. Apply Gram-Schmidt‟s orthogonalization process to diagonalise a given matrix and to solve the given system of equations by least square approximations.

TEXT BOOKS:

1. Friedberg A.H, Insel A.J. and Spence L, Linear Algebra, Prentice Hall of India, New Delhi, 2004.
2. Faires J.D. and Burden R, Numerical Methods, Brooks/Cole (Thomson Publications), New Delhi, 2002.

3. Richard Branson, Matrix Operations, Schaum's outline series, 1989.

REFERENCES:

1. Kumaresan S, Linear Algebra - A geometric approach, Prentice Hall of India, New Delhi, Reprint, 2010.
2. Strang G, Linear Algebra and its applications, Thomson (Brooks / Cole) New Delhi, 2005.
3. Gerald C.F. and Wheatley P.O, Applied Numerical Analysis, Pearson Educations, New Delhi, 2002.
4. Sundarapandian V, Numerical Linear Algebra, Prentice Hall of India, New Delhi, 2008.
5. Bernard Kolman, David R. Hill, Introductory Linear Algebra, Pearson Educations, New Delhi, FirstReprint, 2009.

ONLINE COURSES / RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_ma38/preview
2. https://onlinecourses.nptel.ac.in/noc21_ma44/preview
3. https://onlinecourses.nptel.ac.in/noc21_ma50/preview

21ES1201	BASIC ELECTRICAL, ELECTRONICS AND MEASUREMENTS ENGINEERING	L	T	P	C
		4	0	0	3

OBJECTIVES

- To learn the concepts related with electrical circuits.
- To study the concept of electrical machines.
- To understand the utilization of electrical power.
- To understand the basics of electronic devices.
- To learn the applications of Op-Amp.
- To study the concepts of measurement and transducers.

UNIT-I BASIC ELECTRIC CIRCUITS 9

Current- Voltage- Power- Voltage Source – Current Source- Ohm‟s Law – KCL – KVL (Analysis with only independent source) – Resistors in series and parallel – Current Division – Voltage Division- Mesh analysis, nodal analysis, Phasors- RMS value of current and voltage – Active power- Apparent Power- Complex Power – Power Factor - Simple problems.

UNIT-II ELECTRICAL MACHINES 9

Construction and Working Principle of DC motor, Stepper Motor, BLDC motor, Transformer, Single phase induction motor - Capacitor start and Capacitor run motor.

UNIT-III UTILIZATION OF ELECTRICAL POWER 9

Principle of wind and solar energy systems. Electrical wiring - Domestic and Industrial Illumination - Fluorescent and LED lamps. Protection- Need for Earthing, fuses and circuit breakers -Energy tariff.

UNIT-IV BASICS OF ELECTRONICS 9

PN Junction-VI Characteristics of Diode, Zener diode, Transistors configurations – amplifiers. Op amps- Amplifiers, oscillator, rectifiers, differentiator, integrator, ADC, DAC. Regulated power supply using 7805 and 7905.

UNIT-V MEASUREMENTS AND TRANSDUCERS 9

Fundamentals of moving coil and moving iron meters, Transducers- classification-thermo electric, RTD, Strain gauge, LVDT, LDR and piezoelectric. Smart sensors - Data acquisition systems.

Total Hours : 45

OUTCOMES:

1. Summarize the basic laws and concepts related to electrical circuits.
2. Explain the construction and working of electrical machines.
3. Discuss the utilization of electrical power.
4. Discuss the basic concepts of electronics .
5. Learn the applications of Op-Amp.
6. Explain the concepts of measurement and transducers.

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, ―Basic Electrical and Electronics Engineering‖, McGraw Hill Education, 2014.
2. Thomas L. Floyd, „Electronic Devices‟, 10th Edition, Pearson Education, 2018.
3. John Bird, ―Electrical Circuit theory and technology‖, Routledge, Fifth edition, 2013.

REFERENCE BOOKS

1. William Hayt, Jack Kemmerly, Steven Durbin and Jamie Phillips, :" Engineering Circuit Analysis", McGraw Hill, 2019.
2. Kothari DP and I.J Nagrath, ―Basic Electrical Engineering‖, McGraw Hill, 2010.
3. A.K. Sawhney, Puneet Sawhney „A Course in Electrical & Electronic Measurements & Instrumentation‟, Dhanpat Rai and Co, New Delhi, Edition 2011.

4. B.L.Theraja, A.K. Theraja, "A Text book on Electrical Technology Vol. III & IV", S. Chand publications, Edition 2014.

ONLINE COURSES / RESOURCES

1. https://nptel.ac.in/courses/108/106/108106172/
2. https://nptel.ac.in/courses/108/102/108102146/
3. https://nptel.ac.in/courses/108/101/108101091/
4. https://nptel.ac.in/courses/108/105/108105153/

21AD1201	PROBLEM SOLVING AND PROGRAMMING IN C (LAB INTEGRATED)	L	T	P	C
		3	0	2	4

OBJECTIVES

- To develop C Programs using basic programming constructs
- To develop C programs using arrays and strings
- To develop applications in C using functions, pointers
- To develop applications in C using structures, union
- To develop C programs using linked list

UNIT - I BASICS OF C PROGRAMMING 9

Introduction to programming paradigms - Definitions – Flowchart – Pseudocode - 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

SUGGESTED ACTIVITIES:

- Developing Pseudocodes and flowcharts for real life activities such as ticket reservation using tourism and academic schedules during a semester etc.
- Developing algorithms for basic mathematical expressions using arithmetic operations.
- Programs and Demonstration using arithmetic operations.
- Programs and Demonstration using else-if, switch, do-while, break, continue, enum

SUGGESTED EVALUATION METHODS:

- Assignments on pseudocodes and flowcharts
- Programs on integer type, arithmetic operators, basic input output, else-if, switch, do-while, break, continue, enum
- Quiz

UNIT - II 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.

SUGGESTED ACTIVITIES:

- Programs and Demonstration using arrays and string operations
- Develop an application to perform matrix operations using multi-dimensional arrays.
- Create an application that performs operations like concatenation, finding a substring from a given string, etc. using character arrays.
- Develop an application to perform Selection sort, linear and binary search

SUGGESTED EVALUATION METHODS:

- Programs on arrays and string operations with use of string library functions
- Assignments

UNIT - III FUNCTIONS AND POINTERS 9

Function Basics, Function Prototypes, Passing Parameter by value and reference, passing string to function, Passing array to function, Recursion. Basics of Pointers, Pointer Arithmetic, Null pointers, Array of Pointers.

SUGGESTED ACTIVITIES:

- Programs and Demonstration using functions and concepts of recursion.
- Programs and Demonstration using pointers and arrays, address arithmetic
- Programs and Demonstration using Pointers and strings

SUGGESTED EVALUATION METHODS:

- Programs using functions and concepts of recursion
- Programs on pointers and arrays, address arithmetic
- Programs using pointers and strings

UNIT - IV STRUCTURES AND UNION 9

Basics of Structures, Nested structures, Arrays of Structures, Pointers to Structures, Self-referential Structures, Union

SUGGESTED ACTIVITIES:

- Programs and Demonstration using array of structure, pointers to structures, self-referential structures
- Demonstration of C programs using pointers to variables, arrays, functions and using address arithmetic

SUGGESTED EVALUATION METHODS:

- Tutorials on structures and union.
- Evaluation of the programs implemented.
- Assignment

UNIT - V DYNAMIC MEMORY MANAGEMENT 9

Dynamic Memory Allocation, Linked List: Singly, Doubly and Circular Linked List, Command Line Arguments, Pre-processor directives.

SUGGESTED ACTIVITIES:

- Programs to demonstrate Dynamic Memory Allocation
- Programs to demonstrate student records using linked list

SUGGESTED EVALUATION METHODS:

- Tutorials on dynamic memory allocation and linked list.
- Assignment
- Quiz

TOTAL: 60 PERIODS

OUTCOMES:

1. Solve problems and develop simple applications in C using basic constructs
2. Design and implement applications using arrays
3. Design and implement applications using strings and its operations
4. Develop and implement applications in C using functions and pointers
5. Develop applications in C using structures and union
6. Develop C programs using linked list.

LIST OF EXPERIMENTS:

1. Programs using, I/O statements and expressions
2. Programs using decision-making constructs
3. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.

4. Check whether a given number is Armstrong number or not?
5. Programs using matrix operations
6. Generate salary slip of employees using structures, union and pointers.
7. Implementation of linked list

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, 2006
3. M. A. Weiss, ―Data Structures and Algorithm Analysis in C‖, Pearson Education Asia, 2002. (Unit V)

REFERENCES:

1. Yashavant P. Kanetkar. ―Let Us C‖, BPB Publications, 2011.
2. Paul Deitel and Harvey Deitel, ―C How to Program‖, Seventh edition, Pearson Publication
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
5. Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
6. Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, Data Structures and Algorithms, Pearson Education, New Delhi, 2006.
7. Yashavant P. Kanetkar. ―Let Us C‖, BPB Publications, 2011.

WEB REFERENCES:

1. https://github.com/tscheffl/ThinkC/blob/master/PDF/Think-C.pdf
2. https://freecomputerbooks.com/langCBooks.html

ONLINE COURSES / RESOURCES

1. https://www.programiz.com/c-programming
2. https://www.javatpoint.com/c-programming-language-tutorial
3. https://www.geeksforgeeks.org/c-programming-language/

21AD1202	DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the usage of algorithms in computing
- To Learn program independent view of data structures, including its representation and operations perform on them.
- To learn sorting, searching and indexing methods to increase the knowledge of usage of data structures in algorithmic perspective.
- To select and design data structures and algorithms that is appropriate for problems.
- To understand the usage of algorithms in computing

UNIT - I ABSTRACT DATA TYPES 9

Abstract Data Types (ADTs) – ADTs and classes – Introduction to OOP – classes in Python – Inheritance – namespaces – shallow and deep copying - Introduction to analysis of algorithms – asymptotic notations – recursion – analyzing recursive algorithms.

SUGGESTED ACTIVITIES:

- Exploration on the usage of Abstract Classes.
- Discussion on role of algorithms in computer science.
- Design of induction proofs for algorithm verification for recursive algorithms.
- Practical - Implementation of time complexity in Python.

SUGGESTED EVALUATION METHODS:

- Quizzes on abstract classes.
- Assignments on recursive algorithm analysis.
- Quizzes on algorithm writing.

UNIT - II LINEAR AND NON-LINEAR DATA STRUCTURES 9

Stack ADT – Queue ADT – double ended queues–Trees – Binary Trees – Binary search trees - AVL trees – Graph and its representations – Graph Traversals.

SUGGESTED ACTIVITIES:

- Demonstrating stack for Towers of Hanoi application.
- Developing any application (student‘s choice) using all the linear data structures.
- Implementing binary tree and tree traversals.
- Developing any application using trees.

SUGGESTED EVALUATION METHODS:

- Tutorials on applications of linear data structures.
- Checking output of programs implemented.

UNIT - III DIVIDE AND CONQUER STRATEGY AND GREEDYSTRATEGY 9

Divide and Conquer strategy: Merge sort, Quick sort – Multiplication of large integers and Strassen's Matrix Multiplication- Greedy Approach: Shortest path algorithms - Minimum cost spanning trees – Huffman coding -Disjoint sets.

SUGGESTED ACTIVITIES:

- External learning - External sorting implementation.
- Implementation of all sorting techniques in python language.
- Demonstration of Greedy approach for several applications

SUGGESTED EVALUATION METHODS:

- Tutorials on external sorting.
- Checking output of programs implemented.

UNIT - IV DYNAMIC PROGRAMMING AND STATE SPACE APPROACH 9

Dynamic Programming: Computing binomial coefficient – Knapsack problem and memory functions - Warshall's and Floyd's algorithm - State space approach-exhaustive search: DFS, BFS, Iterative deepening.

SUGGESTED ACTIVITIES:

- External learning - Dynamic programming based algorithms like TSP problem.
- Computation of binomial coefficient.
- Practical - Implementation of Warshall's and Floyd's algorithm.

SUGGESTED EVALUATION METHODS:

- Tutorial on memory functions.
- Quizzes on dynamic programming approach and state space approach.

UNIT - V BACKTRACKING, BRANCH-AND-BOUND AND NP PROBLEMS 9

Backtracking: General method – N Queens Problem – Hamiltonian Circuits – Best first search – Branch and Bound: Knapsack problem – Traveling salesman problem - NP-Complete and NP-Hard problems.

SUGGESTED ACTIVITIES:

- External learning - Backtracking approach for 8 Queens problem.
- External learning - NP complexity.
- Practical - Implementation of approximation algorithms.

SUGGESTED EVALUATION METHODS:

- Tutorials on NP-complete proofs.
- Assignments on traveling salesman problem.
- Quizzes on computational complexity.

TOTAL: 45 PERIODS

OUTCOMES:

1. Develop algorithmic solutions to simple computational problems.
2. Design, implement, and analyze linear and non-linear data structures.
3. Analyze efficient tree structures to meet requirements such as searching, indexing, and sorting.
4. Implement and analyze various problems using greedy and dynamic programming.
5. Apply backtracking technique to different real time applications.
6. Implement branch and bound technique on various applications.

TEXT BOOKS

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, ―Data Structures & Algorithms in Python‖, John Wiley & Sons Inc., 2013
2. Anany Levitin, "Introduction to design and analysis of algorithms",3rd Edition,Pearson Education,2012.
3. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, Second Edition, Prentice Hall of India, New Delhi, 2012.

REFERENCES:

1. Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, Data Structures and Algorithms, Pearson Education, New Delhi, 2006.
2. Mark Allen Weiss, ―Data Structures and Algorithm Analysis in C++‖, Fourth Edition,Pearson Education, 2014.
3. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, Second Edition, Prentice Hall of India, New Delhi, 2012.

4. Sara Baase and Allen Van Gelder, Computer Algorithms – Introduction to Design & Analysis, Third Edition, Pearson Education, New Delhi, 2000.
5. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures, Galgotia Book Sorce, Gurgaon, 1976.
6. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms,Second Edition, Universities Press, Hyderabad, 2008.

SOFTWARE REQUIREMENT: Python 3.7 / 3.8

WEB REFERENCES:

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

ONLINE COURSES / RESOURCES

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

21MC1001	ENVIRONMENTAL SCIENCE	L	T	P	C
		2	0	0	0

OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and non-renewableresources, causes of their degradation and measures to preserve them.
- To familiarize the influence of societal use of resources on the environment and introduce the legal provisions, National and International laws and conventions for environmental protection.
- To inculcate the effect of population dynamics on human and environmental health and inform about human right, value education and role of technology in monitoring human andenvironmental issues.

UNIT - I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 6

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers– energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids Introduction to biodiversity definition: genetic, species and ecosystem diversity – bio geographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India–conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT - II ENVIRONMENTAL POLLUTION 6

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes, biomedicalwastes and e-wastes – role of an individual in prevention of pollution – pollution case studies.

UNIT - III NATURAL RESOURCES 6

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, waterlogging, salinity, case studies – Land resources.

UNIT - IV SOCIAL ISSUES AND THE ENVIRONMENT 6

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization-environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion. environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation-central and state pollution control boards- Public awareness.

UNIT - V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfareprogramme – environment and human health – human rights – value education – HIV / AIDS women and child welfare – role of information technology in environment and human health
Case studies.

TOTAL: 30 PERIODS

OUTCOMES:

1. To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
2. To identify the causes, effects and environmental pollution and natural disasters and contribute to the preventive measures in the immediate society.
3. To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
4. To recognize different forms of energy and apply them for suitable applications in for technological advancement and societal development.
5. To demonstrate the knowledge of societal activity on the long and short term environmental issues and abides by the legal provisions, National and International laws and conventions in professional and personal activities and to identify and analyse effect of population dynamics on human value education, consumerism and role of technology in environmental issues.

TEXT BOOKS:

1. Anubha Kaushik and C. P. Kaushik‟s ―Perspectives in Environmental Studies‖, 6th Edition, New Age International Publishers (2018).
2. Benny Joseph, „Environmental Science and Engineering‟, Tata McGraw-Hill, New Delhi, (2016).
3. Gilbert M.Masters, „Introduction to Environmental Engineering and Science‟, 2ndedition, Pearson Education (2004).

REFERENCES:

1. R.K. Trivedi, „Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards‟, Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, „Environmental Encyclopedia‟, Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, „Environmental law‟, Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, „Environmental Studies-From Crisis to Cure‟, Oxford University Press (2005).
5. Erach Bharucha ―Textbook of Environmental Studies for Undergraduate Courses‖ Orient Blackswan Pvt. Ltd. (2013).

WEB REFERENCES:

1. https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-85-water-and- wastewater-treatment-engineering-spring-2006/lecture-notes/
2. https://www.slideshare.net/reavan/ce6605-environmental-engineering-ii-course-presentation

ONLINE COURSES / RESOURCES:

1. https://nptel.ac.in/courses/103/107/103107084/#
2. https://nptel.ac.in/courses/127/105/127105018/

21ES1211	ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVE:

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

GROUP – A CIVIL & ELECTRICAL

I CIVIL ENGINEERING PRACTICES **15**

Plumbing Work:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows.
b) Other components which are commonly used in household.
c) Preparing plumbing line sketches.
d) Laying pipe connection to the suction side of a pump
e) Laying pipe connection to the delivery side of a pump.
f) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

Wood Work:

a) Introduction to Tools and Equipments
b) Simple Planning and sawing practice
c) Making Half Lap, Dovetail, Mortise and Tenon joints

Wood Work Study:

a) Studying joints in door panels and wooden furniture
b) Studying common industrial trusses using models.

15

II ELECTRICAL ENGINEERING PRACTICES:

a) Residential house wiring using switches, fuse, indicator, lamp and energy meter.
b) Fluorescent lamp wiring.
c) Stair case wiring
d) Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
e) Measurement of energy using single phase energy meter.
f) Measurement of resistance to earth of an electrical equipment.

GROUP – B MECHANICAL AND ELECTRONICS

III MECHANICAL ENGINEERING PRACTICES **15**

Basic Machining Work:

a) Introduction to Lathe machine, Tools and Equipments
b) Simple Turning and facing
c) Step turning
d) Simple Drilling and Tapping of flat plate

Welding Work:

a) Introduction to Arc welding, Tools and Equipments.
b) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.

Assembly Work:

a) Assembling a centrifugal pump.
b) Assembling an air conditioner.

Sheet Metal Work:

a) Demonstrating basic sheet metal operations

Foundry Work:

a) Demonstrating basic foundry operations.

IV ELECTRONICS ENGINEERING PRACTICES **15**

a) Study of Electronic components and equipments – Resistor, colour coding
b) Measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.
c) Study of logic gates AND, OR, EX-OR and NOT.
d) Generation of Clock Signal.
e) Soldering practice – Components Devices and Circuits – Using general purpose PCB.
f) Measurement of ripple factor of HWR and FWR.

TOTAL: 60 PERIODS

OUTCOMES:

1. Connecting various basic pipe fittings and other components which are commonly used in household and to know about the various tools, Equipments and making different joints
2. To know the Lathe machine, Tools and Equipments with machining experiments and have knowledge about Arc welding, Tools and Equipments with making different joints
3. To carry out basic home electrical works and appliances and measure the electrical quantities
4. To analyze the basic electronic circuits and to solder simple components on PCB and test simple electronic circuits.

TEXT BOOKS:

1. Jeyapoovan T., Saravanapandian M. & Pranitha S., ―Engineering Practices Lab Manual‖, Vikas Publishing House Pvt.Ltd, (2006)
2. Kannaiah P. & Narayana K.L., -Manual on Workshop Practice‖, Scitech Publications, (1999).
3. Jeyachandran K., Natarajan S. & Balasubramanian S., ―A Primer on Engineering Practices Laboratory‖, Anuradha Publications, (2007).
4. S. Gowri & T. Jeyapoovan, ―Enginering Practices Lab Manual 5/E‖, S. Chand Publishing, 2019.

REFERENCES:

1. K.C. John, "Mechanical workshop practice", Second edition, PHI learning Pvt Ltd, New Delhi
2. Bawa H.S., -Workshop Practice‖, Tata McGraw – Hill Publishing Company Limited, (2007)

WEB REFERENCES:

1. https://nptel.ac.in/courses/112/107/112107090/
2. https://nptel.ac.in/courses/112/107/112107084/

21AD1211	DATA STRUCTURES AND ALGORITHMS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To understand the various techniques of sorting and searching
- To design and implement stacks, queues, and linked lists
- To understand the complex data structures such as trees and graphs
- To solve real time problems

LIST OF EXPERIMENTS

1. Array based implementation of stack and queue.
2. Binary tree traversals
3. Binary search tree operations
4. AVL tree implementation
5. Merge sort, Quick sort using Divide and Conquer strategy
6. Minimum cost spanning tree using Greedy approach
7. Huffman Coding
8. Strassen's Matrix Multiplication.
9. Knapsack problem using Greedy approach
10. All pairs shortest path problem using dynamic programming
11. Hamiltonian Circuits
12. Backtracking – N Queens Problem
13. Graph colouring using backtracking
14. Branch and Bound – Travelling salesman problem.
15. Approximation algorithms for knapsack and TSP problems

TOTAL: 60 PERIODS

Course Outcome

1. Develop programs to implement linear data structures such as stacks, queues and linked lists
2. Comprehend the implementation of sorting algorithms
3. Apply the concept of trees and graph data structures in real world scenarios
4. Decide on the data structure for any practical problem
5. Apply backtracking technique to real time applications
6. Apply approximation algorithms in case study

WEB REFERENCES:

1. https://www.tutorialspoint.com/python_data_structure/python_tree_traversal_algorithms.htm
2. https://nptel.ac.in/courses/106/106/106106145/
3. https://www.programiz.com/dsa/huffman-coding
4. https://jovian.ai/learn/data-structures-and-algorithms-in-python
5. https://www.udemy.com/course/data-structures-algorithms-in-python/

SEMESTER III

21MA1304	MATHEMATICAL FOUNDATIONS FOR DATA SCIENCE	L	T	P	C
		3	1	0	4

OBJECTIVES

- To extend student‘s logical and mathematical maturity and ability to deal with abstraction.
- To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
- To understand the basic concepts of combinatorics and graph theory.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To gain the knowledge of sampling techniques and use testing of hypothesis for Non Parameter test.

UNIT I LOGIC AND PROOFS 12

Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers –Rules of inference - Introduction to proofs – Proof methods and strategy.

SUGGESTED EVALUATION METHODS

- Assignment on equivalences
- Tutorial on rules of inference

UNIT II COMBINATORICS 12

Mathematical induction – Strong induction and well ordering – The pigeonhole principle – Recurrence relations – Solving linear recurrence relations using generating functions – Inclusion and exclusion principle.

SUGGESTED EVALUATION METHODS

- Assignment on Pigeonhole principle and mathematical induction
- Tutorial on generating functions and permutations and combinations

UNIT III GRAPHS 12

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

SUGGESTED EVALUATION METHODS

- writing python coding for matrix representation of graphs
- Class test on standard results on graph theory
- Tutorial on graph isomorphism and Euler and Hamiltonian circuits

UNIT IV TESTING OF HYPOTHESIS 12

Statistical hypothesis - Large sample test based on Normal distribution for Proportion , single mean and difference of two means - Student's t-test for single mean and difference of two means, F test for Variance. Chi-square tests for independence of attributes and goodness of fit.

SUGGESTED EVALUATION METHODS

- Assignment on sampling distributions

- Tutorial on chi-square test and t-test

UNIT V NON PARAMETRIC TESTS 12

Sign test, Wilcoxon signed rank test, Mann-Whitney test, Kolmogorov-Smirnov test and Kruskal-Wallis test.

SUGGESTED EVALUATION METHODS

- Tutorial on correlation testing

TOTAL: 60 PERIODS

OUTCOMES:

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

1. Apply concept of Predicate Calculus in computer science like design of computing machines, artificial intelligence, and have the knowledge to test the logic of a program
2. Understand the concepts of the counting principles.
3. Understand the application of various types of graphs in real life problem.
4. Apply the concept of testing of hypothesis for small and large samples in real life problems.
5. Use the concepts of Non Parametric Testing for Non-Normal Populations.

REFERENCES

1. Grimaldi, R.P. ‐Discrete and Combinatorial Mathematics: An Applied Introduction‖, 4th Edition, Pearson Education Asia, Delhi,2007
2. Lipschutz, S. and Mark Lipson., ‐Discrete Mathematics‖, Schaum‘s Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
3. Trivedi.K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons, 2008
4. Yates R.D. and Goodman. D. J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.
5. A. Goon, M. Gupta and B. Dasgupta, Fundamentals of Statistics, vol. I & II, World Press, 2016

ONLINE RESOURCES

https://wiki.pathmind.com/graph-analysis

21AD1301	INTERNALS OF COMPUTER SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To design digital circuits using simplified Boolean functions\
- To analyze and design combinational circuits
- To analyze and design synchronous and asynchronous sequential circuits
- To learn the basic structure and operations of a computer
- To learn the basics of pipelined execution

UNIT- I DIGITAL FUNDAMENTALS 9

Digital Systems – Features of Digital Systems- Binary Numbers – Octal – Hexadecimal Conversions – Signed Binary Numbers – Complements – Logic Gates – Boolean Algebra– Standard Forms – NAND – NOR Implementation– K-Maps- Quine McClusky method

SUGGESTED ACTIVITIES

- To illustrate different types of Digital System.
- To analyze the Different types of Number System.
- To study about Complement System.
- To perform simplification of Boolean algebra.

SUGGESTED EVALUATION METHODS

- Quizzes on basic concept of Number System .
- Assignments on illustrative problems for Boolean Algebra.
- Quizzes on Simplification of Boolean Algebra.

UNIT-II COMBINATIONAL AND SEQUENTIAL CIRCUITS 9

Combinational circuits – Adder – Subtractor – ALU Design – Decoder – Encoder – Multiplexers – Introduction to Sequential Circuits – Flip-Flops – Shift registers and their types – Counters.

SUGGESTED ACTIVITIES

- To illustrate different types Combinational and Sequential circuit
- To analyze the Different types of Adder and Subtractor
- To study about Decoder and Encoder
- To design Different types of MUX and shift register

SUGGESTED EVALUATION METHODS

- Quizzes on Combinational and Sequential Logic circuit .
- Assignments on illustrative Decoder and Encoder
- Quizzes on Flip Flop and Shift Register.

UNIT-III COMPUTER FUNDAMENTALS 9

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.

SUGGESTED ACTIVITIES

- To illustrate Generation Computer System
- To analyze the Different types of Instruction set
- To study about Addressing mode
- To design Assembly language

SUGGESTED EVALUATION METHODS

- Quizzes on basic Fundamental of Computer.
- Assignments on illustrative Addressing mode.
- Quizzes on Different types of instruction set

UNIT- IV PROCESSOR 9

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Data Hazard – Control Hazards

SUGGESTED ACTIVITIES

- To illustrate Processor
- To analyze the Data Path
- To implement Control Path
- To design the different types of Hazards

SUGGESTED EVALUATION METHODS

- Quizzes on basic functionality of Macro and Macros
- Assignments on illustrative problems for macro processor
- Quizzes on control flow and functions for macro.

UNIT- V MEMORY AND I/O 9

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O

SUGGESTED ACTIVITIES

- To illustrate Memory and I/O
- To analyze the Memory Management
- To implement Replacement Techniques
- To design the different types of Interrupt

SUGGESTED EVALUATION METHODS

- Quizzes on basic functionality of Memory and I/O
- Assignments on illustrative problems Replacement Algorithm
- Quizzes on control flow and functions Interrupt

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

1. Simplify complex Boolean functions using K-Map
2. Design and Analyze Combinational Circuits
3. Analyze the design of Sequential Circuits
4. Discuss and point out the various Memory management schemes
5. Point out the hazards present in a pipeline and suggest remedies

6. Critically analyze the various characteristics of I/O devices and their interfaces

TEXT BOOKS

1. Digital Principles and Applications – Donald P Leach, Albert Paul Malvino, GoutamSaha, 8th edition , McGraw-Hill Education, 3rd reprint 2015

2. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.

3. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012

REFERENCES

1. Digital design, R.Anantha Natarajan, PHI Learning, 2015.

2. Principles of digital Electronics, K.Meena, PHI Learning, 2013.

3. Digital Computer Fundamentals, Thomas C. Bartee TMH 2007.

4. Digital Circuits and Design, S. Salivahanan and S. Arivazhagan, Vikas Publishers, 2005.

5.William Stallings, Computer Organization and Architecture – Designing for Performance, Eighth Edition, Pearson Education, 2010.

6.John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012.

7.John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative Approach‖, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.

21AD1302	ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To impart artificial intelligence principles, techniques and its history
- To assess the applicability, strengths, and weaknesses of the basic knowledge Inferring systems, problem solving, and learning methods in solving engineering problems
- To develop intelligent systems by assembling solutions to concrete computational problems

UNIT I ARTIFICIAL INTELLIGENCE AND ITS ISSUES 9

Definitions - Importance of AI, Evolution of AI - Applications of AI, Classification of AI systems with respect to environment, Knowledge Inferring systems and Planning, Uncertainty towards Learning Systems.

SUGGESTED ACTIVITIES

- AI Quiz (Paper Pen/Online Quiz)
- Introducing the concept of Smart Cities, Smart Schools and Smart Homes
- Learners will listen to various case-studies of inspiring start-ups, companies or communities where AI has been involved in real-life.
- Learners will be allotted a theme around which they need to search for present AI trends and have to visualize the future of AI in and around their respective theme.

SUGGESTED EVALUATION METHODS

- Quizzes on algorithm and basic python.
- Assignments on illustrative problems.
- Quizzes on simple python programs.

UNIT II PROBLEM SOLVING 9

Heuristic search strategies – heuristic functions Local search and optimization problems – local search in continuous space – search with non-deterministic actions – search in partially observable environments – online search agents and unknown environments.

SUGGESTED ACTIVITIES

- Developing A framework for real life activities such as searching techniques
- Developing algorithms for basic mathematical expressions using uninformed search techniques
- Developing algorithms for basic mathematical expressions using informed search techniques
- Simple program on informed search algorithm

SUGGESTED EVALUATION METHODS

- Quizzes on algorithm and basic python.
- Assignments on illustrative problems.
- Quizzes on simple python programs.

UNIT III ADVERSARIAL SEARCH AND GAMES 9

Game Theory, Optimal Decisions in Games: Minmax Search, Optimal Decisions in Multilayer Games, Alpha-Beta Pruning, Heuristic Alpha-Bata Tree Search, Cutting of Search, Forward Pruning, Monte Carlo Tree Search, Stochastic Games, Partially Observable Game, Card Game.

SUGGESTED ACTIVITIES

- Developing A framework for real life activities such as searching techniques
- Developing algorithms for basic mathematical expressions using simple game program
- Simple program on tic-toe game
- Simple program on 8 queen puzzles

SUGGESTED EVALUATION METHODS

- Quizzes on algorithm and basic python.
- Assignments on illustrative problems.
- Quizzes on simple python programs.

UNIT IV KNOWLEDGE, REASONING, AND PLANNING 9

Logical Agents: Knowledge-Based Agents, Propositional Logic, Propositional Theorem, First- Order Logic: Knowledge Engineering in First order Logic, Interference, Knowledge Representation: Categories and Objects, Events, Reasoning Systems and Default Information, Planning: Definition, Algorithm, Heuristic, Hierarchical, Time Schedules and Analysis.

SUGGESTED ACTIVITIES

- Developing A framework for real life activities such as propositional theorem
- Developing algorithms for basic mathematical expressions using simple reasoning systems
- Simple program on Heuristic techniques
- Simple program on first order logic method

SUGGESTED EVALUATION METHODS

- Quizzes on algorithm and basic python.
- Assignments on illustrative problems.
- Quizzes on simple python programs.

UNIT V EXPERT SYSTEM 9

Expert Systems - Stages in the development of an Expert System - Probability based Expert Systems -Expert System Tools - Difficulties in Developing Expert Systems - Applications of Expert Systems.

SUGGESTED ACTIVITIES

- Developing a framework for real life activities such as monitoring and planning.
- Developing algorithms for basic mathematical expressions using Scheduling activities
- Simple program on classification techniques

SUGGESTED EVALUATION METHODS

- Quizzes on algorithm and basic python.
- Assignments on illustrative problems.
- Quizzes on simple python programs.

TOTAL: 45 PERIODS

OUTCOMES

1. Evaluate Artificial Intelligence (AI) methods and describe their foundations.
2. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning.
3. Demonstrate knowledge of reasoning and knowledge representation for solving real world problems
4. Analyze and illustrate how search algorithms play vital role in problem solving
5. Illustrate the construction of learning and expert system
6. Discuss current scope and limitations of AI and societal implications

TEXT BOOKS

1. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall.
2. Poole, D. and Mackworth, A. 2010. Artificial Intelligence: Foundations of Computational Agents, Cambridge University P
3. Castillo, E., Gutiérrez, J. M., and Hadi, A. S. 1997. Expert Systems and Probabilistic Network Models, Springer-Verlag. ISBN: 0-387-94858-9 (Unit V)

REFERENCES

1. Ric, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGraw Hill.
2. Luger, G.F. 2008. Artificial Intelligence -Structures and Strategies for Complex Problem Solving, 6th edition, Pearson. Brachman, R. and Levesque, H. 2004. Knowledge Representation and Reasoning, Morgan Kaufmann.
3. Alpaydin, E. 2010. Introduction to Machine Learning. 2nd edition.
4. Sutton R.S. and Barto, A.G. 1998. Reinforcement Learning: An Introduction, MIT Press.
5. Padhy, N.P. 2009. Artificial Intelligence and Intelligent Systems, Oxford University Press.

21AD1303	OBJECT ORIENTED PROGRAMMING PARADIGM	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn how C++ supports Object Oriented principles such as abstraction, inheritance, polymorphism etc.,
- To understand Object Oriented Programming concepts such as class definition, inheritance, interface, and event driven programming in Java
- To know the principles generic programming in Java
- To learn about how to write multi-threaded programming in Java
- To learn about how to create client side web programming using CSS and JavaScript

UNIT I FUNDAMENTALS OF OBJECT ORIENTED CONCEPTS IN C++ 9

Structure of C++ program, Primitive data types, Variable, and operators C++, performing input output operations in C++, Object–Oriented Programming concepts: class, object, encapsulation, polymorphism, inheritance – Classes in detail – Access Specifiers – Constructors and Destructors – Static Members – this Pointer – Types of inheritance – Polymorphism: function Overloading – constructor overloading - Overloading Operators – Unary Operator Overloading – Binary Operator Overloading –Abstract class- Friend function and Friend class.

SUGGESTED ACTIVITIES

- Learn to write class in C++ to store student information
- Learn to write abstract class for Person, and define various derived classes from Person, such as Student, Employee, Patient, etc.,

SUGGESTED EVALUATION METHODS

- Demonstration how store students details in object of student class
- Demonstrate how to reuse abstract class by instantiating object of Student and Employee class

UNIT II FUNDAMENTALS OF OBJECT ORIENTED CONCEPTS AND EVENT DRIVEN PROGRAMING IN JAVA 9

The Java Environment - Data Types –Performing input output operations in Java- Arrays in Java – OOP concept in Java - Defining classes in Java– Constructors, Methods, instance and static members, and Access Specifiers – Inheritance in details – Abstract class – Interface in Java - Graphics programming : Window - Frame –Panel – Components, UI Controls - Dialogs - Working with Color, Font, and Image - Basics of event handling – Java Event classes, Listener interface, Adaptor classes – MouseEvent, KeyEvent, WindowEvent, ActionEvent, ItemEvent.

SUGGESTED ACTIVITIES

- Learn to solve real time problem using object oriented concept of Java
- Learn to write java program for handling various events like MouseEvent, KeyEvent, ActionEvent, etc.,

SUGGESTED EVALUATION METHODS

- Demonstration how find area of different shapes(Square, Rectangle, Box, Triangle,etc) using class and inheritance concept

- Demonstration how to generate circle with different colors while moving mouse pointer on the area of Window

UNIT III GENERIC PROGRAMMING IN JAVA 9

Advantage of Java Generics, Generic Type: Defining generic class and Generic methods – Type Parameter and its Naming Convention - Generic Methods and Bounded Type Parameters - Invoking and Instantiating a Generic Type - Multiple Type Parameters - Parameterized Types - Inheritance and Subtypes.

SUGGESTED ACTIVITIES

- Learn to define generic method for swapping values of two variables
- Learn to define generic class for performing stack operations

SUGGESTED EVALUATION METHODS

- Demonstration how to swap value of different data types using generic method
- Demonstration how to perform various stack operations for data of different data types using generic class

UNIT IV MULTI THREADED PROGRAMMING IN JAVA 9

Advantage of Thread Programming, Thread Life Cycle, Thread Class and the Runnable Interface, Creating New Thread by instantiating Thread class and implementing Runnable Interface, Creating new Thread by extending Thread class, Creating Multiple Threads, Thread Priorities, Thread Synchronization, Inter Thread communication, Dead Lock, Suspending, Resuming, and Stopping Threads.

SUGGESTED ACTIVITIES

- Learn to write multithreaded Java Program for your own concept
- Learn to write threaded programs to demonstrate inter thread communication

SUGGESTED EVALUATION METHODS

- Demonstration of inter thread communication for producer consumer problem
- Demonstration dead lock when writing inter thread communication programs

UNIT V INTRODUCTION TO CSS AND CLIENT SIDE PROGRAMMING– JAVASCRIPT 9

CSS3 – the need for CSS, the syntax and structure of style rule, type of style sheets: Inline, embedded and external style sheets – Types of selectors used in CSS: Tag selector, ID selector, and class selector-CSS Rule cascading and Inheritance - JavaScript Data types and Variables - Functions - Objects – Built-in Objects: String, Number, Boolean, Array, Date and Math - Document Object Model – Event Handling - Controlling Windows and Documents - Form validations.

SUGGESTED ACTIVITIES

- Learn to format your web pages by applying CSS
- Learn to use client side validation for web form designed for your web site

SUGGESTED EVALUATION METHODS

- Demonstration of using client side validation for web form designed for your web site
- Demonstration look and feel of your web pages after applying CSS

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Able to understand and design the solution to a problem using object-oriented concepts in C++.
2. Develop Java programs using OOP principles such as abstraction, polymorphism, inheritance, etc.,
3. Design GUI Java applications using AWT concept.
4. Apply generic concept when solving real time problems using Java
5. Understand concurrent and parallel programs using multithreaded concept in java.
6. Develop Web applications using CSS and JavaScript.

TEXT BOOKS

1. E Balagurusamy, ―Object oriented Programming with C++‖, 8 Edition, 2020, Tata McGraw Hill.
2. Herbert Schildt, ―Java The complete reference‖, 9th Edition, McGraw Hill Education, 2014.
3. David Flanagan, ―JavaScript: The Definitive Guide, Seventh Edition‖, O'Reilly Media, 2020.
4. Andreas Maurer, HTML5 & CSS3: A Step-by-Step guide for beginners to build and design responsive and engaging websites with html5 and css3, Kindle Edition,2020.

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1. Bhushan Trivedi, ―Programming with ANSI C++‖, Oxford Press, Second Edition, 2012.
2. Cay S. Horstmann, Gary cornell, ―Core Java Volume –I Fundamentals‖, 9th Edition, Prentice Hall, 2016.
3. S.B Lippman, Josee, JoseeLajoie, Barbara, ― C++ Premier‖ 5 Edition, Pearson , 2013
4. Steven Holzner, ―Java 2 Black book‖, Dreamtech press, 2011.
5. Thomas A Powell, Fritz Schneider, ―JavaScript: The Complete Reference‖, Third Edition, Tata McGraw Hill, 2013.

21CS1401	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basic concepts and the applications of database systems.
- To know the basics of SQL and construct queries using SQL.
- To learn the relational database design principles.
- To understand the basic issues of transaction processing and concurrency control.
- To Familiar with database storage structures and access techniques

UNIT I DATABASE FUNDAMENTALS 9

Introduction: Database System Applications, Purpose of Database Systems, View of Data, components and structure, Database Users and Administrator, History of Database Systems. Data models: ER model, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Enhanced E-R Model.

SUGGESTED ACTIVITIES

- Developing ER diagrams for banking application
- Translating requirements into models
- Comparing various data models and views

SUGGESTED EVALUATION METHODS

- Quizzes on History of Database
- Assignments on architecture of Database
- Assignments on ER model

UNIT II RELATIONAL DATABASE 9

Relational Data Model - Concept of relations, schema-instance distinction, keys, referential integrity and foreign keys, relational algebra operators, SQL - Introduction, data definition in SQL,table, key and foreign key definitions, update behaviors. Querying in SQL, notion of aggregation, aggregation functions group by and having clauses, embedded SQL.

SUGGESTED ACTIVITIES

- Simple SQL queries
- Writing PL-SQL programs

SUGGESTED EVALUATION METHODS

- Quizzes on SQL commands
- Assignments on SQL functions
- Quizzes on control flow and functions.

UNIT III DATABASE DESIGN 9

Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies, Properties of Decompositions. Normalization: First, Second, Third Normal Forms, Dependency Preservation, Boyce-Codd Normal Form – Multivalued Dependencies –Fourth Normal Form – Join Dependencies – Fifth Normal Form.

SUGGESTED ACTIVITIES

- Writing Armstrong‘s Axioms

- Developing Normal Forms for a requirement
- Applying Decomposition and Functional Dependency

SUGGESTED EVALUATION METHODS

- Quizzes on Normalization theory.
- Assignments on Normal Forms
- Case study

UNIT IV TRANSACTION MANAGEMENT 9

Transactions, Transaction Concept, ACID properties, A Simple Transaction Model, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Concurrency Control: Lock–Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes. Recovery System-Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm.

SUGGESTED ACTIVITIES

- Writing Transaction rules for a database
- Comparing the efficiency of protocols
- Understanding the importance of Recovery

SUGGESTED EVALUATION METHODS

- Quizzes on Transaction Management
- Assignments on Protocols
- Quizzes on Recovery

UNIT – V IMPLEMENTATION TECHNIQUES AND NON-RELATIONAL MODEL 9

Data on External Storage – RAID- File Organizations – Indexing and Hashing -Trees – B+ tree and B- Tree index files. Hashing: Static – Dynamic. Query Processing and Query Optimization - Introduction to NoSQL & MongoDB: Advantages, Architecture, Data Models MongoDB Data types and CRUD Operations.

SUGGESTED ACTIVITIES

- Applying RAID models
- Writing queries for index
- Comparing efficiency of Tree methods
- Writing No-Sql Queries

SUGGESTED EVALUATION METHODS

- Quizzes on Tree concepts.
- Assignments on Indexing
- Quizzes on Query Optimization.

TOTAL:45 HOURS

OUTCOMES

At the end of the course, the student will be able to

1. Remember the Structure of a Database
2. Understand an Entity Relational Model for a database.

3. Apply Relational and Non-Relational database concepts to design a database.
4. Analyze the importance of normalization and functional dependencies in database design
5. Evaluate the working principles of indexing and hashing.
6. Create a database design using both Relational and Non- Relational models

TEXT BOOKS

1. Data base System Concepts, A. Silberschatz, Henry. F. Korth, S. Sudarshan, McGraw Hill India Private Limited, 7th edition.

2. MongoDB Complete Guide by Manu Sharma, BPB Publications, ISBN: 9789389898866, July 2021

3. REFERENCE BOOK

1. Data base Management Systems, Raghu Ramakrishnan, Johannes Gehrke, McGraw Hill Education (India) Private Limited, 3rd Edition

NPTEL COURSES:

https://onlinecourses.nptel.ac.in/noc18_cs15/preview

http://nptel.ac.in/courses/106106093/

http://nptel.ac.in/courses/106106095/

NPTEL VIDEO COURSE:

https://www.youtube.com/watch?v=EUzsy3W4I0g

https://www.youtube.com/playlist?list=PL52484DF04A264E59

ONLINE COURSES / RESOURCES:

https://beginnersbook.com/2017/09/introduction-to-nosql/

https://www.w3schools.com/sql/

https://www.toptal.com/database/the-definitive-guide-to-nosql-databases

https://www.w3schools.in/mongodb/

https://www.coursera.org/lecture/introduction-to-nosql-databases/overview-of-nosql-IiIaX

21AD1311	ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To design and implement different techniques to develop simple autonomous agents that make effective decisions in fully informed, and partially observable, settings.
- To apply appropriate algorithms for solving given AI problems.
- To Design and implement logical reasoning agents.
- To Design and implement agents that can reason under uncertainty.
- To understand the Implementation of the reasoning systems using backward or forward inference mechanisms.

LIST OF EXPERIMENTS

1. Implementation of Depth-First Search (DFS)
2. Write a program to implement towers of Hanoi
3. Write a program to implement water jug problem.
4. Write a program to implement Best first search.
5. Write a program to implement n-Queen problem.
6. Write a program to implement heuristic search procedure.
7. Write a program to implement depth limited search.
8. WAP to implement search problem of 3 x 3 puzzles.
9. Program to implement A* / AO* algorithm
10. Write a program to implement Bidirectional Search
11. Write a program to implement Hangman game using python.
12. Write a program to implement tic tac toe game for 0 and X.
13. Implementation of rule based expert system for memory loss disease.
14. Implementation of expert system for diagnosis of influenza.

TOTAL: 60 PERIODS

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Implement simple PEAS descriptions for given AI tasks
2. Develop programs to implement simulated annealing and genetic algorithms
3. Demonstrate the ability to solve problems using searching and backtracking
4. Ability to implement simple reasoning systems using either backward or forward inference mechanisms
5. Will be able to choose and implement a suitable technics for a given AI task

SOFTWARE

Open Source Software using Python

REFERENCES

1. Greg Michaelson, ― A Practical Course in Functional Programming Using Standard ML‖, UCL Press
2. Richard Bosworth, –A Practical Course in Functional Programming Using Standard ML‖,McGraw-Hill
3. Rachel Harrison, –Abstract Data Types in Standard ML‖, John Wiley & Sons.

21AD1312	OBJECT ORIENTED PROGRAMMING PARADIGM LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To Understand client side form validations using JavaScript
- To develop skills in object oriented programming in C++, Java
- To learn generic data structures using templates, abstract class and virtual functions in C++
- To build software development skills using java programming for real-world applications
- To develop applications using concepts of classes, packages, interfaces and event handling

LIST OF EXERCISES

1. Implementation of ADT such as Stack and Queues using C++ classes
2. Write a C++ Program to illustrate Function Overloading
3. Write a C++ Program to illustrate the use of Constructors and Destructors and Constructor Overloading
4. Write a Program to illustrate Static member and methods
5. Write a Program to overload as binary operator, friend and member function
6. Implementation of ADT such as List using Java classes
7. Write a Java program to illustrate static method and fields
8. Write a Java program to illustrate final class and final methods
9. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa) , time converter (hours to minutes, seconds and vice versa) using packages.
10. Write a Program to overload unary operator in Postfix and Prefix form as member and friend function
11. Write C++ Programs and incorporating various forms of Inheritance
12. Write a C++ Program to illustrate Virtual functions
13. Write a C++ Program to illustrate function templates
14. Write a C++ Program to illustrate template class
15. Develop a java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary
16. Write a Java Program to demonstrate the feature of multiple inheritance using the feature of interface with following requirements:

- Create an interface called *"Shape"*, which should contain following members:
  - ➢ Include single static final member field called *"PI"* with initial value as 3.1415
  - ➢ Include two abstract methods with following signatures. This method should be overridden in all its derived classes:
    - *public double area()*
    - *public double perimeter()*
- Create derived class called *Rectangle* that should inherit *"Shape"*, which should contain following members:
  - ➢ Member fields:
    - *l* of double type – represent length of rectangle
    - *b* of Date type – represent breadth of rectangle
  - ➢ Include constructor to initialize members of Rectangle
  - ➢ Include the following overridden methods to compute area and circumference of rectangle :
    - *public double area()*
    - *public double perimeter()*
- Create derived class called *Circle* that should inherit *"Shape"*, which should contain following members:
  - ➢ Member field:
    - *radius* of double type – represent radius of rectangle
  - ➢ Include constructor to initialize members of Rectangle
  - ➢ Include the following overridden methods to compute area and circumference of circle :
    - *public double area()*
    - *public double perimeter()*
- Create objects of Rectangle and Circle and test your program

17. Write a Java Program to demonstrate the feature of abstract class in java with following requirements:

- Create abstract class named –Person‖, which should contain following members:
  - ➢ Include single member field called *"name"* to store name of the person
  - ➢ Include abstract method called *getDescription()* that should return string describing about the person. This method should be overridden in all its derived classes
  - ➢ Include non-abstract method called *getName()* that should return name of the person as string
- Create derived class called *Employee* that should inherit *"Person"*, which should contain following members:

- Member fields:
  - *salary* of double type
  - *hireDay* of Date type
- Include constructor to initialize members of Employee and also include the methods with following signatures:
  - *public double getSalary()* – should return salary of the employee
  - *public Date getHireDay()* - should return hireDay of the employee
- Include the following overridden method
  - *public String getDescription()* – should return string describing employee
- Create derived class called *Student* that should inherit *"Person"*, which should contain following members:
  - Member fields:
    - *major* of string type
  - Include constructor to initialize members of Students
  - Include the following overridden method
    - *public String getDescription()* – should return string describing Student
- Create objects of Employee and Student and test your program

18. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff.

- If the type of the EB connection is domestic, calculate the amount to be paid as follows:
  - First 100 units - Rs. 1 per unit
  - 101-200 units - Rs. 2.50 per unit
  - 201 -500 units - Rs. 4 per unit
  - >501 units - Rs. 6 per unit
- If the type of the EB connection is commercial, calculate the amount to be paid as follows:
  - First 100 units - Rs. 2 per unit
  - 101-200 units - Rs. 4.50 per unit
  - 201 -500 units - Rs. 6 per unit
  - 501 units - Rs. 7 per unit

19. Develop a java script code to validate HTML.

20. Develop a JavaScript application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa) , time converter (hours to minutes, seconds and vice versa).
21. Develop a JavaScript application to conduct online quiz. At the end of the quiz, the application should display information such as number of correct answer, number of wrong answer, score etc.,

TOTAL:60 PERIODS

OUTCOMES

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

1. Develop programs in object oriented paradigm
2. Implement and Suggest appropriate data structure for any given data set using C++
3. Demonstrate C++ program using class template and generalization
4. Develop and implement Java programs for simple applications that make use of classes, packages and interfaces
5. Implement Java programs using AWT controls and event handling
6. Create Web applications using JavaScript

REFERENCES

1. Bhushan Trivedi, ―Programming with ANSI C++‖, Oxford Press, Second Edition, 2012.
2. Cay S. Horstmann, Gary cornell, ―Core Java Volume –I Fundamentals‖, 9th Edition, Prentice Hall, 2016.
3. S.B Lippman, Josee, JoseeLajoie, Barbara, ― C++ Premier‖ 5 Edition, Pearson , 2013.
4. Steven Holzner, ―Java 2 Black book‖, Dreamtech press, 2011.
5. Thomas A Powell, Fritz Schneider, ―JavaScript: The Complete Reference‖, Third Edition, Tata McGraw Hill, 2013.

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2. Herbert Schildt, ―Java The complete reference‖, 9th Edition, McGraw Hill Education, 2014.
3. David Flanagan, ―JavaScript: The Definitive Guide, Seventh Edition‖, O'Reilly Media, 2020.

21CS1411	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
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OBJECTIVES

- Learn to create and use a database.
- Be familiarized with a query language.
- Have hands on experience on DDL Commands.
- Have a good understanding of DML Commands and DCL Commands.
- Familiarize advanced SQL queries.
- Be exposed to different applications.

LIST OF EXPERIMENTS

Tools: Oracle SQL* Plus/No-SQL-MongoDB

1. Creation of a tables for Salesman and Customer Relation with following structure:

Salesman Relation:

salesman_id	name	city	commission

Customer Relation:

customer_id	cust_name	city	grade	salesman_id

2. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.

3. Creation of Views, Synonyms, Sequence, Indexes, Save point.

4. Set various constraints like Not Null, Primary Key, Foreign Key and Check constraints.

5. Creating relationship between the databases and retrieve records using joins for the below relations:

Salesman

salesman_id	name	city	commission
5001	James Hoog	New York	0.15
5002	Nail Knite	Paris	0.13
5005	Pit Alex	London	0.11
5006	Mc Lyon	Paris	0.14
5007	Paul Adam	Rome	0.13
5003	Lauson Hen	San Jose	0.12

Customer Relation:

customer_id	cust_name	city	grade	salesman_id
3002	Nick Rimando	New York	100	5001
3007	Brad Davis	New York	200	5001
3005	Graham Zusi	London	300	5002
3004	Fabian	Paris	300	5006
3009	Geoff Cameron	Rome	100	5007
3003	Jozy	San Jose	300	5003

Execute the different types of Joins to find the output for the below:

a) From the following tables write a SQL query to find the salesperson and customer who reside in the same city. Return Salesman, cust_name and city
b) From the following tables write a SQL query to find those orders where the order amount exists between 500 and 2000. Return ord_no, purch_amt, cust_name, city.
c) From the following tables write a SQL query to find the salesperson(s) and the customer(s) he represents. Return Customer Name, city, Salesman, commission
d) From the following tables write a SQL query to find salespeople who received commissions of more than 12 percent from the company. Return Customer Name, customer city, Salesman, commission
e) Write a SQL statement to join the tables salesman, customer and orders so that the samecolumn of each table appears once and only the relational rows are returned

6. Write a PL/SQL block to satisfy some conditions by accepting input from the user.
7. Write a PL/SQL block that handles all types of exceptions.
8. Creation of Procedures.
9. Creation of database triggers and functions
10. Database Connectivity with Front End Tools (Java/Python)
11. Mini project

a. Inventory Control System.
b. Material Requirement Processing.
c. Hospital Management System.
d. Railway Reservation System.
e. Personal Information System.
g. Timetable Management System.
h. Hotel Management System

TOTAL: 60 PERIODS

OUTCOMES

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

1. Understand the Syntax of SQL commands
2. Remember queries to retrieve records
3. Apply referential integrity constraints
4. Analyze the database design using constraints
5. Evaluate PL/SQL programs to implement triggers, functions, procedures and exceptions
6. Create front end tools to manipulate information from backend

SEMESTER IV

21MA1406	PROBABILITY AND STATISTICAL MODELINGFOR DATA SCIENCE	L	T	P	C
		3	1	0	4

OBJECTIVES

- To introduce probability concepts and some standard distributions
- To introduce multi-dimensional random variables
- To find difference between treatments in the output using ANOVA
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- To mention some of the models used in Time series for forecasting.

Unit I Random variables 12

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

SUGGESTED EVALUATION METHODS:

- TUTORIAL AND CLASS TEST

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. (Without Proof)

SUGGESTED EVALUATION METHODS:

- TUTORIAL AND ASSIGNMENT

Unit III Design of experiments 12

One way and Two way classifications - Completely randomized design – Randomized block design –Latin square design - 2 2 factorial design.

SUGGESTED EVALUATION METHODS:

- TUTORIAL AND CLASS TEST

Unit IV Statistical quality control 12

Control charts for measurements (and R charts) – Control charts for attributes (p, c and np charts) –Tolerance limits - Acceptance sampling.

SUGGESTED EVALUATION METHODS:

- TUTORIAL AND ASSIGNMENT

Unit V Time series analysis 12

Definition-Components-Secular trend – Moving averages-Seasonal indices.

SUGGESTED EVALUATION METHODS:

- TUTORIAL AND SEMINAR ON ― TIME SERIES IN BUSINESS MANAGEMENT‖

OUTCOMES

After completing this course, students should demonstrate competency in the followingtopics:

- Use probability functions to find moments
- Classify probability distributions underlying in a particular situation and find related probabilities
- To introduce two dimensional random variables and find relationship between them
- To find difference between treatments in the output using ANOVA
- Use control charts to conclude a process is under control

- Find various components of time series for a given data and predict future value

REFERENCES:

1.Trivedi, K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons, 2002.

2.T. Veerarajan - Probability, Statistics And Random Processes (3rd Edition)-Tata McGraw-Hill Education (2008)

3. Ibe, O.C., ―Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Indian Reprint, 2007

4. Devore, J. L., ―Probability and Statistics for Engineering and the Sciences‖, 8th Edition, Cengage Learning, 2014.

5. Dallas E. Johnson, ―Applied Multivariate Methods for Data Analysis‖, Thomson and Duxbury press, 1998.

6. Gupta S.C. and Kapoor V.K.,‖ Fundamentals of Mathematical Statistics‖, Sultan and Sons, New Delhi, 2001.

7. Johnson, R.A., Miller, I and Freund J., "Miller and Freund_s Probability and Statistics for Engineers ", Pearson Education, Asia, 8th Edition, 2015.

8. Richard A. Johnson and Dean W. Wichern, ―Applied Multivariate Statistical Analysis‖, 5th Edition, Pearson Education, Asia, 2002

21AD1401	MACHINE LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basics of Machine Learning (ML)
- To understand the methods of Machine Learning
- To know about the implementation aspects of machine learning
- To understand the concepts of Data Analytics and Machine Learning
- To understand and implement use cases of ML

UNIT I MACHINE LEARNING BASICS 9

Introduction to Machine Learning (ML) - Essential concepts of ML – Types of learning – Machine learning methods based on Time – Dimensionality – Linearity and Non linearity – Early trends in Machine learning – Data Understanding Representation and visualization.

SUGGESTED ACTIVITIES

- Developing a framework for real life activities such as image detection
- Developing algorithms for basic mathematical expressions using machine learning
- Installing machine learning package
- Simple program on object detection

SUGGESTED EVALUATION METHODS

- Quizzes on algorithm and basic python.
- Assignments on illustrative problems.
- Quizzes on simple python programs.

UNIT II SUPERVISED LEARNING ALGORITHMS 9

Learning a Class from Examples, Linear, Non-linear, Multi-class and Multi-label classification, Decision Trees: ID3, Classification and Regression Trees (CART), Regression: Linear Regression, Multiple Linear Regression, Logistic Regression, Bayesian Network, Bayesian Classifier.

SUGGESTED ACTIVITIES

- Developing A framework for real life activities such as decision tree
- Developing algorithms for basic mathematical expressions using regression tree
- Simple program on SVM classification
- Simple program on Linear regression

SUGGESTED EVALUATION METHODS

- Quizzes on algorithm and basic python.
- Assignments on illustrative problems.
- Quizzes on simple python programs.

UNIT III ADVANCED SUPERVISED AND ENSEMBLE LEARNING 9

Neural Networks: Introduction, Perceptron, Multilayer Perceptron, Support vector machines: Linear

and Non-Linear, Kernel Functions, K-Nearest Neighbors, Ensemble Learning Model Combination Schemes, Voting, Error-Correcting Output Codes, Bagging: Random Forest Trees, Boosting: Adaboost, Stacking

SUGGESTED ACTIVITIES

- Developing A framework for real life activities such as kernel functions
- Developing algorithms for basic mathematical expressions using KNN
- Simple program on Ensemble Learning model
- Simple program on RFT algorithm

SUGGESTED EVALUATION METHODS

- Quizzes on algorithm and basic python.
- Assignments on illustrative problems.
- Quizzes on simple python programs.

UNIT IV UNSUPERVISED LEARNING 9

Introduction to clustering, Hierarchical: AGNES, DIANA, Partitional: K-means clustering, K-Mode Clustering, Self-Organizing Map, Expectation Maximization, Gaussian Mixture Models, Principal Component Analysis (PCA), Locally Linear Embedding (LLE), Factor Analysis, Fuzzy Modeling, Genetic Modeling.

SUGGESTED ACTIVITIES

- Developing A framework for real life activities such as clustering techniques
- Developing algorithms for basic mathematical expressions K-Mode Clustering
- Simple program on SOM algorithm
- Simple program on PCA algorithm

SUGGESTED EVALUATION METHODS

- Quizzes on algorithm and basic python.
- Assignments on illustrative problems.
- Quizzes on simple python programs.

UNIT V APPLICATIONS OF MACHINE LEARNING 9

Image Recognition – Speech Recognition – Email spam and Malware Filtering – Online fraud detection – Medical Diagnosis.

SUGGESTED ACTIVITIES

- Developing A framework for real life activities such as clustering techniques
- Developing algorithms for basic mathematical expressions using classification techniques
- Case study on medical diagnosis
- Case study on credit card fraud detection

SUGGESTED EVALUATION METHODS

- Quizzes on algorithm and basic python.
- Assignments on illustrative problems.
- Quizzes on simple python programs.

TOTAL: 60 PERIODS

OUTCOMES

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

1. Recognize the characteristics of machine learning strategies.
2. Apply various supervised learning methods to appropriate problems.
3. Identify and integrate more than one technique to enhance the performance of learning.
4. Create probabilistic and unsupervised learning models for handling unknown pattern.
5. Analyze the co-occurrence of data to find interesting frequent patterns and pre-process the data before applying to any real-world problem and can evaluate its performance.

TEXT BOOKS

1. Taeho Jo –Machine Learning Foundations: Supervised, Unsupervised, and Advanced Learning,‖ First Edition. 2021. Publisher: Springer
2. Ethem Alpaydin,"Introduction to Machine Learning‖, MIT Press, Prentice Hall of India, Third Edition 2014.
3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar "Foundations of Machine Learning‖, MIT Press, 2012.
4. Dr.S.N. Sivanandam, Dr.S.N. Deepa –Principles of Soft Computing‖ Second Edition, Wiley

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1. Tom Mitchell, –Machine Learning‖, McGraw Hill, 3 rd Edition,1997.
2. Charu C. Aggarwal, –Data Classification Algorithms and Applications‖, CRC Press, 2014.
3. Stephen Marsland, –Machine Learning – An Algorithmic Perspective‖, 2 nd Edition, CRC Press, 2015.
4. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012
5. Jiawei Han and MichelineKambers and Jian Pei, –Data Mining –Concepts and Techniques‖, 3 rd Edition,Morgan Kaufman Publications, 2012.
6. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, –Mathematics for Machine Learning‖, Cambridge University Press, 2019.

21AD1402	BASICS OF DATA SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES

- Will gain knowledge in the basic concepts of Data Analysis
- To acquire skills in data preparatory and preprocessing steps
- To understand the mathematical skills in statistics
- To learn the tools and packages in Python for data science
- To gain understanding in classification and Regression Model
- To acquire knowledge in data interpretation and visualization techniques

UNIT I INTRODUCTION 9

Need for data science – benefits and uses – facets of data – data science process – setting the research goal – retrieving data – cleansing, integrating, and transforming data – exploratory data analysis – build the models – presenting and building applications.

SUGGESTED ACTIVITIES

- Developing a framework for cleansing, integrating, and transforming data
- Simple program exploratory data analysis

SUGGESTED EVALUATION METHODS

- Quizzes on data science process.
- Assignments on data analysis.

UNIT II DESCRIBING DATA ANALYSIS I 9

Frequency distributions – Outliers – relative frequency distributions – cumulative frequency distributions –frequency distributions for nominal data – interpreting distributions – graphs –averages – mode – median – mean – averages for qualitative and ranked data – describing variability – range – variance – standard deviation – degrees of freedom – interquartile range –variability for qualitative and ranked data.

SUGGESTED ACTIVITIES

- Developing a framework for basic statistics
- Simple program on interquartile range

SUGGESTED EVALUATION METHODS

- Quizzes on basic statistics.
- Assignments on Variability.

UNIT III PYTHON FOR DATA HANDLING 9

Basics of Numpy arrays – aggregations – computations on arrays – comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – hierarchical indexing – combining datasets –aggregation and grouping –pivot tables.

SUGGESTED ACTIVITIES

- Developing simple programs on structured array
- Programs on hierarchical indexing

- Simple programs on numpy

SUGGESTED EVALUATION METHODS

- Quizzes on algorithms and basic python.
- Assignments on hierarchical indexing.
- Quizzes on simple python programs.

UNIT IV DESCRIBING DATA ANALYSIS II 9

Normal distributions – z scores – normal curve problems – finding proportions – finding scores –more about z scores – correlation – scatter plots – correlation coefficient for quantitative data –computational formula for correlation coefficient – regression – regression line – least squares regression line – standard error of estimate – interpretation of r2 – Population – Analysis of variance.

SUGGESTED ACTIVITIES

- Developing simple programs on Normal distributions
- Simple programs on regression

SUGGESTED EVALUATION METHODS

- Quizzes on Normal distributions.
- Assignments on regression.

UNIT V PYTHON FOR DATA VISUALIZATION 9

Visualization with matplotlib – line plots – scatter plots – visualizing errors – density and contour plots – histograms, binnings, and density – three dimensional plotting – geographic data – data analysis using statmodels and seaborn – graph plotting using Plotly – interactive data visualization using Bokeh.

SUGGESTED ACTIVITIES

- Developing a visualization framework using matplotlib
- Developing programs for data analysis using statmodels and seaborn

SUGGESTED EVALUATION METHODS

- Quizzes on matplotlib.
- Assignments on data analysis using statmodels and seaborn.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course Students will be able to:

1. Apply the skills of data inspecting and cleansing.
2. Determine the relationship between data dependencies using statistics
3. Can handle data using primary tools used for data science in Python
4. Represent the useful information using mathematical skills
5. Can apply the knowledge for data describing and visualization using tools.

TEXT BOOKS

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, ―Introducing Data Science‖, Manning Publications, 2016. (first two chapters for Unit I)

2. Robert S. Witte and John S. Witte, ―Statistics‖, Eleventh Edition, Wiley Publications, 2017. (Chapters 1–7 for Units II and IV)

3. Jake VanderPlas, ―Python Data Science Handbook‖, O‘Reilly, 2016. (Parts of chapters 2–4 for Units III and V)

REFERENCES

1. Allen B. Downey, ―Think Stats: Exploratory Data Analysis in Python‖, Green Tea Press, 2014.

21CS1303	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the phases in a software project
- To understand fundamental concepts of requirements engineering and Analysis Modeling.
- To understand the various software design methodologies, software testing, software process Models.
- To learn various testing and maintenance measures.
- To understand the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects

UNIT–I SOFTWARE PROCESS MODELS 9

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Waterfall model – Spiral Model – V shaped model – RAD model – Iterative Model – Prototype model**.**

SUGGESTED ACTIVITIES

- Analyze which process model is suitable for a particular project
- Analyze Agile compare with traditional process models
- Estimate activity durations and resources required for a particular project

SUGGESTED EVALUATION METHODS

- Incremental model compare with Waterfall model
- Assignments on different process models
- Evaluate the software process model is suitable for software concerns in the present scenario

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.

SUGGESTED ACTIVITIES

- Gathering the requirements of the client – functional and non -functional requirements
- Prepare the Software Requirements Specification (SRS) of a particular project(e.g Railway
- reservation system, Airlines etc)
- Identify customer‘s needs of a particular project
- Evaluate the system for feasibility(both technically and financially feasible)

SUGGESTED EVALUATION METHODS

- Establish schedule and constraints for a particular project
- Create system definitions
- Perform economic and technical analysis

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.

SUGGESTED ACTIVITIES

- Implementing architectural design of a particular software project
- Implementing Interface design of a particular software project
- Implementing Component design of a particular software project
- Implementing Database design of a particular software project

SUGGESTED EVALUATION METHODS

- Evaluate Questionnaire method for software design
- Assignments on Heuristic evaluation methods applied in design of the software.
- Tabulate the tools used in software design

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 – Software Configuration Management.

SUGGESTEDACTIVITIES

- Develop test cases for any software project
- Enumerate the tools available for software testing
- Enumerate the principles of software testing
- List out the principles of BPR

SUGGESTEDEVALUATIONMETHODS

- Assignments on test suite.
- Assignments on Black box testing for any software product.
- Assignments on Testing artifacts of a software project

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 Introduction to Agility: Extreme programming, Scrum, DevOps.

SUGGESTEDACTIVITIES

- How to estimate the size of the software product using LOC or other traditional methods
- Enumerate Earned Value Analysis for a particular project
- Draft the time frame of a particular project using Gantt chart
- Compare traditional process models with agile methods

SUGGESTEDEVALUATIONMETHODS

- How to fix the size of the software and evaluate the cost of the software project
- Determine the cost of the software project using COCOMO I & II Model
- How to predict the risk of a particular project
- Evaluate how the agile software process model is suitable for software concerns in present scenario

TOTAL: 45 PERIODS

OUTCOME

At the end of the course, the student will be able to

1. Identify the key activities in managing a software project.
2. Compare different process models.
3. Concepts of requirements engineering and Analysis Modeling.
4. Apply systematic procedure for software design and deployment.
5. Compare and contrast the various testing and maintenance.
6. Manage project schedule, estimate project cost and effort required.

TEXTBOOKS

1. Roger S. Pressman, Bruce R.Maxim—Software Engineering – A Practitioner's Approach, Eight Edition, McGraw-Hill International Edition, 2015.
2. IanSommerville, —Software Engineering, 9th Edition, Pearson Education Asia, 2011.
3. Gene Kim, Jez Humble, Patrick Debois, and John Willis, The DevOps Handbook- How to Create World-Class Agility, Reliability, & Security in Technology Organizations, IT Revolution Press,2nd Edition,2016

REFERENCES

1. Rajib Mall, —Fundamentals of Software Engineering, Third Edition, PHI Learning PrivateLimited,2009.
2. PankajJalote, —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.
5. http://nptel.ac.in

WEB REFERENCES

1. https://ethics.acm.org/code-of-ethics/software-engineering-code/
2. https://freecomputerbooks.com/specialSoftwareBooks.html
3. https://unimelb.libguides.com/comsci_softeng_infotech

ONLINECOURSES/ RESOURCES

1. https://www.geeksforgeeks.org/software-engineering-introduction-to-software-engineering/
2. https://www.w3schools.in/category/software-testing/
3. https://www.tutorialspoint.com/software_engineering/index.htm
4. https://www.javatpoint.com/software-engineering-tutorial
5. https://nptel.ac.in/courses/

21AD1403	SYSTEM SOFTWARE AND OPERATING SYSTEMS	L	T	P	C
		3	0	4	4

OBJECTIVES

- To make students understand the design concepts of various system software like Assembler, Linker, Loader and Macro pre-processor.
- To understand the basic concepts and functions of operating systems.
- To analyze Scheduling algorithms.

UNIT- I INTRODUCTION SYSTEM SOFTWARE AND ASSEMBLERS DESIGN OPTION 9

System Software Vs. Application Software, Different System Software– Assembler, Linker, Loader, Macro Processor, Text Editor, Debugger, Device Driver, Compiler, Interpreter, Operating System(Basic Concepts only) SIC & SIC/XE Architecture, Addressing modes, SIC & SIC/XE Instruction set, Assembler Directives and Programming.-Basic Functions of Assembler. Assembler output format – Header, Text and End Records- Assembler data structures, Two pass assembler algorithm, Hand assembly of SIC/XE program, Machine dependent assembler features. Machine Independent assembler features – program blocks, Control sections, Assembler design options Algorithm for Single Pass assembler.

SUGGESTED ACTIVITIES

- To Illustrate different types of addressing Mode.
- To Analyse the Different types of Instruction set
- To Study about CISC and RISC architecture.
- Simple Python/C program implementation using one pass assembler

SUGGESTED EVALUATION METHODS

- Quizzes on basic concept of system software and assembler activities.
- Assignments on illustrative problems for addressing mode.
- Quizzes on simple instruction set..

UNIT-II DESIGN LOADER, LINKER AND MACROS 9

Basic Loader functions - Design of absolute loader, Simple bootstrap Loader, Machine dependent loader features- Relocation, Program Linking, Algorithm and data structures of two pass Linking Loader, Machine dependent loader features, Loader Design Options.-Macro Instruction Definition and Expansion. One pass Macro processor Algorithm and data structures, Machine Independent Macro Processor Features, Macro processor design options.

SUGGESTED ACTIVITIES

- Simple Python/C program implementation Absolute Loader
- To Implement of pass 1 algorithm for Linking Loader
- To Implement of pass 2 algorithm for Linking Loader
- To Design Macro processor

SUGGESTED EVALUATION METHODS

- Quizzes on basic functionality of Loader and Linker.
- Assignments on illustrative problems for Linking.
- Quizzes on control flow and functions for dynamic loader and Macro processor .

UNIT- III INTRODUCTION OF OPERATING SYSTEM AND PROCESS MANAGEMENT 9

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- Processes — Process Concept, Process Scheduling, Operations on Processes, Inter-process

Communication; CPU Scheduling — Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling. Deadlock – System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

SUGGESTED ACTIVITIES

- Simple Python/C/Linux program basic function of Operating System
- To Implement of process creation
- To Implement CPU Scheduling
- Design Real Time Scheduling

SUGGESTED EVALUATION METHODS

- Quizzes on basic comments of Operating System.
- Assignments on illustrative CPU Scheduling
- Quizzes on control flow and functions for Real time scheduling.

UNIT- IV 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.

SUGGESTED ACTIVITIES

- Simple Python/C/Linux program basic function of Storage Management System
- To Implement of Contiguous Memory Allocation
- To Implement Paging
- Design Virtual Memory

SUGGESTED EVALUATION METHODS

- Quizzes basic memory management.
- Assignments on illustrative Page replacement algorithm
- Quizzes on control flow and functions for virtual memory .

UNIT- V FILE 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.

SUGGESTED ACTIVITIES:

- Simple Python/C/Linux program basic function of File System

- To Implement of Disk Scheduling
- To Implement File Sharing
- Design Directory Implement
-

SUGGESTED EVALUATION METHODS:

- Quizzes basic File Management.
- Assignments on illustrative Disk Scheduling
- Quizzes on control flow and functions for File System.

OUTCOMES

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

1. Distinguish different software into different categories
2. Design, analyze and implement one pass, two pass or multi pass assembler.
3. Develop and implement loader, linker and Macro processor.
4. Analyze various scheduling algorithms.
5. Compare and contrast various memory management schemes

LIST OF EXPERIMENTS

1. Implement a symbol table with functions to create, insert, modify, search, and display.
2. Implement a single pass assembler.
3. Implement a two pass macro processor
4. Implement an absolute loader.
5. Implement a relocating loader.
6. Implement a CPU scheduling
7. Implement a Page Replacement Algorithm
8. Implementation of Deadlock Detection Algorithm
9. Implementation of the following Memory Allocation Methods for fixed partition
10. Implementation of the various File Organization Techniques

THEORY :45 PERIODS
PRACTICALS: 30 PERIODS
TOTAL :75 PERIODS

TEXT BOOKS

1. Leland L. Beck, System Software: An Introduction to Systems Programming, 3/E, Pearson Education Asia. (UNIT I,II)

2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, ―Operating System Concepts‖, 9th Edition, John Wiley and Sons Inc., 2012. (UNIT III, UNIT-IV AND UNIT -V)

REFERENCES

1.D.M. Dhamdhere, Systems Programming and Operating Systems, Second Revised Edition, Tata McGraw Hill.

2. John J. Donovan, Systems Programming, Tata McGraw Hill Edition 1991.

3. Writing UNIX device drivers - George Pajari – Addison Wesley Publications (Ebook : http://tocs.ulb.tudarmstadt.de/197262074.pdf).

4. Peter Abel, IBM PC Assembly Language and Programming, Third Edition, Prentice Hall of India.

5. Jonathan Corbet, Alessandro Rubini, Greg Kroah-Hartman, Linux Device Drivers, Third Edition, O.Reilly Books

6. M. Beck, H. Bohme, M. Dziadzka, et al., Linux Kernel Internals, Second Edition, Addison Wesley Publications,

7. J Nithyashri, System Software, Second Edition, Tata McGraw Hill.
8. http://gcc.gnu.org/onlinedocs/gcc-2.95.3/cpp_1.html - The C Preprocessor
9. Ramaz Elmasri, A. Gil Carrick, David Levine, ―Operating Systems – A Spiral Approach‖, Tata McGraw Hill Edition, 2010
10. Achyut S.Godbole, Atul Kahate, ―Operating Systems‖, McGraw Hill Education, 2016
11. Andrew S. Tanenbaum, ―Modern Operating Systems‖, Second Edition, Pearson Education, 2004

21AD1411	MACHINE LEARNING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To get practical knowledge on implementing machine learning algorithms in real time problem forgetting solutions
- To implement supervised learning and their applications
- To understand unsupervised learning like clustering and EM algorithms
- To understand the theoretical and practical aspects of probabilistic graphical

models.LIST OF EXPERIMENTS

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Selectappropriate data set for your experiment and draw graphs

TOTAL: 60 PERIODS

COURSE OUTCOMES

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

1. Implement simple PEAS descriptions for given AI tasks
2. Develop programs to implement simulated annealing and genetic algorithms
3. Demonstrate the ability to solve problems using searching and backtracking
4. Ability to implement simple reasoning systems using either backward or forward inferencemechanisms
5. Will be able to choose and implement a suitable technic for a given AI taskSOFTWARE

Jupiter Notebook (Python)

21AD1412	DATA SCIENCE LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- Understand the Python Programming packages Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh Language.
- To prepare data for data analysis through understanding its distribution.
- Exposure on data processing using NUMPY and PANDAS
- To acquire knowledge in plotting using visualization tools.
- To understand and implement classification and Regression Model.

Tools: Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly,bokeh

LIST OF EXPERIMENTS

1. Create an empty and a full NumPy array.
2. Program to remove rows in Numpy array that contains non-numeric Values.
3. Program to build an array of all combinations of two NumPy arrays.
4. Program to add a border around a NumPy array.
5. Program to compare two NumPy arrays.
6. Write a Pandas program to create and display a DataFrame from a specified dictionary data which has the index labels.
7. Write a Pandas program to get the first 3 rows of a given DataFrame.
8. Write a Python program to draw a line with suitable label in the x axis, y axis and a title.
9. Write a Python program to draw line charts of the financial data of Alphabet Inc. between October 3, 2016 to October 7, 2016.
10. The table below gives the values of runs scored by Virat Kohli in last 25 T-20 matches. Represent the data in the form of less than type cumulative frequency distribution:

45	34	50	75	22
56	63	70	49	33
08	14	39	86	52
92	88	70	56	50
57	45	42	12	39

11. Program to find the sum and average of n integer numbers.
12. Program to find the variance and standard deviation of set of elements.
13. Program to plot a normal distribution in python.
14. Program to plot a Correlation and scatter plots.
15. Program for Linear Regression and Logistic Regression.
16. Mini project on real time applications

TOTAL:60 PERIODS

OUTCOMES

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

- Develop relevant programming abilities.
- Demonstrate knowledge of statistical data analysis techniques
- Exhibit proficiency to build and assess data-based models.
- Demonstrate skill in Data management & processing tasks using Python
- Apply data science concepts and methods to solve problems in real-world contexts and
- Will communicate these solutions effectively

REFERENCES

1. Jake VanderPlas, ―Python Data Science Handbook‖, O‘Reilly, 2016.
2. Allen B. Downey, ―Think Stats: Exploratory Data Analysis in Python‖, Green Tea Press,2014.
3. Data Science From Scratch: First Principles with Python, Second Edition by Joel Grus,2019.

SEMESTER V

21AD1501	FORMAL LANGUAGE AND AUTOMATA THEORY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand finite automata for a given language.
- To understand regular expression and languages.
- To design a context free grammar for any given language
- To understand Push Down Automata
- To understand Turing Machine.
- To understand Class P, NP and NP hard Problems

UNIT I FINITE AUTOMATA 9

Alphabets, Strings and Languages - Finite Automata and Grammars - Deterministic Finite Automata (DFA) - Formal Definition - Simplified Notation: State Transition Graph - Transition Table - Language of DFA - Nondeterministic Finite Automata (NFA) - NFA with Epsilon Transition - Language of NFA- Equivalence of NFA and DFA - Moore and Mealy Machine - Equivalence of Moore and Mealy Machine - Applications and Limitation of FA.

SUGGESTED ACTIVITIES:

- To solve more problems on Finite Automata.
- Tutorial Session on NFA.
- Tutorial Session on Equivalence of NFA and DFA.

SUGGESTED EVALUATION METHODS:

- Quizzes on Alphabets, strings and Languages
- Assignments on Moore and Mealy Machines.
- Quizzes on DFA

UNIT II REGULAR EXPRESSION AND LANGUAGES 9

Introduction to Regular Expression (RE) Definition - Operators of Regular Expression and their Precedence - Kleen's Theorem - Regular Expression to FA - DFA to Regular Expression - Pumping Lemma for Regular Languages - Application of Pumping Lemma - Closure Properties of Regular Languages – Minimization of Finite Automata - Myhill-Nerode Theorem.

SUGGESTED ACTIVITIES:

- Tutorial session for DFA to Regular Expression.
- Tutorial session for Pumping Lemma for Regular Languages.

SUGGESTED EVALUATION METHODS:

- Quizzes on closure property of Regular Languages.
- Assignments on Minimization of Finite Automata.

UNIT III CONTEXT FREE GRAMMAR AND LANGUAGES 9

Context Free Grammar (CFG) – Derivation and its types – Derivation Trees – Ambiguity in Grammars and Languages – Unambiguous – CFG - Useless symbols - Simplification of CFGs - Normal Forms for CFGs: CNF and GNF - Closure Properties of CFLs - Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs- Chomsky Hierarchy Language.

SUGGESTED ACTIVITIES:

- Chart display of closure properties of CFLs.
- Doubt Clearing Sessions on Derivation and its types.
- Group activity on closure properties of CFLs.

SUGGESTED EVALUATION METHODS:

- Quizzes on Context Free Grammar.
- Assignments on Normal Forms of CFGs.
- Assignments on Pumping Lemma for CFLs.

UNIT IV PUSH DOWN AUTOMATA 9

Introduction of Push Down Automata (PDA) - Instantaneous Description - Language of PDA - Acceptance by Final state - Acceptance by empty stack - Deterministic PDA - Non Deterministic PDA - Equivalence of PDA and CFG - CFG to PDA and PDA to CFG - Two Stack PDA.

SUGGESTED ACTIVITIES:

- Chart display of Languages of PDA
- Tutorial session on Deterministic PDA.

SUGGESTED EVALUATION METHODS:

- Quizzes on Two stack PDA.
- Assignments on CFG to PDA.
- Assignments on PDA to CFG.

UNIT V TURING MACHINE 9

Introduction of Turing Machine (TM) - Basic Model, Definition and Representation, Instantaneous Description - Language acceptance by TM - Variants of Turing Machine - TM as Computer of Integer Functions - Universal TM - Church‘s Thesis - Rice Theorem - Recursive and Recursively enumerable languages - Halting problem - Introduction to Undecidability - Undecidable problems about TMs- Post Correspondence Problem (PCP) - Modified PCP - Class P, NP and NP hard Problems.

SUGGESTED ACTIVITIES:

- Tutorial session on Rice Theorem.
- Tutorial session on Variants of Turing Machine

SUGGESTED EVALUATION METHODS:

- Quizzes on Turing Machine.
- Assignments on Class P, NP and NP hard Problems.

TOTAL: 45 PERIODS

OUTCOMES

1. Construct automata for any pattern.
2. Construct regular expression for any pattern.
3. Write Context free grammar for any construct.
4. Design Push down Automata
5. Design a Turing machine
6. Derive whether a problem is decidable or not

TEXT BOOKS

1. J.E. Hopcroft, R. Motwani and J.D. Ullman ― Introduction to Automata Theory, Languages and Computations‖, Second Edition, Pearson Education, 2007.
2. J.Martin, –Introduction to Languages and the Theory of Computation‖, Third Edition, TMH, 2003

REFERENCES

1. K.L.P.Mishra and N.Chandrasekaran, –Theory of Computer Science: Automata Languages and Computation‖, 3rd Edition, Prentice Hall of India, 2006.
2. Harry R Lewis and Christos H Papadimitriou , "Elements of the Theory of Computation", 2nd Edition, Prentice Hall of India, 2015

WEB REFERENCES

1. https://www.iitg.ac.in/dgoswami/Flat-Notes.pdf
2. https://www.geeksforgeeks.org/theory-of-computation-automata-tutorials/

ONLINE COURSES / RESOURCES

1. https://archive.nptel.ac.in/courses/111/103/111103016/
2. https://nptel.ac.in/courses/106104148

21AD1502	DATA COMMUNICATION AND NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the protocol layering and physical level communication.
- To analyze the performance of a network.
- To understand the various components required to build different networks and the functionality of various routing protocols.
- To familiarize the functions and protocols of the Transport layer and Application layer.
- To understand the fundamentals of Cryptography and various key distribution and management schemes and to identify security issues in network.

UNIT I FUNDAMENTALS OF COMPUTER NETWORKS AND COMMUNICATION 9

Process of Data communication and its components - Protocols and Standards - Bandwidth, Data Transmission rate, Baud rate, Bits per second Modes of Communications Networks — Network Types — Protocol Layering — TCP/IP Protocol suite — OSI Model — Physical Layer: Performance — Transmission media — Switching — Circuit-switched Networks — Packet Switching.

SUGGESTED ACTIVITIES:

- Classify network connection devices with their specifications.
- Role play for OSI reference model.
- Virtual tour on network types.
- Implementing LAN in a simple way.

SUGGESTED EVALUATION METHODS:

- Assignments on TCP/IP Protocol suite.
- Quizzes on types of networks.
- Debate on layered architecture.

UNIT II DATA-LINK LAYER 9

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

SUGGESTED ACTIVITIES:

- Prepare specification table for addressing.
- Prepare a chart on Data Link Layer Protocols.
- Preparation of 3D animation video on Bluetooth.
- Virtual tour on connecting devices.

SUGGESTED EVALUATION METHODS:

- Debate on DLC services.
- Assignments on HDLC.
- Quiz on IEEE 802.11.

UNIT III NETWORK LAYER 9

Network Layer Services — IPV4 Addresses — Forwarding of IP Packets — Network Layer Protocols: IP, ICMP v4 — Unicast Routing Algorithms — Protocols — Multicasting Basics — IPV6 Addressing — IPV6 Protocol.

SUGGESTED ACTIVITIES:

- Classify network layer services.
- Compare IPv4 and IPv6.
- Compare and contrast network layer protocols.
- Virtual tour on Multicasting.

SUGGESTED EVALUATION METHODS:

- Assignments on Forwarding IP Packets.

- Quiz on addressing.
- Debate on network layer services.

UNIT IV TRANSPORT LAYER AND APPLICATION LAYER 9

Transport layer: Introduction — Transport Layer Protocols — Services — Port Numbers — User Datagram Protocol — Transmission Control Protocol. Application layer: WWW and HTTP — FTP — Email –Telnet –SSH — DNS — SNMP.

SUGGESTED ACTIVITIES:

- Prepare specification table for transport layer protocols.
- Prepare specification table for transport layer protocols.
- Prepare a report on port numbers.
- Animation videos preparation for Transmission Control Protocol.

SUGGESTED EVALUATION METHODS:

- Assignments on Application layer.
- Debate on UDP.
- Quiz conducted on protocols of application layer.

UNIT V PUBLIC KEY CRYPTOSYSTEM AND NETWORK SECURITY 9

Classical Cryptography-Substitution Ciphers-permutation Ciphers-Block Ciphers-DES Modes of Operation- AES-Linear Cryptanalysis, Differential Cryptanalysis- Hash Function - Introduction to Public key Cryptography- Number theory- The RSA Cryptosystem and Factoring Integer- Attacks on RSA.

SUGGESTED ACTIVITIES:

- 3D models can be made for DES.
- Role play for substitution ciphers.
- Prepare a document on HASH function.
- Animation videos preparation for AES and RSA.

SUGGESTED EVALUATION METHODS:

- Assignments on Firewalls.
- Debate on various network security issues and protocols.
- Quiz on Number Theory and cryptosystem.

TOTAL: 45 PERIODS

OUTCOMES

1. Able to understand the protocol layering and physical level communication.
2. Capable of analysing the performance of a network.
3. Able to understand the various components required to build different networks and the functionality of various routing protocols.
4. Capable of familiarizing the functions and protocols of the Transport layer and Application layer.
5. Able to understand the fundamentals of Cryptography and various key distribution and management schemes
6. Able to identify security issues in network.

TEXT BOOKS

1. Forouzan Behrouz A, ‒Data Communications and Networking‖, Tata McGraw Hill, New Delhi 2006, ISBN:9780-07-296775-3.
2. William Stalings, ‒Cryptography and Network Security‖, Prentice Hall, ISBN:10: 0-13-187316-4.

REFERENCES

1. Godbole Achyut, ‒Data Communication and Networks‖, Tata McGraw Hill, New Delhi 2006, ISBN:0070472971.

2. Comer Douglas E, ‒Internetworking with TCP/IP Principles, Protocols and Architectures‖, PHI Learning Pvt. Ltd., Delhi, ISBN: 81-203-2065-4.

WEB REFERENCES:

1. https://w3.cs.jmu.edu/bernstdh/web/common/references/networking.php
2. https://web.njit.edu/~ansari/ECE639/ReferencesS11.pdf
3. https://www.citethisforme.com/topic-ideas/technology/data%20communication%20and%20networking%20references-39792182

ONLINE COURSES / RESOURCES:

1. https://nptel.ac.in/courses/106105082
2. https://www.studytonight.com/computer-networks/
3. https://www.tutorialspoint.com/data_communication_computer_network/index.htm
4. https://in.coursera.org/lecture/fundamentals-network-communications/welcome-Pugyq
5. https://www.my-mooc.com/en/mooc/data-communications-and-network-services/

21AD1503	DATA EXPLORATION AND VISUALIZATION	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basics of Data Explorations
- To understand the basic concepts of Data visualization
- To study the linear and non-linear ways of Data visualization
- To study the integration of processing with java
- To explore the data visualization using R language
- To apply various data visualization techniques for a variety of tasks

UNIT I INTRODUCTION TO DATA EXPLORATION **9**

Introduction to Single variable: Distribution Variables - Numerical Summaries of Level and Spread - Scaling and Standardising – Inequality - Smoothing Time Series.

SUGGESTED ACTIVITIES:

- Using SPSS to produce bar charts, pie charts and histograms
- Presenting time series data

SUGGESTED EVALUATION METHODS:

- Quizzes on Level and Spread Calculation
- Assignments on Inequality and Time Series

UNIT II INTRODUCING TWO VARIABLE AND THIRD VARIABLE **9**

Relationships between Two Variables - Percentage Tables - Analysing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines – Transformations - Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data.

SUGGESTED ACTIVITIES:

- Developing the relationship between two variables
- Establishing a casual path model for three variables

SUGGESTED EVALUATION METHODS:

- Assignments on relationship between two variables
- Assignments on Transformations
- Quizzes on Two variables and Three variables Relationship.

UNIT III BASICS OF DATA VISUALIZATION **9**

The Seven Stages of Visualizing Data - Getting Started with Processing - Mapping - Time Series - Connections and Correlations - Scatterplot Maps - Trees, Hierarchies, and Recursion - Networks and Graphs – Acquiring Data – Parsing Data - Integrating Processing with Java.

SUGGESTED ACTIVITIES:

- Developing the correlations between data
- Drawing a Map with processing tool
- Visualizing the data with scatterplots

SUGGESTED EVALUATION METHODS:

- Assignments on visualization of data
- Quizzes on basic data visualization

UNIT IV DATA EXPLORATION AND DATA VISUALIZATION IN R **9**

Introduction to R and R Studio - The Basics of Data Exploration - Loading Data into R - Transforming Data - Creating Tidy Data

SUGGESTED ACTIVITIES:

- Using R tool to explore various commands for descriptive data analytics
- Exploring various variable and row filters in R for cleaning data
- Using R commands for probability distributions and probability statistics.

SUGGESTED EVALUATION METHODS:

- Assignments on descriptive data analytics to explore various commands
- Quizzes on basics of R

UNIT V TECHNIQUES AND APPLICATIONS OF DATA EXPLORATION AND VISUALIZATION IN R **9**

Basic Data Exploration Techniques - Basic Data Visualization Techniques - Visualizing Geographic Data with ggmap - R Markdown - Case Study – Wildfire Activity in the Western United States - Case Study – Single Family Residential Home and Rental Values

SUGGESTED ACTIVITIES:

- Appling various plot features in R on sample data sets
- Doing case study on wildfire activity

SUGGESTED EVALUATION METHODS:

- Assignments on visualization of geographic data with ggmap
- Quizzes on basic data visualization techniques

TOTAL: 45 PERIODS

OUTCOMES

1. Understand the basics of Data Exploration
2. Use Univariate and Multivariate Analysis for Data Exploration
3. Explain various Data Visualization methods
4. Understand the integration of processing with java
5. Apply the concept of Data Visualization on various datasets
6. Apply the data visualization techniques using R language

TEXT BOOKS

1. Catherine Marsh, Jane Elliott, Exploring Data: An Introduction to Data Analysis for Social Scientists, Wiley Publications, 2nd Edition, 2008.
2. Visualizing Data: Exploring and Explaining Data with the processing Environment, O Reily Publications, 2007.
3. Eric Pimpler, Data Visualization and Exploration with R, Geo Spatial Training service, 2017
4. Authors: Xiang Zhou, Sean, Yong Rui, Huang, Thomas S., Exploration of Visual Data, Springer Publications, 2003
5. Claus.O.Wlike, Fundamentals of Data Visualization, A primer on making informative and compelling Figures, O'Reily Publications, 2019

21AD1504	DATA ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the competitive advantages of data analytics
- To understand the big data frameworks
- To learn data analysis methods
- To learn predictive analytics using R
- To learn stream computing
- To gain knowledge on Hadoop related tools such as HBase, Cassandra, Pig and Hive for big data analytics

UNIT I INTRODUCTION TO BIG DATA 9

Big Data – Definition, Characteristic Features – Big Data Applications - Big Data vs Traditional Data - Risks of Big Data - Structure of Big Data - Challenges of Conventional Systems - Web Data – Evolution of Analytic Scalability - Evolution of Analytic Processes, Tools and methods - Analysis vs Reporting - Modern Data Analytic Tools.

SUGGESTED ACTIVITIES:

- Developing programs using data analytic tools

SUGGESTED EVALUATION METHODS:

- Assignments on Evolution of Analytic tools and methods
- Quizzes on Big data applications

UNIT II HADOOP FRAMEWORK 9

Distributed File Systems - Large-Scale FileSystem Organization – HDFS concepts - MapReduce Execution, Algorithms using MapReduce, Matrix-Vector Multiplication – Hadoop YARN.

SUGGESTED ACTIVITIES:

- Writing programs on map reduce for real time data set

SUGGESTED EVALUATION METHODS:

- Assignments on Evolution of Analytic tools and methods
- Quizzes on Big data applications

UNIT III DATA ANALYSIS 9

Statistical Methods: Regression modeling, Multivariate Analysis - Classification: SVM & Kernel Methods - Rule Mining - Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data - Predictive Analytics – Data analysis using R.

SUGGESTED ACTIVITIES:

- Developing programs on classification methods
- Writing programs for data analysis using R

SUGGESTED EVALUATION METHODS:

- Assignments on Classification and partitioning methods
- Quizzes on clustering methods

UNIT IV MINING DATA STREAMS 9

Streams: Concepts – Stream Data Model and Architecture - Sampling data in a stream - Mining Data Streams and Mining Time-series data - Real Time Analytics Platform (RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

SUGGESTED ACTIVITIES:

- Developing real time analytics platform applications
- Writing programs for case studies

SUGGESTED EVALUATION METHODS:

- Assignments on mining data streams and time series data
- Assignments on streaming data model

UNIT V BIG DATA FRAMEWORKS 9

Introduction to NoSQL – Aggregate Data Models – Hbase: Data Model and Implementations – Hbase Clients – Examples – .Cassandra: Data Model – Examples – Cassandra Clients – Hadoop Integration. Pig – Grunt – Pig Data Model – Pig Latin – developing and testing Pig Latin scripts. Hive – Data Types and File Formats – HiveQL Data Definition – HiveQL Data Manipulation – HiveQL Queries

SUGGESTED ACTIVITIES:

- Developing programs on HBase Data model
- Writing code for HiveQL Queries

SUGGESTED EVALUATION METHODS:

- Assignments on different NoSQL data models.

TOTAL:45 PERIODS

OUTCOMES

At the end of this course, the students will be able to:

- Understand how to leverage the insights from big data analytics
- Apply the concepts of Map Reduce in various data sets
- Apply classification algorithms on various data sets
- Analyse data by utilizing various statistical and data mining approaches
- Perform analytics on real-time streaming data
- Understand the various NoSql alternative database models

REFERENCES:

1. Bill Franks, ―Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics‖, Wiley and SAS Business Series, 2012.

2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.

3. Michael Berthold, David J. Hand, ―Intelligent Data Analysis‖, Springer, Second Edition, 2007.

4. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.

5. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.

6. Richard Cotton, "Learning R – A Step-by-step Function Guide to Data Analysis, , O_Reilly Media, 2013.

21AD1505	KNOWLEDGE ENGINEERING AND INTELLIGENT SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To Know fundamentals of Knowledge Engineering
- To understand Resolution in knowledge Engineering
- To know the logical implications in probabilistic Reasoning
- To know the game theory concepts.
- To understand Learning Probabilistic Models
- To explore the techniques in Reinforcement Learning.

UNIT I FIRST ORDER LOGIC 9

Knowledge based Systems –Syntax – Semantics – Interpretations – Denotation – Satisfaction and models – Pragmatics – Explicit and Implicit Beliefs - Logical Consequence – Expressing Knowledge - Basic and Complex Facts – Terminological Facts – Entailment –Abstract Individuals - Other Sorts of Facts.

SUGGESTED ACTIVITIES:

- Chart activity of Knowledge based Systems
- Group discussion about Pragmatics and Beliefs

SUGGESTED EVALUATION METHODS:

- Quizzes on satisfaction and models.
- Assignments on Facts.
- Quizzes on Expressing knowledge.

UNIT II RESOLUTION 9

The Propositional Case – Predicate Logic – Handling Variables and Quantifiers –First Order Resolution- Answer Extraction – Skolemization – Clause Form – Equality - Dealing with Computational Intractability - The First-Order Case - Herbrand Theorem - The Propositional Case - The Implications - SAT Solvers - Most General Unifiers - Other Refinements

SUGGESTED ACTIVITIES:

- Tutorial session on Predicate logic
- Group discussion on unifiers

SUGGESTED EVALUATION METHODS:

- Quizzes on Handling Variables and Quantifiers
- Assignments on SAT Solvers.
- Quizzes on Computational Intractability.

UNIT III PROBABILISTIC REASONING II 9

Acting under uncertainty – Bayesian inference – naïve Bayes models for Probabilistic reasoning – Bayesian networks - Inference in temporal models – Hidden Markov Models – Kalman filters

SUGGESTED ACTIVITIES:

- Writing programs using Hidden Markov Models.
- Group activity on large joint distribution into smaller distributions,

SUGGESTED EVALUATION METHODS:

- Quizzes on Bayesian inference.
- Assignments on Inference in temporal models.
- Quizzes on kalman filters.

UNIT IV DECISIONS UNDER UNCERTAINTY 9

Basis of utility theory – utility functions – multi-attribute utility functions – decision networks – value of information – unknown preferences Sequential decision problems – MDPs – Bandit problems – partially observable MDPs - Multiagent environments – non-cooperative game theory – cooperative game theory – making collective decisions

SUGGESTED ACTIVITIES:

- Chart activity of Multi agent environments
- Group discussion on game theory
- Simple program on inference method

SUGGESTED EVALUATION METHODS:

- Quizzes on decision networks.
- Assignments on utility functions.

UNIT V LEARNING PROBABILISTIC MODELS 9

Statistical learning theory – maximum-likelihood parameter learning – naïve bayes models – generative and descriptive models – continuous models – Bayesian parameter learning – Bayesian linear regression – learning Bayesian net structures – density estimation - EM Algorithm – unsupervised clustering – Gaussian mixture models – learning Bayes net parameters – learning HMM – learning Bayes net structures with hidden variables

SUGGESTED ACTIVITIES:

- Developing algorithms using statistical learning theory
- Simple program on classification techniques

SUGGESTED EVALUATION METHODS:

- Assignments on Gaussian mixture.
- Quizzes on Bayesian parameter learning.

TOTAL: 60 PERIODS

OUTCOMES

- Develop fundamentals of knowledge Engineering.
- To apply Resolution
- To apply logical implications in probabilistic Reasoning
- Explain the use of game theory for decision making.
- Apply Probabilistic Models for various use cases.
- Demonstrate knowledge of reasoning and knowledge representation for solving real-world problems

TEXT BOOKS

1. Ronald J. Brachman and Hector J. Levesque, ‒Knowledge Representation and Reasoning‖, 1st Edition, Morgan Kaufmann Publishers, 2004.
2. Stuart Russel and Peter Norvig, ‒Artificial Intelligence: A Modern Approach‖, Fourth Edition, Pearson Education, 2020**.**

REFERENCES

1. Dan W. Patterson, ‒Introduction to AI and ES‖, Pearson Education, 2007
2. Kevin Night, Elaine Rich, and Nair B., ‒Artificial Intelligence‖, McGraw Hill, 2008
3. Patrick H. Winston, "Artificial Intelligence", Third edition, Pearson Edition, 2006

21AD1511	KNOWLEDGE ENGINEERING AND INTELLIGENT SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To impart knowledge about Artificial Intelligence.
- To understand the main abstractions and reasoning for intelligent systems.
- To understand various AI algorithms.
- To understand HMM Models
- To understand various learning methods
- To solve real world problems using Intelligent systems

LIST OF EXPERIMENTS

1. To implement Bayesian Belief networks
2. To approximate inferences in Bayesian network
3. To implement decision problems for various real-world applications
4. To learn various Bayesian parameters
5. To implement Hidden Markov Models
6. Implement EM algorithm for HMM
7. Implement the Reinforcement learning for various reward-based applications
8. Solve Robot (traversal) problem using means End Analysis
9. Write a program to implement Chatbot.
10. Mini-Project

TOTAL: 60 PERIODS

OUTCOMES

- Solve basic AI based problems.
- Implement the concept of Bayesian Network.
- Apply AI algorithms to real-world problems.
- Implement HMM for real-world application.
- Use various Learning methods to implement intelligent systems.
- Solving real world problems using Intelligent systems.

SOFTWARE:

Java / Python with Machine Learning Packages

REFERENCES:

1. aimacode · GitHub (https://github.com/aimacode)

21AD1512	DATA ANALYTICS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To implement Map Reduce programs for processing big data
- To realize storage of big data using H base, Mongo DB
- To analyze big data using linear models
- To analyze logistic regression models
- To analyze big data using machine learning techniques such as SVM / Decision tree classification and clustering
- To visualize data using plotting framework

LIST OF EXPERIMENTS

1. Install, configure and run Hadoop and HDFS
2. Implement word count / frequency programs using MapReduce
3. Implement an MR program that processes a weather dataset
4. Implement Linear and logistic Regression
5. Implement SVM / Decision tree classification techniques
6. Implement clustering techniques
7. Visualize data using any plotting framework
8. Implement an application that stores big data.

TOTAL: 60 PERIODS

OUTCOMES

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

- Process big data using Hadoop framework
- Perform storage of big data using H base, Mongo DB
- Build and apply linear regression models
- Build and apply logistic regression models
- Perform data analysis with machine learning methods
- Perform graphical data analysis

LIST OF SOFTWARE

Hadoop
R Package

REFERENCES

1. Alan Gates and Daniel Dai, "Programming Pig – Dataflow scripting with Hadoop", O'Reilley, 2nd Edition, 2016.
2. Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, ‒An Introduction to Statistical Learning with Applications in R‖, Springer Publications, 2015(Corrected 6th Printing)
3. Hadley Wickham,‖ggplot2–Elegant Graphics for Data Analysis‖, Springer Publications,2nd Edition, 2016
4. Kristina Chodorow, "MongoDB: The Definitive Guide – Powerful and Scalable Data Storage", O' Reilley, 2nd Edition, 2013.
5. Lars George, "HBase: The Definitive Guide", O'Reilley, 2015.
6. Tom White,‖Hadoop: The Definitive Guide – Storage and Analysis at Internet Scale‖, O'Reilley, 4th Edition, 2015.

21AD1513	INNOVATION PRACTICES	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To develop their scientific and technical reading skills that they need to understand.
- To develop their writing skills.
- To obtain information from Journals and Conference papers.
- To construct research articles.
- To present their final paper as presentation
- The students are motivated to submit their paper to Journals for publication.

PROCEDURES:

1. Selecting an area of interest and Topic.
2. Stating an objective.
3. Collection of Journal Papers (atleast 10 journal papers)
4. Preparing a working outline.
5. Studying the papers and understanding the authors contributions.
6. Analyzing each paper.
7. Linking the papers and preparing a draft of the paper.
8. Preparing conclusions based on the reading of all the papers.
9. Writing the Final Paper and giving final Presentation.

TOTAL: 30 PERIODS

OUTCOMES:

After the completion of this course, students will be able to

- To gain knowledge of their technical reading skills.
- To apply their writing skills.
- Explore the information from Journals and Conference papers.
- Draft research articles.
- Make effective presentations
- Apply their paper to Journals for publication.

SEMESTER VI

21AD1601	DEEP LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To build the foundation of deep learning.
- To understand how to build the neural network.
- To understand the concepts of applying deep learning to computer vision.
- To understand analogy reasoning
- To know the applications of Deep learning techniques to NLP
- To build solutions for real world problems

UNIT I INTRODUCTION 9

Feed forward Neural networks - Gradient descent and the back propagation algorithm - Unit saturation - Adaptive Gradient Algorithm- Dropout Regularization - Data Augmentation - CNN Architectures - LeNet-5- AlexNet- VCG-16 - U-Net

SUGGESTED ACTIVITIES:

- Tutorial session on Gradient descent
- To write programs using CNN.

SUGGESTED EVALUATION METHODS:

- Quizzes on unit saturation.
- Assignments on Regularization.

UNIT II RECURRENT NEURAL NETWORKS 9

LSTM - GRU - Encoder Decoder architectures - Deep Unsupervised Learning: Autoencoders - Variational Auto-encoders - Adversarial Generative Networks - Auto-encoder and DBM - Attention and memory models - Dynamic Memory Models

SUGGESTED ACTIVITIES:

- Write programs using RNN
- Write programs using LSTM

SUGGESTED EVALUATION METHODS:

- Quizzes on Encoder Decoder architecture
- Assignments on Adversarial Generative Networks,
- Assignments on Dynamic memory models

UNIT III APPLICATIONS OF DEEP LEARNING TO COMPUTER VISION 9

Image segmentation - Object detection - Automatic image captioning - Image generation with Generative adversarial networks - Video to text with LSTM models - Attention models for computer vision tasks

SUGGESTED ACTIVITIES:

- Write programs for image captioning
- Discussions on Image segmentation

SUGGESTED EVALUATION METHODS:

- Quizzes on Video to text LSTM models
- Assignments on computer vision tasks

UNIT IV ANALOGY REASONING 9

Named Entity Recognition - Opinion Mining using Recurrent Neural Networks - Parsing and

Sentiment Analysis using Recursive Neural Networks - Sentence Classification using Convolutional Neural Networks - Dialogue Generation with LSTMs

SUGGESTED ACTIVITIES:

- Write simple programs using CNN

SUGGESTED EVALUATION METHODS:

- Quizzes on Named Entity Recognition
- Assignments on Recurrent Neural Networks

UNIT V APPLICATIONS OF DEEP LEARNING TO NLP 9

Introduction to NLP and Vector Space Model of Semantics - Word Vector Representations: Continuous Skip-Gram Model - Continuous Bag-of-Words model(CBOW) - Glove - Evaluations and Applications in word similarity

SUGGESTED ACTIVITIES:

- Chart activity for applications of NLP

SUGGESTED EVALUATION METHODS:

- Quizzes on NLP
- Assignments on Recurrent Neural Networks

TOTAL: 45 PERIODS

OUTCOMES

- Learn the fundamental principles of deep learning.
- To apply Neural networks to applications
- To apply deep learning to computer vision
- Explain analogy reasoning
- To apply the deep learning algorithms for NLP.
- Implement deep learning algorithms and solve real-world problems.

TEXT BOOKS

1. Deep Learning by Ian Goodfellow, YoshuaBengio and Aaron Courville, MIT Press. 2016.

2. Amit kumar Das, Saptarsi Goswami, Pabitra Mitra, Amlan Chakrabarti –Deep Learning'", Pearson Education, 2022.

REFERENCES

1. Li Deng, Dong Yu, Deep Learning: Methods and Applications, NOW Publishers, 2014.
2. Charu C. Aggarwal, –Neural Networks and Deep Learning: A Textbook‖', Springer International Punlishing, 2018.
3. Nikhil Buduma and Nicholas Locascio, Fundamentals of Deep Learning: DesigningNext-Generation Artificial Intelligence Algorithms, O'Reilly Media, 2017.
4. Stone, James. (2019). Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning, Sebtel Press, United States, 2019.

WEB REFERENCES:

1. http:// neuralnetworksanddeeplearning.com/index.html
2. https: //cs.stanford.edu/~quocle/tutorial1.pdf, https://cs.stanford. edu/~quocle/tutorial2.pdf, and http://www.trivedigaurav.com/ blog/quoc-les-lectures-on-deep-learning/
3. http://deeplearning.net/reading-list/
4. https://github.com/terryum/awesome-deep-learning-papers
5. https://karpathy.github.io/2015/05/21/rnn-effectiveness/

ONLINE COURSES / RESOURCES:

- https://nptel.ac.in/courses/106106184
- https://nptel.ac.in/courses/106105215

21AD1602	AUGMENTED REALITY, VIRTUAL REALITY WITH AI	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the relevance of AR/VR course to the existing technology through concepts and applications.
- To comprehend the architecture of AR and VR.
- To explore and understand the concept of 3D modeling and positioning of objects.
- To understand the need and significance of AR/VR and its collaboration with AI.
- To interpret cross platform of AR/VR with a futuristic vision along with real-time impact and issues.
- To provide a foundation to the fast growing field of AR/VR with its real-time applications.

UNIT I INTRODUCTION 9

Introduction to Virtual Reality – Definition – Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR – System Structure of Augmented Reality – Key Technology in AR – 3D Vision – Approaches to Augmented Reality – Alternative Interface Paradigms – Spatial AR – Input Devices – 3D Position Trackers – Performance Parameters – Types Of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System.

SUGGESTED ACTIVITIES:

- Experience the virtual reality effect by watching 360-degree VR videos.
- Assignment on comparison of VR with traditional multimedia applications.

SUGGESTED EVALUATION METHODS:

- Tutorials on AR/VR applications.
- Brainstorming session – VR effects.
- Quizzes on the difference between VR and Multimedia applications.

UNIT II AR/VR COMPUTING ARCHITECTURE 9

Computing Architectures of VR – Rendering Principle – Graphics and Haptics Rendering –PC Graphics Architecture – Graphics Accelerators – Graphics Benchmarks – Workstation Based Architectures – SGI Infinite Reality Architecture – Distributed VR Architectures –Multi-pipeline Synchronization – Collocated Rendering Pipelines – Distributed Virtual Environments – AR Architecture.

SUGGESTED ACTIVITIES:

- External learning – Different types of graphics architectures and workstations.
- Practical – GPU programming.

SUGGESTED EVALUATION METHODS:

- Tutorials on graphics pipeline.
- Brainstorming session – Graphics architectures.
- Quizzes on various topics of the unit.
- Demonstration of GPU programs for creating simple multimedia Applications.

UNIT III 3D MODELING 9

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants – Object Hierarchies – Viewing The 3D World – Physical Modeling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.

SUGGESTED ACTIVITIES:

- Modeling three-dimensional objects and grouping techniques.
- Practical – Creating three-dimensional models.

SUGGESTED EVALUATION METHODS:

- Tutorials on 3D modeling techniques.
- Brainstorming session – Collision detection algorithms.
- Demonstration of three-dimensional models

UNIT IV CREATING CROSS-PLATFORM AR/VR 9

AI-based tools for Augmented Reality/Virtual Reality - Creating Cross-Platform Augmented Reality and Virtual Reality- Cross-Platform Game Engines – Understanding 3D graphics – Virtual Camera- Degree of Freedom – Virtual Reality Toolkit – Best Practices.

SUGGESTED ACTIVITIES:

- External learning - Popular AR VR Tools of 2021
- Practical – Modeling AR using AR Core, AR Kit, Vuforia, etc.
- Practical – Modeling VR using Unity, co-spaces, etc.

SUGGESTED EVALUATION METHODS:

- Tutorials on Unity.
- Brainstorming session – AI-based toolkits for AR/VR.

UNIT V REAL-TIME APPLICATIONS 9

Artificial Intelligence Reshaping AR, VR, and MR Technologies-Medical Applications of VR – Education, Arts, and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – AI and AR/VR: A Perfect Fit?

SUGGESTED ACTIVITIES:

- External learning – Learn different types of available AR/VR applications.
- Practical – Develop an AR/VR application in any domain of your interest.
- Tutorials on AR/VR applications

SUGGESTED EVALUATION METHODS:

- Evaluation of the developed application.
- Demonstration of AR/VR application development and appropriate evaluation.

TOTAL: 45 PERIODS

OUTCOMES

On completion of the course, learner will be able to

- Analyze how AR/VR systems work and list its applications.
- Understand the design and architecture of AR and VR.
- Comprehend the 3D modeling techniques and graphics.

- Create cross-platform on AR and VR
- Describe the noteworthy applications of AR and VR.
- Demonstrate AR/VR toolkits and its best practices.

TEXTBOOKS

1. Grigore C. Burdea, Philip Coiffet, ‒Virtual Reality Technology‖, Second Edition, WileyIndia.
2. Erin Pangilinan, Steve Lukas, and Vasanth Mohan, ―Creating Augmented and Virtual Realities Theory & Practice for Next-Generation Spatial Computing‖, O'Reilly 2019

REFERENCES

1. William R. Sherman, Alan B. Craig, ‒Understanding Virtual Reality Interface, Application, And Design‖, 2003
2. Steve Aukstakalnis, ‒Practical Augmented Reality - A Guide to the Technologies,Applications, and Human Factors for AR and VR‖, 2016
3. Alan B. Craig., ‒Understanding Augmented Reality Concepts and Applications‖, MorganKaufmann, Elsevier, 2013.
4. Charles Palmer, John Williamson, ‒Virtual Reality Blueprints: Create Compelling VRExperiences for Mobile‖, Packt Publisher, 2018.
5. John Vince, ‒Introduction to Virtual Reality‖, Springer-Verlag, 2004.

WEB REFERENCES:

1. https://arpost.co/2022/01/04/artificial-intelligence-reshape-ar-vr-mr/
2. https://aithority.com/technology/virtual-reality-technology/ai-based-tools-or-sdks-for- augmented-reality-virtual-reality/
3. https://business.adobe.com/blog/basics/how-aipowered-augmented-reality-transforms- digital-experiences
4. https://appen.com/blog/augmented-and-virtual-reality/
5. https://www.smartindustry.com/articles/2021/incorporating-3d-artificial-intelligence-with-ar- and-vr-technology/

ONLINE COURSES & RESOURCES:

1. https://www.coursera.org/learn/introduction-virtual-reality
2. https://nptel.ac.in/courses/106106138

21AD1603	DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To become familiar with digital image fundamentals
- 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
- To become familiar with image segmentation.

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.

SUGGESTED ACTIVITIES:

- Have an idea of the fundamentals of Digital Image Processing including the Topics of filtering, transforms and morphology, and image analysis and compression.
- Be able to implement basic image processing algorithms
- Have the skill base necessary to further explore advanced topics of Digital Image Processing.
- Be in a position to make a positive professional contribution in the field of Digital Image Processing.

SUGGESTED EVALUATION METHODS:

- Quizzes on fundamentals of Digital Image Processing.
- Assignments on problems regarding Image Sampling and Quantization.
- Quizzes on Image Sampling and Quantization.

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.

SUGGESTED ACTIVITIES:

- Introduce the students to some advanced topics in digital image processing and Histogram processing.
- Give the students a taste of the applications of the theories taught in the subject. This will be achieved through the project and some selected lab sessions.
- Be able to implement basic image processing algorithms.

SUGGESTED EVALUATION METHODS:

- Quizzes on fundamentals of gray level transformation and histogram trasformation.
- Assignments on problems regarding color Image Sampling and color image enhancement.
- Quizzes on Image Enhancement and color image sampling.

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

SUGGESTED ACTIVITIES:

- Introduce the students to some advanced topics in digital image processing and Histogram processing.
- Give the students a taste of the applications of the theories taught in the subject. This will be achieved through the project and some selected lab sessions.
- Be able to implement basic image processing algorithms.
- Introduce the students to some advanced topics in digital image processing and Histogram processing.

SUGGESTED EVALUATION METHODS:

- Quizzes on fundamentals of image restoration and inverse filtering
- Assignments on problems regarding band pass filters and notch filters.
- Quizzes on Image restoration.

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- Edge-Based Segmentation- Threshold-Based Segmentation- Region-Based Segmentation- Cluster-Based Segmentation-Watershed Segmentation.

SUGGESTED ACTIVITIES:

- To perform a set of operations through which it becomes possible to get an enhanced version of the image segmentation
- To understand its usage in different fields of technology and start developing the project/projects bound to ideas like Watershed segmentation algorithm.
- Be able to implement basic Watershed segmentation algorithm.

SUGGESTED EVALUATION METHODS:

- Quizzes on fundamentals of edge based segmentation and threshold based segmentation
- Assignments on problems regarding edge detection.
- Quizzes on edge based segmentation.

UNIT V IMAGE COMPRESSION AND RECOGNITION 9

Need for data compression, the two types of image compression, the basic flow of image 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.

SUGGESTED ACTIVITIES:

- To perform a set of operations through which it becomes possible to get an enhanced version of the image compression and recognition
- To understand its usage in different fields of technology and start developing the project/projects bound to ideas like Fourier Descriptor.
- Be able to implement basic Topological feature.
- To perform a set of operations through which it becomes possible to get an enhanced version of the Patterns and Pattern classes

SUGGESTED EVALUATION METHODS:

- Quizzes on fundamentals of image compression and recognition
- Assignments on problems regarding Huffman coding and arithmetic coding.
- Quizzes on Image compression and recognition

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the student will be able to

1. Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
2. Operate on images using the techniques of smoothing, sharpening and enhancement.

3. Understand the restoration concepts and filtering techniques.
4. Learn the basics of segmentation, features extraction, compression and recognition methods for color models.
5. Understand the segmentation concepts.
6. Understand the basics and fundamentals of digital image processing techniques and image restoring techniques.

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 RM. 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 et al _Image processing, analysis and machine vision‘, Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.

21ML1601	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	1	0	3

OBJECTIVES

- To learn the fundamentals of natural language processing
- To understand word level and syntactic analysis.
- To understand the syntax analysis and parsing
- To understand the role of semantics of sentences and pragmatics
- To get knowledge about the machine translation

UNIT I OVERVIEW AND LANGUAGE MODELLING 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 ANALYSIS AND MORPHOLOGY 9

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging,Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models- Morphological analysis and generation using Finite State Automata and Finite State transducer

UNIT III SYNTACTIC ANALYSIS 9

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

UNIT IV INFORMATION RETRIEVAL AND LEXICAL RESOURCES 9

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.

UNIT V APPLICATIONS IN NLP 9

Question Answering with SQUAD – Dependency Parsing – Machine Translation –Conference Resolution – Text Summarization-WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC)

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, students will be able to

- To tag a given text with basic Language features
- To design an innovative application using NLP components
- To implement a rule based system to tackle morphology/syntax of a language
- To design a tag set to be used for statistical processing for real-time applications
- To apply NLG and machine translation

TEXT BOOKS

1. Daniel Jurafsky, James H. Martin, –Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition‖, Second Edition, Pearson Publication, 2014
2. Christopher Manning, –Foundations of Statistical Natural Language Processing‖, MIT Press, 2009
3. Nitin Indurkhya and Fred J. Damerau, ‖Handbook of Natural Language Processing‖, Second Edition, Chapman & Hall/CRC Press, 2010.

REFERENCE BOOKS

1. Steven Bird, Ewan Klein and Edward Loper, –Natural Language Processing with Python‖, First Edition, OReilly Media, 2009
2. Breck Baldwin, –Natural Language Processing with Java and LingPipe Cookbook‖, Atlantic Publisher, 2015.
3. Richard M Reese,‖ Natural Language Processing with Java‖, First Edition, Packt Publishing,2015.
4. Yoav Goldberg, GraemeHirst, –Neural Network Methods for Natural Language Processing - Synthesis Lectures on Human Language Technologies‖, Morgan and Claypool Life Sciences, 2017.
5. Deepti Chopra,Nisheeth JoshiItiMathur, –Mastering Natural Language Processing with Python‖, First Edition, Packt Publishing Limited, 2016
6. Mohamed ZakariaKurdi –Natural Language Processing and Computational Linguistics 1: Speech, Morphology and Syntax‖, First Edition, ISTE Ltd. Wiley, 2016
7. AtefehFarzindar,DianaInkpen, –Natural Language Processing for Social Media, Second Edition, Morgan and Claypool Life Sciences, 2015

21AD1611	AUGMENTED REALITY, VIRTUAL REALITY WITH AI LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To explore and interpret Unity software.
- To design and model game objects.
- To understand the scripting in Unity.
- To analyze and experiment Marker-based AR.
- To set up VR environment.
- To develop AR/VR mini project.

LIST OF EXPRIMENTS

1. Installing Unity and navigating the Scene view
2. Creating game objects (Rotate – Transform – Scale)
3. Models – Applying Textures, Shaders, and Materials to Models
4. Scripting in Unity (Object rotation via C# script)
5. Experimenting with Colliders
6. Creating the animation (Object Spinning & Timing)
7. Creating a Timeline Asset
8. Adding Audio in the Scene View
9. Marker based AR :2D – 2D video mapping
10. Marker based AR : 2D – 3D mapping
11. Virtual buttons in AR (Creating Virtual buttons on Image target)
12. Creating AR app using Unity and Vuforia (Projecting 3D Model on Image Target).
13. Setting up a VR environment
14. Mini Project: Build a Gaming environment
15. Mini Project : Export an Android app with augmented reality

Software:

Software – Blender and Unity

TOTAL PERIODS: 60

OUTCOMES

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

- Operate on Unity Software
- Create 3D game objects
- Implement scripting in Unity
- Analyse Marker-based AR
- Develop AR app
- Examine and set up VR environment

TEXT BOOKS

1. Unity 2018 Game Development, Mike Garg, O'Reilly.
2. C# SCRIPTING -Unity Game Development Cookbook, Paris Buttfield-Addison, Jon Manning, Tim Nugent O'Reilly.

REFERENCES

1. Unity Animation Essentials, Packt, 2015
2. Building AR Applications with Unity and Vuforia, Daniel Wise,Packt.
3. Unity AR & VR by tutorials, First edition, Jimmy, Matt Larson, Jonathan.

21AD1612	DEEP LEARNING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To implement deep neural network for simple problems
- To implement various activation function
- To implement Neural Network model
- To implement LSTM
- To implement CNN.
- Design solutions for real life problems using Deep learning algorithms

LIST OF PROGRAMS

1. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

2. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

3. Write a program to construct a skip gram model using NLP

4. Develop a code to design object detection and classification for traffic analysis using CNN

5. Implement sentiment analysis using LSTM

6. Implement the analysis of X-ray image using autoencoders

7. Write a program to implement Continuous Bag of Words Model using CNN Algorithm.

8. Build a model that takes an image as input and determines whether the image contains a picture of a dog or a cat.

9. Use CIFAR-10 dataset and build an image classification model that will be able to identify what class the input image belongs to.

10. Implement a Human Face Recognition Model and determine the accuracy in detecting the bounding boxes of the human face.

11. Build a chatbot to identify the context the user is asking and then provide it with the relevant answer.

12. Mini Project

REFERENCES

1. Deep Learning by Ian Goodfellow, YoshuaBengio and Aaron Courville, MIT Press. 2016.

2. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.

TOTAL: 60 PERIODS

OUTCOMES

- Apply deep neural network for simple problems
- Apply various activation function
- Design and build a Neural Network model
- Implement LSTM
- Deploy Convolutional Neural Network for given application
- Develop a real world application using suitable deep neural networks

SOFTWARE:

Java / Python

Understanding on working of Colab and Transfer Learning Networks

21AD1613	SOCIALLY RELEVANT PROJECT	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To explore solution for socially existing problems with the concepts and tools.
- To explore areas related to the course such as Big Data.
- To implement Machine Learning Techniques.
- To apply Deep Learning Techniques.
- To understand and implement Image Processing Algorithms.
- To build the projects to portray their own creativity.

LIST OF EXPERIMENTS:

1. Solve social problems using Statistical and Mathematical Concepts.
2. Solve Problems using Big Data related Concepts.
3. Solving Business Intelligence related Concepts.
4. Solving problems with Machine Learning Algorithms.
5. Solving problems with Deep Learning Algorithms .
6. Solving Problems with Image Processing Techniques. (Computer Vision required)
7. Solve any Security Related Problems.
8. Solving health Related Problems using AI Techniques. (New AI Algorithms)
9. Solve problems related to Data wrangling.

TOTAL: 60 PERIODS

OUTCOMES

After the completion of this course, students will be able to

- To develop solution using different platforms and tools.
- To Apply Hadoop Ecosystem (Hive, Pig, Sqoop, Flume), Big Data Lakes, Apache Spark, Spark MLLib , HPCC.
- Implement complex problems by the use of Machine Learning Techniques.
- Implement simple problems using Deep Learning Techniques.
- Have skills in developing and executing Image Processing Algorithms.
- To Apply the various tools in building the projects.

REFERENCES

1. https://www.jeremyjordan.me/ml-projects-guide/
2. Problems listed in Smart India Hackathon : www.sih.gov.in

		L	T	P	C
21AD1701	BUSINESS ANALYTICS	3	0	0	3

OBJECTIVES

- To understand the Analytics Life Cycle.
- To comprehend the process of acquiring Business Intelligence
- To understand various types of analytics for Business Forecasting
- To model the supply chain management for Analytics.
- To apply analytics for different functions of a business
- To apply visualization tools for Business Analytics

UNIT I INTRODUCTION TO BUSINESS ANALYTICS 9

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validating and verifying analytical results, Communicating and presenting results to clients and Driving organizational change and assessing impact– Interpretation – Deployment and Iteration

SUGGESTED ACTIVITIES:

- Develop Customer segmentation based on demographics and customer preferences and understand customer personality to take better business decisions.
- Developing algorithms for basic mathematical expressions using arithmetic Operations
- Installing Python.
- Simple programs on print statements, arithmetic operations.

SUGGESTED EVALUATION METHODS:

- Quizzes on algorithm and basic python.
- Assignments on illustrative problems.
- Quizzes on simple python programs.

UNIT II BUSINESS INTELLIGENCE 9

Data Warehouses and Data Mart - Knowledge Management – Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence – OLAP – , Analytic functions

SUGGESTED ACTIVITIES:

- Simple Python program implementation using Operators, Conditionals, Iterative Constructs and Functions
- Developing simple Business Analytics using Excel, Advanced Excel etc.

SUGGESTED EVALUATION METHODS:

- Quizzes on Knowledge Management
- Assignments on Business Intelligence

UNIT III BUSINESS FORECASTING 9

Introduction to Business Forecasting and Predictive analytics - Data Mining and Predictive Analysis Modeling -Linear Regression, Cluster, CART and Neural Network model– Data Visualization and Analytics- Charts(Bars-Pie-Line-Scatter-Map-Bubble-Box & Whisker-Tree map - Heat map-Circle and Area) -Worksheet, Dashboard and Story Board creation

SUGGESTED ACTIVITIES:

- Implementing Power PI tool using Airways traffic flow, Stock market Analytics Scenario
- Simple Dashboard Creation techniques

- Student Chart Report
- Billing Worksheet Scheme during shopping.
- Implementing any Business data application using R pogamming

SUGGESTED EVALUATION METHODS:

- Quizzes on Linear Regression.
- Assignments Predicative analytics.

UNIT IV HR & SUPPLY CHAIN ANALYTICS 9

Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain

SUGGESTED ACTIVITIES:

- Utilize linear programming to observe key metrics of suppliers for supply chain optimization to choose the right mix of products from the right suppliers.
- Tableue tool for data Visualization

SUGGESTED EVALUATION METHODS:

- Quizzes on Planning and Training Analytics.
- Assignments on Logistics
- Quizzes on HR & Supply Chain Management.

UNIT V MARKETING & SALES ANALYTICS 9

Marketing Strategy, Marketing Mix, Customer Behavior – selling Process – Sales Planning – Analytics applications in Marketing and Sales

SUGGESTED ACTIVITIES:

- To explore the various data types, data structures, operators, and functions in R to better understand why R is a preferred tool for business analytics
- Implementing Python program to analysis Marketing and Sales.

SUGGESTED EVALUATION METHODS:

- Quizzes on Marketing Strategy
- Assignments on Selling problems.
- Quizzes on Analytics Applications.

TOTAL: 45 PERIODS

OUTCOMES

- Explain the real world business problems and model with analytical solutions.
- Identify the business processes for extracting Business Intelligence
- Apply predictive analytics for business fore-casting
- Apply analytics for supply chain and logistics management.
- Use analytics for marketing and sales.
- Use Analytics for Visualization Techniques

REFERENCES

1. R. Evans James, Business Analytics, 2017
2. R N Prasad , Seema Acharya , Fundamentals of Business Analytics,
3. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
4. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010
5. Mahadevan B, ―Operations Management -Theory and Practice‖,3rd Edition, Pearson Education, 2018.

21AD1702	COMPUTER VISION	L	T	P	C
		3	0	0	3

OBJECTIVES

- To review image processing techniques for computer vision.
- To understand various features and recognition techniques
- To learn about histogram and binary vision.
- Apply three-dimensional image analysis techniques.
- To understand motion analysis.
- Study real world applications of computer vision algorithms.

UNIT I INTRODUCTION 9

Image Processing, Computer Vision ,What is Computer Vision - Low-level, Mid-level, High-level ; Fundamentals of Image Formation, Transformation: Orthogonal Euclidean, Affine, Projective, Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.

SUGGESTED ACTIVITIES:

- Developing Types of Images in computer.
- Writing program on Image Formation.

SUGGESTED EVALUATION METHODS:

- Quizzes on Histogram Processing.
- Assignment on Image Enhancement.

UNIT II FEATURE EXTRACTION AND FEATURE SEGMENTATION 9

Feature Extraction -Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space 69 Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT. Image Segmentation -Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation.

SUGGESTED ACTIVITIES:

- Developing Line detectors.
- Developing Harris and Hessian Affine.

SUGGESTED EVALUATION METHODS:

- Quizzes on Graph-Cut.
- Assignment on Texture Segmentation.

UNIT III SHAPES AND REGIONS 9

Binary shape analysis – connectedness – object labelling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.

SUGGESTED ACTIVITIES:

- Developing object labeling and counting.
- Developing region descriptors.

SUGGESTED EVALUATION METHODS:

- Quizzes on distance functions.
- Assignment on Histogram Comparison.

UNIT IV 3D VISION AND MOTION 9

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion–spline-based motion- optical flow – layered motion.

SUGGESTED ACTIVITIES:

- Developing active range finding.
- Writing program on 3D object detection.

SUGGESTED EVALUATION METHODS:

- Quizzes on spline.
- Assignment on layered motion.

UNIT V APPLICATIONS 9

Applications: Photo album – Face detection – Face recognition Overview of Diverse Computer Vision Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval. In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians. (Application of CV in Transportation Plays a vital role in avoiding accidents)

SUGGESTED ACTIVITIES:

- Developing Diverse Computer Vision Applications.
- Developing Document Image Analysis.
- Developing Activities for biometric.

SUGGESTED EVALUATION METHODS:

- Quizzes on , Medical Image Analysis
- Assignment on Augmented Reality.

OUTCOMES

1. Explain low level processing of image and transformation techniques applied to images.
2. Explain the feature extraction, segmentation and object recognition methods.
3. Apply Histogram transform for detection of geometric shapes like line, ellipse and objects.
4. Illustrate 3D vision process and motion estimation techniques.
5. Implement motion related techniques.
6. Apply vision techniques to real time applications.

TOTAL: 45 PERIODS

TEXT BOOKS

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

REFERENCES

1. B. K. P. Horn -Robot Vision, McGraw-Hill.
2. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012.
3. Mark Nixon and Alberto S. Aquado, Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press, 2012.
4. E. R. Davies, (2012), ―Computer & Machine Vision‖, Fourth Edition, Academic Press. 5. Concise Computer Vision: An Introduction into Theory and Algorithms, by Reinhard Klette, 2014.

21AD1703	AI AND ROBOTICS (LAB INTEGRATED)	L	T	P	C
		3	0	2	4

OBJECTIVES

- To study the Robot Locomotion and types of robots.
- To explore the kinematic models and constraints
- To learn sensors of robots and image processing for robotics.
- To understand the methods for mobile robot Localization
- To study the Path planning and Navigation of Robots.
- To understand the simulation for robot Localization.

UNIT I ROBOT LOCOMOTION 9

Introduction to AI and Robotics – robot locomotion – legged mobile robots – wheeled mobile robots – aerial mobile robots.

SUGGESTED ACTIVITIES:

- Define what a robot is.
- Describe the main components of a robot.
- Explain how the aerial mobile robots can be programmed to move.
- Explain that troubleshooting is an important part of engineering something new.

SUGGESTED EVALUATION METHODS:

- Quizzes on AI and Robotics
- Assignments on illustrative problems.
- Quizzes on simple AI programs.

UNIT II MOBILE ROBOT KINEMATICS 9

Kinematic models and constraints – mobile robot maneuverability (a mobile robot with a steerable wheel and two passive casters) – different types of kinematics in robotics - kinematics used in robotics - mobile robot workspace –advanced kinematics – motion control.

SUGGESTED ACTIVITIES:

- The course will feature several practical sessions with hands-on robot programming
- It also teaches algorithmic strategies that enable the coordination of multi-robot systems and robot Kinematics.
- Explain how the Mobile Robot Kinematics can be programmed to move forward and reverse.

SUGGESTED EVALUATION METHODS:

- Quizzes on Mobile Robot Kinematics
- Assignments on illustrative problems.
- Quizzes on simple Mobile Robot Kinematics programs.

UNIT III ROBOT PERCEPTION 9

Sensors for mobile robots – sensing and perception in robotics - 4 Characteristics of robots - computer vision for robots – image processing for robotics – place recognition – range data.

SUGGESTED ACTIVITIES:

- This course teaches the foundations of autonomous mobile robots, covering topics such as perception, motion control, and planning.
- It also teaches algorithmic strategies that enable the coordination of multi-robot systems and robot swarms.
- The course will feature several practical sessions with hands-on robot programming.

SUGGESTED EVALUATION METHODS:

- Quizzes on Robot Perception
- Assignments on illustrative problems.
- Quizzes on simple Robot Perception programs.

UNIT IV MOBILE ROBOT LOCALIZATION **9**

Introduction to localization – 4 basic parts of a mobile robot - localization in mobile robot - noise and aliasing – localization-based navigation – belief representation – map representation – probabilistic map-based localization – autonomous map building.

SUGGESTED ACTIVITIES:

- Understand the role of mobile robots in the improvement of industrial processes and be able to design and implement software that allows them to behave autonomously.
- Understand the structure of the Robot Operating System (ROS) and use it to build robotic software.
- Assemble all the basic modules that allow a mobile robot to behave autonomously.

SUGGESTED EVALUATION METHODS:

- Quizzes on Mobile Robot Localization
- Assignments on illustrative problems.
- Quizzes on simple Mobile Robot Localization programs.

UNIT V ROBOT PLANNING AND NAVIGATION **9**

Planning and navigation – 3 types of navigation - purpose of navigation - planning and reacting – path planning – obstacle avoidance – navigation architectures - The benefits of navigation.

SUGGESTED ACTIVITIES:

- The students will undertake mini-projects, which will be formally evaluated through a report and presentation
- Understand the structure of the Robot planning and navigation and use it to build robotic software.
- Assemble all the basic modules that allow a robot planning and navigation to behave autonomously.

SUGGESTED EVALUATION METHODS:

- Quizzes on Robot Planning And Navigation
- Assignments on illustrative problems.
- Quizzes on simple Robot Planning And Navigation programs.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the student will be able to

- Explain the types of Robots
- Narrate the kinematics of Robots
- Implement image processing algorithms
- Devise Localization algorithms
- Devise Path planning methods for navigation
- Implement the line tracing algorithms

LIST OF EXPERIMENTS

1. The design of the printed circuit using Easy EDA Speed Line Follower Robot V4
2. To perform certain hand Gesture controlled bot
3. To implements a robotic arm with four degrees of freedom (4 DOF) Robotic Arm
4. Home Security System using Node MCU
5. RF Controlled or Wi-Fi controlled Navigation bot
6. Pick and place bot with Object Detection
7. To perform wall following robot must be capable of detecting and avoiding obstacles in Wall Following bot
8. Maze solving Robot using Arduino ADC
9. Forward and reverse kinematics based experiment using open source platforms
10. Write a program to implement Computer Vision based robotic tasks execution
11. Building an easy Line Follower Robot using Arduino Uno
12. To determine the motion of a robot to reach a desired position in Inverse kinematics

13. To calibrate the camera using the same image when the position tracker is reassembled.

PRACTICALS: 15 PERIODS

SOFTWARE
Open Source Software

TEXT BOOKS
1. R. Siegwart, I. R. Nourbaksh, and D. Scarramuzza, –Introduction to Autonomous Mobile Robots‖, Second Edition, MIT Press, 2011.
2. Stuart Russel and Peter Norvig, –Artificial Intelligence: A Modern Approach‖, Fourth Edition, Pearson Education, 2020.

21AD1711	COMPUTER VISION LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To review image processing techniques for computer vision.
- To understand shape and region analysis.
- To understand Hough Transform and its applications to detect lines, circles, ellipses.
- To understand three-dimensional image analysis techniques.
- To understand motion analysis.
- To study some applications of computer vision algorithms.

LIST OF EXPRIMENTS

1. Implementation of various Filter Technique.
2. Implementation of Histogram
3. Implementation of various segmentation Algorithm.
4. Program to implement object labelling.
5. Implementation of face reorganization system.
6. Licence plate identification.
7. Implementation of Medical image.
8. Edge Detection ,Corner Detection, Line Detection.
9. Face Recognition using Colour Model Representation.
10. Authorized Face recognition system using Feature matching.
11. Identifying the stereo correspondence of the two images.
12. Human Pose Estimation.
13. Abnormal detection in traffic video surveillance.
14. Human action recognition and Object localizations.
15. Identifying the road structure.

SOFTWARE

Anaconda Python 3.x.x

TOTAL PERIODS: 60

OUTCOMES

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

- Implement fundamental image processing techniques required for computer vision.
- Perform shape analysis.
- Implement boundary tracking techniques.
- Apply chain codes and other region descriptors.
- Apply Hough Transform for line, circle, and ellipse detections.
- Implement motion related techniques.

TEXT BOOKS

1. David A. Forsyth and Jean Ponce, ―Computer Vision - A Modern Approach‖, PHI Learning 2009
2. Richard Szeliski, ―Computer Vision: Algorithms and Applications‖, Springer, 2010.
3. E. R. Davies, ―Computer and Machine Vision‖, Fourth Edition, Elsevier, 2012.

REFERENCES

1. Richard Hartley and Andrew Zisserman, ―Multiple View Geometry in Computer Vision‖ 2nd edition, Cambridge University press, 2003
2. Simon. J. D Prince, ―Computer Vision: Models, Learning, and Inference (1st Edition)‖, 2012.

21AD1712	MINI PROJECT ON ANALYTICS	L	T	P	C
		0	0	4	2

OBJECTIVES

- To explore various analytical tools to develop a mini project.
- To use Python packages for performing analytics.
- To learn data analysis for the problems.
- To learn data visualization using Apache Spark.
- To implement analytical procedures in various distributed frameworks.
- To use tool Apache Spark for applications.

LIST OF EXPERIMENTS

1. To solve Data analysis for City Employee
2. To solve Market Basket Analysis
3. Solving Movie Review Sentiment Analysis
4. Solving Store Sales Forecasting
5. Solve Data Analysis and Visualization using Apache Spark
6. To solve Airline Dataset Analysis
7. Use Apache Hive for Real-time Queries and Analytics
8. To solve Covid -19 Impacts Analysis
9. Solving Event Data Analysis

TOTAL: 60 PERIODS

OUTCOMES

After the completion of this course, students will be able to

1. Install analytical tools and configure distributed file system.
2. To become skilled to use various packages in Python.
3. To Analyze data for various applications.
4. To apply visualization for the application.
5. Have skills in developing and executing analytical procedures in various distributed frameworks.
6. Implement real world applications by using Apache Spark.

REFERENCES

1. https://www.projectpro.io/article/big-data-analytics-projects-for-students-/436
2. Allen B. Downey, –Think Stats: Exploratory Data Analysis in Python‖, Green Tea Press, 2014.
3. Data Science From Scratch: First Principles with Python, Second Edition by Joel Grus, 2019.

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical for AI&DS - I

21AD1901	EXPLORATORY DATA ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To outline an overview of exploratory data analysis.
- To learn T-test.
- To perform univariate data exploration and analysis
- To apply bivariate data exploration and analysis.
- To use Data exploration and visualization techniques for multivariate and time series data
- To implement data visualization using advanced techniques

UNIT - I EXPLORATORY DATA ANALYSIS 9

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques- Case study - attack for tampering with recommender systems.

UNIT - II T-TEST 9

t-test for one sample – sampling distribution of t – t-test procedure – degrees of freedom – estimating the standard error – case studies t-test for two independent samples – statistical hypotheses – sampling distribution – test procedure – p-value – statistical significance – estimating effect size – meta analysis t-test for two related samples.

UNIT - III UNIVARIATE ANALYSIS 9

Introduction to Single variable: Distribution Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality- Medical Statistics

UNIT - IV BIVARIATE ANALYSIS 9

Relationships between Two Variables - Percentage Tables - Analysing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines- Regression Analysis.

UNIT - V MULTIVARIATE AND TIME SERIES ANALYSIS 9

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Timebased indexing – Visualizing – Grouping – Resampling- COVID 19**.**

TOTAL: 45 PERIODS

OUTCOME:

- **CO1:** Understand the fundamentals of exploratory data analysis
- **CO2:** Use T-test in analysis Process.
- **CO3:** Perform univariate data exploration and analysis.
- **CO4:** Apply bivariate data exploration and analysis.
- **CO5:** Use Data exploration and visualization techniques for multivariate and time series data.
- **CO6:** To implement data visualization using advanced techniques

TEXT BOOKS:

1. Suresh Kumar Mukhiya, Usman Ahmed, “Hands-On Exploratory Data Analysis with Python”, Packt Publishing, 2020. (Unit 1)

2. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017 (Unit 2)

3. Catherine Marsh, Jane Elliott, “Exploring Data: An Introduction to Data Analysis for Social Scientists”, Wiley Publications, 2nd Edition, 2008. (Unit 3,4,5)

REFERENCES:

1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017

2. Claus O. Wilke, “Fundamentals of Data Visualization”, O’reilly publications, 2019

3. Matthew O. Ward, Georges Grinstein, Daniel Keim, “Interactive Data Visualization: Foundations, Techniques, and Applications”, 2nd Edition, CRC press, 2015.

21AD1902	RECOMMENDER SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the foundations of the recommender system.
- To learn the significance of machine learning and data mining algorithms for Recommender systems
- To learn about collaborative filtering
- To make students design and implement a recommender system.
- To learn collaborative filtering.

UNIT I INTRODUCTION 9

Introduction and basic taxonomy of recommender systems - Traditional and non-personalized Recommender Systems - Overview of data mining methods for recommender systems- similarity measures- Dimensionality reduction – Singular Value Decomposition (SVD)

UNIT II CONTENT-BASED RECOMMENDATION SYSTEMS 9

High-level architecture of content-based systems - Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

UNIT III COLLABORATIVE FILTERING 9

A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF, components of neighborhood methods (rating normalization, similarity weight computation, and neighborhood selection

UNIT IV ATTACK-RESISTANT RECOMMENDER SYSTEMS 9

Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack – Group attack – Strategies for robust recommender design - Robust recommendation algorithms.

UNIT V EVALUATING RECOMMENDER SYSTEMS 9

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – Design Issues – Accuracy metrics – Limitations of Evaluation measures

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Understand the basic concepts of recommender systems.

CO2: Implement machine-learning and data-mining algorithms in recommender systems data sets.

CO3: Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.

CO4: Design and implement a simple recommender system.

CO5: Learn about advanced topics of recommender systems.

CO6: Learn about advanced topics of recommender systems applications

TEXTBOOKS:

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Dietmar Jannach, Markus Zanker, Alexander Felfernig and Gerhard Friedrich, Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
3. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Sytems Handbook, 1st ed,Springer (2011),
4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 2020.

21AD1903	SOFT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on humanexperience
- To provide the mathematical background for carrying out the optimization associated with neural network learning
- To learn various evolutionary Algorithms.
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
- To introduce case studies utilizing the above and illustrate the Intelligent behavior of programs based on soft computing
- To make students to implement real time applications

UNIT - I INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC 9

Introduction - Fuzzy Logic - Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems -Case study : Analytic Hierarchy Process Approach.

UNIT - II NEURAL NETWORKS 9

Supervised Learning Neural Networks – Perceptrons - Backpropagation -Multilayer Perceptrons – Unsupervised Learning Neural Networks – Kohonen Self-Organizing Networks – Convolutional NeuralNetwork.

UNIT - III GENETIC ALGORITHMS 9

Chromosome Encoding Schemes -Population initialization and selection methods - Evaluation function - Genetic operators- Cross over – Mutation - Fitness Function – Maximizing function – maximizing afunction program - Case study: Job scheduling.

UNIT - IV NEURO FUZZY MODELING 9

ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling – Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum - Analysis of AdaptiveLearning Capability- Three input non-linear function**.**

UNIT - V APPLICATIONS 9

Modeling a two input sine function - Printed Character Recognition – Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition - Soft Computing for Color Recipe Prediction- Hybrid Approach**.**

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Understand the fundamentals of fuzzy logic operators and inference mechanisms

CO2: Understand neural network architecture for AI applications such as classification and clustering.

CO3: Learn the functionality of Genetic Algorithms in Optimization problems

CO4: Use hybrid techniques involving Neural networks and Fuzzy logic

CO5: Apply soft computing techniques in real world applications

CO6: To implement real time applications.

TEXT BOOKS:

1. Jang, J.-S. R., Sun, C.-T., & Mizutani, E. Neuro-fuzzy and soft computing: A computational approach to learning and machine intelligence. Upper Saddle River, NJ, Prentice Hall,1997
2. Himanshu Singh, Yunis Ahmad Lone, Deep Neuro-Fuzzy Systems with Python With Case Studies and Applications from the Industry, Apress, 2020

REFERENCES:

1. Roj Kaushik and Sunita Tiwari, Soft Computing-Fundamentals Techniques and Applications, 1st Edition, McGraw Hill, 2018.
2. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms",PHI, 2003
3. Samir Roy, Udit Chakraborthy, Introduction to Soft Computing, Neuro Fuzzy and Genetic Algorithms, Pearson Education, 2013.
4. S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Third Edition, Wiley India PvtLtd, 2019.

21AD1904	TEXT ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the methods for keyword extraction from documents
- To learn clustering methods for grouping of documents
- To explore the methods for classification of documents and E-mails
- To explore text visualization techniques and anomaly detection.
- To learn about Events and trends in text streams
- To learn about advanced text visualization techniques

UNIT - I TEXT EXTRACTION 9

Introduction- Rapid automatic keyword extraction: candidate keywords, keyword scores, adjoining keywords, extracted keywords-Benchmark evaluation: precision and recall, efficiency, stoplist generation, Evaluation on new articles, Intelligent Text extraction.

UNIT - II DOCUMENT CLUSTERING 9

Multilingual document clustering: Multilingual LSA, Tucker1 method, PARAFAC2 method, LSA with term alignments, LMSA, LMSA with term alignments; Constrained clustering with k-means type algorithms, Document Clustering vs Topic Models : A case study.

UNIT - III CONTENT BASED CLASSIFICATION 9

Classification algorithms for Document Classification, Content-based spam email classification, Utilizing nonnegative matrix factorization for email classification problems, Development of content based SMS classification.

UNIT - IV ANOMALY AND TREND DETECTION 9

Text visualization techniques: Visualization in text analysis, Tag clouds, tag clouds, authorship and change tracking, Data Exploration and the search for noval patterns, sentiment tracking, visual analytics and FutureLens, scenario discovery. adaptive threshold setting for novelty mining: Introduction, adaptive threshold for anomaly detection, Experimental study.

UNIT - V TEXT STREAMS 9

Events and trends in text streams: Introduction, Text streams, Feature extraction and data reduction, Event detection, Trend detection, Event and trend descriptions. Embedding semantics in LDA topic models: Introduction, vector space modeling, latent semantic analysis, probabilistic latent semantic analysis, Latent Dirichlet allocation, embedding external semantics from Wikipedia, data-driven semantic embedding, Dynamic sampling of text streams and its application in text analysis**.**

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Design text extraction techniques.

CO2: To apply clustering methods for grouping of documents.

CO3: Design classification techniques for text mining

CO4: Apply visualization techniques and perform anomaly & trend detection.

CO5: Perform Event operations in Text streams

CO6: Apply advanced text visualization techniques.

TEXT BOOKS:

1. Michael W. Berry & Jacob Kogan,"Text Mining Applications and Theory", Wiley publications, 2010.
2. Aggarwal, Charu C., and ChengXiangZhai, eds., “Mining text data”, Springer Science & Business Media, 2012.

REFERENCES:

1. Gary Miner, John Elder, Thomas Hill, Dursun Deller, Andrew Fast, Robert A. Nisbet, “Practical text mining and statistical analysis for non-structured text data applications”, Academic Press, 2012.
2. Srivastava, Ashok N., and MehranSahami, “Text mining: Classification, clustering, and applications”, Chapman and Hall/CRC, 2009.
3. Buitelaar, Paul, Philipp Cimiano, and Bernardo Magnini, eds., “Ontology learning from text: methods, evaluation and applications”, Vol. 123. IOS press, 2005.

21AD1905	ENGINEERING PREDICTIVE ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To explain terminology, technology and applications of predictive analysis
- To apply data preparation techniques and generate appropriate association rules.
- To discuss various descriptive models, their merits, demerits and application.
- To describe various predictive modelling methods
- To introduce the text mining tools, technologies and case study which is used in day-today analytics cycle
- To learn about advanced text visualization techniques

UNIT - I INTRODUCTION TO PREDICTIVE ANALYTICS 9

Overview of Predictive Analytics- Setting Up the Problem - Data Understanding- Single Variable- Data Visualization in One Dimension- Data Visualization, Two or Higher Dimensions-The Value of Statistical Significance- Pulling It All Together into a Data Audit – Case study: Churn prevention**.**

UNIT - II DATA PREPARATION AND ASSOCIATION RULES 9

Data Preparation- Variable Cleaning- Feature Creation- Item sets and Association Rules - Terminology- Parameter Settings- How the Data Is Organized- Measures of Interesting Rules - Deploying Association Rules- Problems with Association Rules- Building Classification Rules from Association Rules- Hospital Readmission.

UNIT - III MODELLING 9

Descriptive Modeling- Data Preparation Issues with Descriptive Modeling- Principal Component Analysis- Clustering Algorithms- Interpreting Descriptive Models- Standard Cluster Model Interpretation

UNIT - IV PREDICTIVE MODELLING 9

Decision Trees- Logistic Regression -Neural Network Model – K-Nearest Neighbours – Naive Bayes – Regression Models - Linear Regression - Other Regression Algorithms- Case study: predictive web Analytics

UNIT - V TEXT MINING 9

Motivation for Text Mining- A Predictive Modeling Approach to Text Mining- Structured vs. Unstructured Data- Why Text Mining Is Hard- Data Preparation Steps- Text Mining Features Modeling with Text Mining Features- Regular Expressions- Case Studies:- Survey Analysis.

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Explain terminology, technology and applications of predictive analysis

CO2: Apply data preparation techniques to effectively interpret big data

CO3: Discuss various descriptive models, their merits, demerits and application.

CO4: Describe principles of predictive analytics and apply them to achieve real, pragmatic solutions.

CO5: Illustrate the features and applications of text mining.

CO6: Apply advanced text visualization techniques.

TEXT BOOKS:

1. Dean Abbott, "Applied Predictive Analytics-Principles and Techniques for the Professional Data Analyst", Wiley, 2014
2. Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012

REFERENCES:

1. Conrad Carlberg, "Predictive Analytics: Microsoft Excel", 1st Edition, Que Publishing, 2012.
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani. An Introduction to Statistical Learning with Applications in R Springer 2013
3. Alberto Cordoba, "Understanding the Predictive Analytics Lifecycle", Wiley, 2014

21AD1906	IMAGE AND VIDEO ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basics of image processing techniques for computer vision
- To learn the techniques used for image pre-processing.
- To discuss the various object detection techniques
- To understand the various Object recognition mechanisms.
- To elaborate on the video analytics techniques.
- To implement real time applications.

UNIT - I INTRODUCTION 9

Computer Vision – Image representation and image analysis tasks - Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures- T-pyramid of an image- the quad tree representation of an image using the homogeneity criterion of equal intensity

UNIT - II IMAGE PRE-PROCESSING 9

Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models - Edges in multi-speralct images - Local pre-processing in the frequency domain - Line detection by local pre-processing operators - Image restoration – Geometric transformations -Case study of MNIST.

UNIT - III OBJECT DETECTION USING MACHINE LEARNING 9

Object detection– Object detection methods – Deep Learning framework for Object detection– bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once(YOLO)-Salient features-Loss Functions-YOLO architectures - motion analysis using moving edges - Case study: Geospatial objet detection.

UNIT - IV FACE RECOGNITION AND GESTURE RECOGNITION 9

Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition- DeepFace solution by Facebook-FaceNet for Face Recognition- Implementation using FaceNet- Gesture Recognition – Implementation of Facial Detection and Recognition - static hand gesture.

UNIT - V VIDEO ANALYTICS 9

Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem-RestNet architecture-RestNet and skip connections-Inception Network-GoogleNet architecture-Improvement in Inception v2-Video analytics-RestNet and Inception v3. Case study: Airport Projects - event detection in video surveillance system

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Understand the basics of image processing techniques for computer vision and video analysis.

CO2: Explain the techniques used for image pre-processing.

CO3: Develop various object detection techniques

CO4: Understand the various face recognition mechanisms

CO5: Elaborate on deep learning-based video analytics.

CO6: Implement in real time applications.

TEXT BOOKS:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4nd edition, Thomson Learning, 2013
2. Vaibhav Verdhan,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras,Apress 2021(UNIT-III,IV and V)

REFERENCES:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited,2011
2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence", Springer, 2012
3. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2003

21AD1907	ETHICS AND AI	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the need for ensuring ethics in AI
- To understand ethical issues with the development of AI agents
- To apply the ethical considerations in different AI applications
- To evaluate the relation of ethics with nature
- To overcome the risk for Human rights and other fundamental values
- To understand ethics in all AI applications

UNIT - I INTRODUCTION TO ETHICS OF AI 9

Role of Artificial Intelligence in Human Life, Understanding Ethics, Why Ethics in AI? Ethical Considerations of AI, Current Initiatives in AI and Ethics, Ethical Issues with our relationship with artificial Entities**,** Ethics of AI and big data**.**

UNIT - II FRAMEWORK AND MODELS 9

AI Governance by Human-right centered design, Normative models, Role of professional norms, Teaching Machines to be Moral

UNIT - III CONCEPTS AND ISSUES 9

Accountability in Computer Systems, Transparency, Responsibility and AI. Race and Gender, AI as a moral right-holder, Trust and Transparency.

UNIT - IV PERSPECTIVES AND APPROACHES 9

Perspectives on Ethics of AI, Integrating ethical values and economic value, Automating origination, AI a Binary approach, Machine learning values, Artificial Moral Agents, Deep learning values.

UNIT - V CASES AND APPLICATION 9

Ethics of Artificial Intelligence in Transport, Ethical AI in Military, Biomedical research, Patient Care, Public Health, Robot Teaching, Pedagogy, Policy, Smart City Ethics, Chatbots.

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Understand the ethical issues in the development of AI agents

CO2: Learn the ethical considerations of AI with perspectives on ethical values

CO3: Apply the ethical policies in AI based applications and Robot development

CO4: To implement the AI concepts to societal problems by adapting the legal conceptsby securing fundamental rights

CO5: This study will help to overcome the evil genesis in the concepts of AI.

CO6: To apply ethics in all AI applications

TEXT BOOKS:

1. Paula Boddington, “Towards a Code of Ethics for Artificial Intelligence”, Springer, 2017
2. Markus D. Dubber, Frank Pasquale, Sunit Das, “The Oxford Handbook of Ethics of AI”, Oxford University Press Edited book, 2020

REFERENCES:

1. S. Matthew Liao, “Ethics of Artificial Intelligence”, Oxford University Press Edited Book, 2020

2. N. Bostrom and E. Yudkowsky. “The ethics of artificial intelligence”. In W. M. Ramsey and K. Frankish, editors, The Cambridge Handbook of Artificial Intelligence, pages 316–334. Cambridge University Press, Cambridge, 2014.

3. Wallach, W., & Allen, C, “Moral machines: ceaching robots right from wrong”, Oxford University Press, 2008.

21AD1908	BIG DATA MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand about big data
- To learn and use NoSQL big data management
- To learn mapreduce analytics using Hadoop and related tools.
- To work with map reduce applications
- To understand the usage of Hadoop related tools for Big Data Analytics
- To implement real time applications

UNIT - I UNDERSTANDING BIG DATA 9

What is big data – why big data – convergence of key trends – unstructured data – 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 – Introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.

UNIT - II NOSQL DATA MANAGEMENT 9

Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – sharding – master-slave replication – peer-peer replication – sharding and replication – consistency – relaxing consistency – version stamps – map-reduce – partitioning and combining – composing map-reduce calculations- Case study: Apache Cassandra.

UNIT - III BASICS OF HADOOP 9

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures- installing Hadoop.

UNIT - IV **MAPREDUCE APPLICATIONS** **9**

MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats- Implement Matrix Multiplication.

UNIT - V **HADOOP RELATED TOOLS** **9**

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis.Cassandra – cassandra data model – cassandra examples – cassandra clients – Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries, Installation of Hive.

TOTAL: 45 PERIODS

OUTCOME:

CO1: Describe big data and use cases from selected business domains.

CO2: Explain NoSQL big data management

CO3: Install, configure, and run Hadoop and HDFS

CO4: Perform map-reduce analytics using Hadoop.

CO5: Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

CO6: Implement real time applications.

TEXT BOOKS:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. Tom White, Hadoop The Definitive Guide, O‟Reilly, 4th Edition, 2015.

REFERENCES:

1. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012

2. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.

3. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.

Vertical II Full Stack Development

21IT1901	OPEN SOURCE TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the difference between open-source software and commercial software.
- Understand the policies, licensing procedures and ethics of FOSS.
- Understand open-source philosophy, methodology and ecosystem.
- Awareness with Open-Source Technologies
- Knowledge to start, manage open-source projects

UNIT - I INTRODUCTION 9

Introduction to Open-Source: Open Source, Need and Principles of OSS, Open-Source Standards, Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Vs. Proprietary Software, Free Software Vs. Open-Source Software, Public Domain. History of free software, Proprietary Vs Open-Source Licensing Model, use of Open- Source Software, FOSS does not mean no cost. History: BSD, The Free Software Foundation and the GNU Project.

UNIT- II OPEN-SOURCE PRINCIPLES AND METHODOLOGY 9

Open-Source History, OpenSource Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open-Source Software Development, Licenses, Copyright vs. Copy left, Patents, Zero marginal cost, Income-generation Opportunities, Internationalization - Licensing: What is a License, How to create your own Licenses, Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT- III OPEN SOURCE PROJECT 9

Starting and maintaining own Open-Source Project, Open-Source Hardware, Open-Source Design, Open-source Teaching, Open-source media.Collaboration: Community and Communication, Contributing to OpenSource Projects Introduction to GitHub, interacting with the community on GitHub, Communication and etiquette, testing open-source code, reporting issues, contributing code. Introduction to Wikipedia, contributing to Wikipedia or contributing to any prominent open-source project of student's choice

UNIT- IV UNDERSTANDING OPEN-SOURCE ECOSYSTEM 9

Open-Source Operating Systems: GNU/Linux, Android, Free BSD, Open Solaris. Open-Source Hardware, Virtualization Technologies, Containerization Technologies: Docker, Development tools, IDEs, Debuggers, Programming languages, LAMP, Open-Source Database technologies.

UNIT V OPEN SOURCE ETHICS & CASE STUDIES 9

Open Source Ethics – Open Vs Closed Source – Government – Ethics – Impact of Open source Technology – Shared Software – Shared Source.Example Projects: Apache web server, GNU/Linux, Android, Mozilla (Firefox), Wikipedia, Drupal, wordpress, GCC, GDB, github, Free BSD, Open Solaris, Open Office. Open Source Hardware, Virtualization Technologies, Containerization Technologies: Docker, Development tools, IDEs, debuggers, Programming languages, LAMP, Open Source database technologies.

Study: Understanding the developmental models, licensing, mode of funding, commercial/non-commercial use.

TOTAL: 45 PERIODS

OUTCOMES:

On Completion of the course, the students should be able to:

CO1: Differentiate between Open Source and Proprietary software and Licensing.

CO2: Understand the policies, licensing procedures and ethics of FOSS

CO3: Build and modify one or more Free and Open Source Software packages.

CO4: Recognize the applications, benefits and features of Open-Source Technologies

CO5: Contribute software to and interact with Free and Open Source Software development projects.

CO6: Gain knowledge to start, manage open-source projects.

TEXT BOOKS

1. Kailash Vadera, Bhavyesh Gandhi, "Open Source Technology", Laxmi Publications Pvt Ltd 2012, 1st Edition.
2. Open Source Software, P.Rizwan Ahmed, Margham Publication, Chennai, 2015

REFERENCES

1. Fadi P. Deek and James A. M. McHugh, "Open Source: Technology and Policy", Cambridge Universities Press 2009.
2. "Open-Source Technology", Kailash Vadera&Bhavyesh Gandhi, University Science Press, Laxmi Publications, 2009
3. Unix Concepts and Applications by Sumitabha Das, Tata McGraw Hill Education, 2006
4. The official Ubuntu Book, 8th Edition
5. "Perspectives on Free and Open-Source Software", Clay Shirky and Michael Cusumano, MIT press.
6. "Understanding Open Source and Free Software Licensing", Andrew M. St. Laurent, O'Reilly Media.
7. "Open Source for the Enterprise", Dan Woods, GautamGuliani, O'Reilly Media
8. Linux kernel Home: http://kernel.org4
9. Open-Source Initiative: https://opensource.org/5
10. The Linux Foundation: http://www.linuxfoundation.org/
11. The Linux Documentation Project: http://www.tldp.org/2
12. Docker Project Home: http://www.docker.com3.
13. Linux Documentation Project: http://www.tldp.org/6
14. Wikipedia: https://en.wikipedia.org/7.https://en.wikipedia.org/wiki/Wikipedia:Contributing_to_Wikipedia8
15. GitHub: https://help.github.com/9.

The Linux Foundation:http://www.linuxfoundation.org/

21IT1902	APP DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn development of native applications with basic GUI Components
- To develop cross-platform applications with event handling
- To develop applications with location and data storage capabilities
- To develop web applications with database access

UNIT I FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT 9

Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, What is Progressive Web App, Responsive Web design,

UNIT II NATIVE APP DEVELOPMENT USING JAVA 9

Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Dev elopment Frameworks, Java & Kotlin for Android, Swift & Objective-C for iOS, Basics of React Native, Native Components, JSX, State, Props

UNIT III HYBRID APP DEVELOPMENT 9

Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks, Ionic, Apache Cordova,

UNIT IV CROSS-PLATFORM APP DEVELOPMENT USING REACT-NATIVE 9

What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross-platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native, Native Components, JSX, State, Props

UNIT V NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS 9

Comparison of different App frameworks, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Development, UI/UX, Reusability

OUTCOMES:

On Completion of the course, the students should be able to:

CO1:Develop Native applications with GUI Components.

CO2: Develop hybrid applications with basic event handling.

CO3: Implement cross-platform applications with location and data storage capabilities.

CO4: Implement cross platform applications with basic GUI and event handling.

CO5: Develop web applications with cloud database access.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Head First Android Development, Dawn Griffiths, O'Reilly, 1st edition, November 2021
2. Apache Cordova in Action, Raymond K. Camden, Manning. 2015
3. Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, FullStack publishing, 2019.

REFERENCES

1. Android Programming for Beginners, John Horton, Packt Publishing, 2nd Edition, 2018.
2. Native Mobile Development by Shaun Lewis, Mike Dunn, November 2019
3. Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An ActiveLearning Approach, Pawan Lingras, Matt Triff, Rucha Lingras, 2015
4. Apache Cordova 4 Programming, John M Wargo, 2015
5. React Native Cookbook, Daniel Ward, Packt Publishing, 2nd Edition, 2019.

21CS1903	CLOUD SERVICES MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Introduce Cloud Service Management terminology, definition & concepts
- Compare and contrast cloud service management with traditional IT service management
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloudservices
- Select appropriate structures for designing, deploying and running cloud-based services ina business environment
- Illustrate the benefits and drive the adoption of cloud-based services to solve real worldproblems

UNIT I CLOUD SERVICE MANAGEMENT FUNDAMENTALS 9

Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, CloudService Deployment Models

UNIT II CLOUD SERVICES STRATEGY 9

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture

UNIT III CLOUD SERVICE MANAGEMENT 9

Cloud Service Reference Model, Cloud Service LifeCycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service OperationsManagement

UNIT IV CLOUD SERVICE ECONOMICS 9

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models

UNIT V CLOUD SERVICE GOVERNANCE & VALUE 9

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership.

TOTAL : 45 PERIODS

OUTCOMES:

On Completion of the course, the students should be able to:

CO1: Understand Cloud Service Management terminology, definition & concepts

CO2: Compare and contrast cloud service management with traditional IT service management

CO3: Build and automate business solutions using cloud technologies.

CO4: Identify strategies to reduce risk and eliminate issues associated with adoption of Cloud services

CO5: Select appropriate structures for designing, deploying and running cloud-based services In business environment

CO6: Illustrate the benefits and drive the adoption of cloud-based services to solve real worldproblems

TEXT BOOKS

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era byEnamul Haque, Enel Publications,2020.
2. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini,Zaigham Mohammad ,2013.
3. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour,2017.

REFERENCES

1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya,Christian Vechhiola, S. Thamarai Selvi

21IT1903	UI AND UX DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- To understand the various Research Methods used in Design
- To explore the various Tools used in UI & UX
- Creating a wireframe and prototype

UNIT I FOUNDATIONS OF DESIGN 9

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking -Brainstorming and Game storming - Observational Empathy

UNIT II FOUNDATIONS OF UI DESIGN 9

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles –Branding - Style Guides

UNIT III FOUNDATIONS OF UX DESIGN 9

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know aboutBusiness Goals

UNIT IV WIREFRAMING, PROTOTYPING AND TESTING 9

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools
- Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration

UNIT V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE 9

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - CreatingPersonas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Understand the various Research Methods used in Design

CO2: Build UI for user Applications

CO3: Evaluate UX design of any product or application

CO4: Demonstrate UX Skills in product development

CO5: Implement Sketching principles

CO6: Create Wireframe and Prototype

TEXT BOOKS

1. Joel Marsh, “UX for Beginners”, O’Reilly , 2022
2. Jon Yablonski, “Laws of UX using Psychology to Design Better Product & Services” O’Reilly 2021

REFERENCES

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, “Designing Interface” 3 rd Edition , O’Reilly2020
2. Steve Schoger, Adam Wathan “Refactoring UI”, 2018
3. Steve Krug, “Don't Make Me Think, Revisited: A Commonsense Approach to Web &Mobile”, Third Edition, 2015
4. https://www.nngroup.com/articles/
5. https://www.interaction-design.org/literature.

21IT1904	SOFTWARE TESTING AND AUTOMATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of software testing
- To learn how to do the testing and planning effectively
- To build test cases and execute them
- To focus on wide aspects of testing and understanding multiple facets of testing
- To get an insight about test automation and the tools used for test automation

UNIT I FOUNDATIONS OF SOFTWARE TESTING 9

Why do we test Software?, Black-Box Testing and White-Box Testing, Software Testing Life Cycle,V-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing

UNIT II TEST PLANNING 9

The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting,Metrics and Statistics.

UNIT III TEST DESIGN AND EXECUTION 9

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.

UNIT IV ADVANCED TESTING CONCEPTS 9

Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, Testing in the Agile Environment, Testing Web and Mobile Applications.

UNIT V TEST AUTOMATION AND TOOLS 9

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Understand the basic concepts of software testing and the need for software testing

CO2: Design Test planning and different activities involved in test planning

CO3: Design effective test cases that can uncover critical defects in the application

CO4: Focus on wide aspects of testing

CO5: Understand multiple facets of testing

CO6: Automate the software testing using Selenium and TestNG

TEXTBOOKS

1. Yogesh Singh, “Software Testing”, Cambridge University Press, 2012
2. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" - SecondEdition 2018

REFERENCES

1. Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition,2012, John Wiley & Sons, Inc.
2. Ron Patton, Software testing, 2nd Edition, 2006, Sams Publishing
3. Paul C. Jorgensen, Software Testing: A Craftsman’s Approach, Fourth Edition, 2014, Taylor& Francis Group.
4. Carl Cocchiaro, Selenium Framework Design in Data-Driven Testing, 2018, Packt Publishing.
5. Elfriede Dustin, Thom Garrett, Bernie Gaurf, Implementing Automated Software Testing,2009, Pearson Education, Inc.
6. Satya Avasarala, Selenium WebDriver Practical Guide, 2014, Packt Publishing.
7. Varun Menon, TestNg Beginner's Guide, 2013, Packt Publishing.

		L	T	P	C
21IT1905	**WEB APPLICATION SECURITY**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To understand the fundamentals of web application security
- To focus on wide aspects of secure development and deployment of web applications
- To learn how to build secure APIs
- To learn the basics of vulnerability assessment and penetration testing
- To get an insight about Hacking techniques and Tools

UNIT I FUNDAMENTALS OF WEB APPLICATION SECURITY 9

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation.

UNIT II SECURE DEVELOPMENT AND DEPLOYMENT 9

Web Applications Security - Security Testing, Security Incident Response Planning,The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)

UNIT III SECURE API DEVELOPMENT 9

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys , OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

UNIT IV VULNERABILITY ASSESSMENT AND PENETRATION TESTING 9

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerabilityscanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database- based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

UNIT V HACKING TECHNIQUES AND TOOLS 9

Social Engineering, Injection, Cross-Site Scripting(XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite.

TOTAL :45 PERIODS

OUTCOMES:

CO1: Understanding the basic concepts of web application security and the need for it
CO2: Be acquainted with the process for secure development and deployment of web applications
CO3: Acquire the skill to design and develop Secure Web Applications that use Secure APIs
CO4: Be able to get the importance of carrying out vulnerability assessment and penetration testing
CO5: Acquire the skill to think like a hacker and to use hackers tool sets

TEXT BOOKS

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw- Hill Companies.
3. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

REFERENCES

1. Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing,Inc.
2. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.
3. Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.
4. Malcom McDonald, Web Security for Developers, 2020, No Starch Press, Inc.
5. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, The McGraw-Hill Companies.

21IT1906	DEVOPS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce DevOps terminology, definition & concepts
- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
- To understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve realworld problems

UNIT I INTRODUCTION TO DEVOPS 9

Devops Essentials - Introduction to AWS, GCP, Azure - Version control systems: Git and Github - Gerrit Code review.

UNIT II COMPILE AND BUILD USING MAVEN , GRADLE & ANT 9

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle – Introduction to ANT- Installation of ANT – Understand and Build using ANT.

UNIT III CONTINUOUS INTEGRATION USING JENKINS 9

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT IV CONFIGURATION MANAGEMENT USING ANSIBLE 9

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

UNIT V BUILDING DEVOPS PIPELINES USING AZURE 9

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Builda sample code, Modify azure-pipelines.yaml file - Testing and Monitoring - Selenium, Jira, ELK

OUTCOMES:

CO1: Understand different actions performed through Version control tools like Git.

CO2: Perform Continuous Integration and Continuous Testing and Continuous Deploymentusing Jenkins by building and automating test cases using Maven & Gradle.

CO3: Ability to Perform Automated Continuous Deployment

CO4: Ability to do configuration management using Ansible

CO5: Understand to leverage Cloud-based DevOps tools using Azure DevOps

TOTAL:45 PERIODS

TEXT BOOKS

1. Roberto Vormittag, “A Practical Guide to Git and GitHub for Windows Users: From Beginnerto Expert in Easy Step-By-Step Exercises”, Second Edition, Kindle Edition, 2016.
2. Jason Cannon, “Linux for Beginners: An Introduction to the Linux Operating System and Command Line”, Kindle Edition, 2014

REFERENCES

1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020
2. by Mitesh Soni
3. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", FirstEdition, 2015.
4. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible forDevOps", Second Edition, 2016.
5. Mariot Tsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to VersionControl, Project Management, and Teamwork for the New Developer", Second Edition, 2019.
6. https://www.jenkins.io/user-handbook.pdf
7. https://maven.apache.org/guides/getting-started/

21IT1907	PRINCIPLES OF PROGRAMMING LANGUAGES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand and describe syntax and semantics of programming languages
- To understand data, data types, and basic statements
- To understand call-return architecture and ways of implementing them
- To understand object-orientation, concurrency, and event handling in programming languages
- To develop programs in non-procedural programming paradigms

UNIT I SYNTAX AND SEMANTICS 9

Evolution of programming languages – describing syntax – context-free grammars – attribute grammars – describing semantics – lexical analysis – parsing – recursive-descent – bottom up parsing

UNIT II DATA, DATA TYPES, AND BASIC STATEMENTS 9

Names – variables – binding – type checking – scope – scope rules – lifetime and garbage collection – primitive data types – strings – array types – associative arrays – record types –union types – pointers and references – Arithmetic expressions – overloaded operators –type conversions – relational and boolean expressions – assignment statements – mixed mode assignments – control structures – selection – iterations – branching – guarded statements

UNIT III SUBPROGRAMS AND IMPLEMENTATIONS 9

Subprograms – design issues – local referencing – parameter passing – overloaded methods – generic methods – design issues for functions – semantics of call and return – implementing simple subprograms – stack and dynamic local variables – nested subprograms – blocks – dynamic scoping

UNIT IV OBJECT-ORIENTATION, CONCURRENCY, AND EVENT HANDLING 9

Object-orientation – design issues for OOP languages – implementation of object-oriented constructs – concurrency – semaphores – monitors – message passing – threads – statement level concurrency – exception handling – event handling

UNIT V FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES 9

Introduction to lambda calculus– fundamentals of functional programming languages – Programming with Scheme – Programming with ML – Introduction to logic and logic programming – Programming with Prolog – multi-paradigm languages

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Describe syntax and semantics of programming languages
CO2: Explain data, data types, and basic statements of programming languages
CO3: Design and implement subprogram constructs
CO4: Apply object-oriented, concurrency, and event handling programming constructs and Develop programs in Scheme, ML, and Prolog
CO5: Understand and adopt new programming languages

TEXT BOOKS

1. Robert W. Sebesta, "Concepts of Programming Languages", Twelfth Edition (GlobalEdition), Pearson, 2022.
2. Michael L. Scott, "Programming Language Pragmatics", Fourth Edition, Elsevier, 2018.
3. R. Kent Dybvig, "The Scheme programming language", Fourth Edition, Prentice Hall, 2011.
4. Jeffrey D. Ullman, "Elements of ML programming", Second Edition, Pearson, 1997.
5. W. F. Clocksin and C. S. Mellish, "Programming in Prolog: Using the ISO Standard", FifthEdition, Springer, 2003.

Vertical III Cloud Computing and Data Center Technologies

21CS1901	CLOUD TOOLS AND TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gain expertise in Virtualization, Virtual Machines and deploy practical virtualization solution
- To understand the architecture, infrastructure and delivery models of cloud computing
- To explore the roster of AWS services and illustrate the way to make applications in AWS
- To gain knowledge in the working of Windows Azure and Storage services offered by Windows Azure
- To develop the cloud application using various programming model of Hadoop and Aneka

UNIT I CLOUD PLATFORM ARCHITECTURE 9

Cloud Computing: Definition, Characteristics - Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software- A Generic Cloud Architecture Design – Layered cloud Architectural Development – Architectural Design Challenges

UNIT II VIRTUALIZATION AND VIRTUALIZATION INFRASTRUCTURE 9

Basics of Virtual Machines - Taxonomy of Virtual Machines - Virtualization – Management Virtualization — Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization - Implementation levels of virtualization – Virtualization structure – Virtualization of CPU, Memory and I/O devices – Virtual clusters and Resource Management – Virtualization for data center automation

UNIT III PAAS CLOUD PLATFORM 9

Windows Azure: Origin of Windows Azure, Features, The Fabric Controller – First Cloud APP in Windows Azure- Service Model and Managing Services: Definition and Configuration, Service runtime API- Windows Azure Developer Portal- Service Management API- Windows Azure Storage Characteristics-Storage Services-REST API- Blops

UNIT IV AWS CLOUD PLATFORM – IAAS 9

Amazon Web Services: AWS Infrastructure- AWS API- AWS Management Console - Setting up AWS Storage - Stretching out with Elastic Compute Cloud - Elastic Container Service for Kubernetes- AWS Developer Tools: AWS Code Commit, AWS Code Build, AWS Code Deploy, AWS Code Pipeline, AWS code Star - AWS Management Tools: Cloud Watch, AWS Auto Scaling, AWS control Tower, Cloud Formation, Cloud Trail, AWS License Manager.

UNIT V PROGRAMMING MODEL 9

Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job –Developing Map Reduce Applications - Design of Hadoop file system –Setting up Hadoop Cluster- Aneka: Cloud Application Platform, Thread Programming, Task Programming and Map-Reduce Programming in Aneka.

OUTCOMES:

CO1: Employ the concepts of virtualization in the cloud computing
CO2: Identify the architecture, infrastructure and delivery models of cloud computing
CO3: Develop the Cloud Application in AWS platform
CO4: Apply the concepts of Windows Azure to design Cloud Application
CO5: Develop services using various Cloud computing programming models.

TEXT BOOKS **TOTAL: 45 PERIODS**

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, “Distributed and Cloud Computing, FromParallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.
2. James Turnbull, “The Docker Book”, O’Reilly Publishers, 2014.
3. Krutz, R. L., Vines, R. D, “Cloud security. A Comprehensive Guide to Secure CloudComputing”, Wiley Publishing, 2010.

REFERENCES

1. Bernard Golden, Amazon Web Service for Dummies, John Wiley & Sons, 2013.
2. Raoul Alongi, AWS: The Most Complete Guide to Amazon Web Service from Beginner to Advanced Level, Amazon Asia- Pacific Holdings Private Limited, 2019. 3. Sriram Krishnan, Programming: Windows Azure, O’Reilly,2010
3. Sriram Krishnan, Programming: Windows Azure, O’Reilly,2010
4. Rajkumar Buyya, Christian Vacchiola, S.Thamarai Selvi, Mastering Cloud Computing , MCGraw Hill Education (India) Pvt. Ltd., 2013.
5. Danielle Ruest, Nelson Ruest, ―Virtualization: A Beginner‟s Guide‖, McGraw-Hill Osborne Media, 2009. Jim Smith, Ravi Nair , "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
6. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010
7. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
8. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.

21CS1902	VIRTUALIZATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Learn the basics and types of Virtualization
- To understand the Hypervisors and its types
- To Explore the Virtualization Solutions
- To Experiment the virtualization platforms

UNIT I INTRODUCTION TO VIRTUALIZATION 9

Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations- Types of hardware virtualization: Full virtualization - partial virtualization – Para virtualization-Types of Hypervisors

UNIT II SERVER AND DESKTOP VIRTUALIZATION 9

Virtual machine basics- Types of virtual machines- Understanding Server Virtualization- types of server virtualization- Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform-Desktop Virtualization-Types of Desktop Virtualization

UNIT III NETWORK VIRTUALIZATION 9

Introduction to Network Virtualization-Advantages- Functions-Tools for Network Virtualization- VLAN-WAN Architecture-WAN Virtualization

UNIT IV STORAGE VIRTUALIZATION 9

Memory Virtualization-Types of Storage Virtualization-Block, File-Address space Remapping-Risksof Storage Virtualization-SAN-NAS-RAID

UNIT V VIRTUALIZATION TOOLS 9

VM Ware-Amazon AWS-Microsoft Hyper V- Oracle VM Virtual Box - IBM Power VM- Google Virtualization-Case study.

OUTCOMES:

CO1: Analyze the virtualization concepts and Hypervisor

CO2: Apply the Virtualization for real-world applications

CO3: Install & Configure the different VM platforms

CO4: Experiment with the VM with various software

TOTAL:45 PERIODS

TEXT BOOKS

1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter,TATA McGraw- Hill , New Delhi – 2010
2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg,Andrzej Goscinski, John Wiley & Sons, Inc. 2011
3. David Marshall, Wade A. Reynolds, Dave McCrory , Advanced Server Virtualization: VMware and MicrosoftPlatform in the Virtual Data Center, Auerbach,2006
4. Chris Wolf, Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", APress,2005.

REFERENCES

1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems andProcesses", Elsevier/Morgan Kaufmann, 2005.
2. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and MicrosoftPlatform in the Virtual Data Center", Auerbach Publications, 2006.

21CS1904	STORAGE TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Characterize the functionalities of logical and physical components of storage
- Describe various storage networking technologies
- Identify different storage virtualization technologies
- Discuss the different backup and recovery strategies
- Understand common storage management activities and solutions

UNIT I STORAGE SYSTEMS 9

Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center, Compute systems and compute virtualizationand Software-defined data center.

UNIT II INTELLIGENT STORAGE SYSTEMS AND RAID 5

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and scale- out storage Architecture**.**

UNIT III STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION 13

Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage. Fibre Channel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol,connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.

UNIT IV BACKUP, ARCHIVE AND REPLICATION 12

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration,
Disaster Recovery as a Service(DRaaS)**.**

UNIT V SECURING STORAGE INFRASTRUCTURE 6

Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance, Storage infrastructuremanagement functions, Storage infrastructure mana gement processes.

OUTCOMES:

CO1: Demonstrate the fundamentals of information storage management and various models ofCloud infrastructure services and deployment

CO2: Illustrate the usage of advanced intelligent storage systems and RAID

CO3: Interpret various storage networking architectures - SAN, including storage subsystems andvirtualization

CO4: Examine the different role in providing disaster recovery and remote replication technologies

CO5: Infer the security needs and security measures to be employed in information storagemanagement

TOTAL: 45 PERIODS

TEXTBOOKS

1. EMC Corporation, Information Storage and Management, Wiley, India,2012
2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017
3. Ulf Troppens,Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein, Storage Networks Explained, Second Edition, Wiley, 2009

21IT1919	SOFTWARE DEFINED NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the need for SDN and its data plane operations
- To understand the functions of control plane
- To comprehend the migration of networking functions to SDN environment
- To explore various techniques of network function virtualization
- To comprehend the concepts behind network virtualization

UNIT I SDN: INTRODUCTION 9

Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane , Control plane and Application Plane

UNIT II SDN DATA PLANE AND CONTROL PLANE 9

Data Plane functions and protocols - OpenFLow Protocol - Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface – SDN Controllers - Ryu, OpenDaylight, ONOS - Distributed Controllers

UNIT III SDN APPLICATIONS 9

SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering – Measurement and Monitoring – Security – Data Center Networking

UNIT IV NETWORK FUNCTION VIRTUALIZATION 9

Network Virtualization - Virtual LANs – OpenFlow VLAN Support - NFV Concepts – Benefits and Requirements – Reference Architecture

UNIT V NFV FUNCTIONALITY 9

NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases – SDN and NFV

TOTAL : 45 PERIODS

OUTCOMES:

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

CO1: Describe the motivation behind SDN
CO2: Identify the functions of the data plane and control plane
CO3: Design and develop network applications using SDN
CO4: Orchestrate network services using NFV
CO5: Explain various use cases of SDN and NFV

TEXTBOOKS:

1. William Stallings, “Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud”, Pearson Education, 1st Edition, 2015.

REFERENCES:

1. Ken Gray, Thomas D. Nadeau, “Network Function Virtualization”, Morgan Kauffman, 2016.
2. Thomas D Nadeau, Ken Gray, “SDN: Software Defined Networks”, O’Reilly Media, 2013.
3. Fei Hu, “Network Innovation through OpenFlow and SDN: Principles and Design”, 1st Edition, CRC Press, 2014.
4. Paul Goransson, Chuck Black Timothy Culver, “Software Defined Networks: A Comprehensive Approach”, 2nd Edition, Morgan Kaufmann Press, 2016.
5. Oswald Coker, Siamak Azodolmolky, “Software-Defined Networking with OpenFlow”, 2nd Edition, O’Reilly Media, 2017.

C21CS1906	STREAM PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Introduce Data Processing terminology, definition & concepts
- Define different types of Data Processing
- Explain the concepts of Real-time Data processing
- Select appropriate structures for designing and running real-time data services in abusiness environment
- Illustrate the benefits and drive the adoption of real-time data services to solve real worldproblems

UNIT I FOUNDATIONS OF DATA SYSTEMS 9

Introduction to Data Processing, Stages of Data processing, Data Analytics, Batch Processing, Stream processing, Data Migration, Transactional Data processing, Data Mining, Data Management Strategy, Storage, Processing, Integration, Analytics, Benefits of Data as a Service, Challenges

UNIT II REAL-TIME DATA PROCESSING 9

Introduction to Big data, Big data infrastructure, Real-time Analytics, Near real-time solution, Lambda architecture, Kappa Architecture, Stream Processing, Understanding Data Streams, Message Broker, Stream Processor, Batch & Real-time ETL tools, Streaming Data Storage

UNIT III DATA MODELS AND QUERY LANGUAGES 9

Relational Model, Document Model, Key-Value Pairs, NoSQL, Object-Relational Mismatch, Many- to-One and Many-to-Many Relationships, Network data models, Schema Flexibility, Structured Query Language, Data Locality for Queries, Declarative Queries, Graph Data models, Cypher QueryLanguage, Graph Queries in SQL, The Semantic Web, CODASYL, SPARQL

UNIT IV EVENT PROCESSING WITH APACHE KAFKA 9

Apache Kafka, Kafka as Event Streaming platform, Events, Producers, Consumers, Topics, Partitions, Brokers, Kafka APIs, Admin API, Producer API, Consumer API, Kafka Streams API, Kafka Connect API.

UNIT V REAL-TIME PROCESSING USING SPARK STREAMING 9

Structured Streaming, Basic Concepts, Handling Event-time and Late Data, Fault-tolerant Semantics, Exactly-once Semantics, Creating Streaming Datasets, Schema Inference, Partitioningof Streaming datasets, Operations on Streaming Data, Selection, Aggregation, Projection, Watermarking, Window operations, Types of Time windows, Join Operations, Deduplication

OUTCOMES:

CO1: Understand the applicability and utility of different streaming algorithms.

CO2: Describe and apply current research trends in data-stream processing.

CO3: Analyze the suitability of stream mining algorithms for data stream systems.

CO4: Program and build stream processing systems, services and applications.

CO5: Solve problems in real-world applications that process data streams.

TOTAL: 45 PERIOD

TEXT BOOKS

1. Streaming Systems: The What, Where, When and How of Large-Scale Data Processing byTyler Akidau, Slava Chemyak, Reuven Lax, O'Reilly publication,2018
2. Designing Data-Intensive Applications by Martin Kleppmann, O'Reilly Media,2017
3. Practical Real-time Data Processing and Analytics : Distributed Computing and EventProcessing using Apache Spark, Flink, Storm and Kafka, Packt Publishing,2017

REFERENCES

1. https://spark.apache.org/docs/latest/streaming-programming-guide.html
2. Kafka.apache.org

21CS1907	SECURITY AND PRIVACY IN CLOUD	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Introduce Cloud Computing terminology, definition & concepts
- To understand the security design and architectural considerations for Cloud
- To understand the Identity, Access control in Cloud
- To follow best practices for Cloud security using various design patterns
- To be able to monitor and audit cloud applications for security

UNIT I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 9

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Non- repudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 9

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protectionstrategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key

UNIT III ACCESS CONTROL AND IDENTITY MANAGEMENT 9

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options
- OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention

UNIT IV CLOUD SECURITY DESIGN PATTERNS 9

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud

UNIT V MONITORING, AUDITING AND MANAGEMENT 9

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management

OUTCOMES:

CO1: Understand the cloud concepts and fundamentals.
CO2: Explain the security challenges in the cloud.
CO3: Define cloud policy and Identity and Access Management.
CO4: Understand various risks and audit and monitoring mechanisms in the cloud.
CO5: Define the various architectural and design considerations for security in the cloud.

TOTAL:45 PERIODS

TEXTBOOKS

1. Raj Kumar Buyya , James Broberg, andrzejGoscinski, "Cloud Computing:‖, Wiley 2013
2. Dave shackleford, "Virtualization Security‖, SYBEX a wiley Brand 2013.
3. Mather, Kumaraswamy and Latif, "Cloud Security and Privacy‖, OREILLY 2011

REFERENCES

1. Mark C. Chu-Carroll "Code in the Cloud‖,CRC Press, 2011
2. Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya,Christian Vechhiola, S. ThamaraiSelvi,2013

Vertical IV Cyber Security and Data Privacy

21IT1908	ETHICAL HACKING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of computer based vulnerabilities.
- To explore different foot printing, reconnaissance and scanning methods.
- To expose the enumeration and vulnerability analysis methods.
- To understand hacking options available in Web and wireless applications.
- To explore the options for network protection.
- To practice tools to perform ethical hacking to expose the vulnerabilitie.UNIT I INTRODUCTION 9

Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security

UNIT II FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS 9

Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering - Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall

UNIT III ENUMERATION AND VULNERABILITY ANALYSIS 9

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss

UNIT IV SYSTEM HACKING 9

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade

UNIT V NETWORK PROTECTION SYSTEMS 9

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk AnalysisTools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network-Based andHost-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.

OUTCOMES:

At the end of this course, the students will be able:

CO1: To express knowledge on basics of computer based vulnerabilities

CO2: To gain understanding on different foot printing, reconnaissance and scanning methods.

CO3: To demonstrate the enumeration and vulnerability analysis methods

CO4: To gain knowledge on hacking options available in Web and wireless applications.

CO5: To acquire knowledge on the options for network protection.

CO6: To use tools to perform ethical hacking to expose the vulnerabilities.

TOTAL:45 PERIODS

TEXTBOOKS

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking andNetwork Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS,Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, DafyddStuttard and Marcus Pinto, 2011.

REFERENCES

1. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

21IT1909	DIGITAL AND MOBILE FORENSICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand basic digital forensics and techniques.
- To understand digital crime and investigation.
- To understand how to be prepared for digital forensic readinessTo understand and use forensics tools for iOS devices.
- To understand and use forensics tools for Android devices.

UNIT I INTRODUCTION TO DIGITAL FORENSICS 9

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase

UNIT II DIGITAL CRIME AND INVESTIGATION 9

Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence

UNIT III DIGITAL FORENSIC READINESS 9

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics

UNIT IV iOS FORENSICS 9

Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud

UNIT V ANDROID FORENSICS 9

Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools –Oxygen Forensics – MobilEdit – Android App Decompiling

OUTCOMES:

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

CO1: Have knowledge on digital forensics.

CO2: Know about digital crime and investigations.

CO3: Be forensic ready.

CO4: Investigate, identify and extract digital evidence from iOS devices.

CO5: Investigate, identify and extract digital evidence from Android devices.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Andre Arnes, “Digital Forensics”, Wiley, 2018.
2. Chuck Easttom, “An In-depth Guide to Mobile Device Forensics”, First Edition, CRCPress, 2022.

REFERENCES

1. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, CharlesRiver Media, 2005, ISBN: 1-58450-389.

21IT1910	SOCIAL NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To develop semantic web related simple applications
- To explain Privacy and Security issues in Social Networking
- To explain the data extraction and mining of social networks
- To discuss the prediction of human behavior in social communities
- To describe the Access Control, Privacy and Security management of social networks

UNIT I FUNDAMENTALS OF SOCIAL NETWORKING 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, Historical overview of privacy and security, Majorparadigms, for understanding privacy and security

UNIT II SECURITY ISSUES IN SOCIAL NETWORKS 9

The evolution of privacy and security concerns with networked technologies, Contextual influenceson privacy attitudes and behaviors, Anonymity in a networked world

UNIT III EXTRACTION AND MINING IN SOCIAL NETWORKING DATA 9

Extracting evolution of Web Community from a Series of 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, Big data and Privacy

UNIT IV PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES 9

Understanding and predicting human behavior 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, What is Neo4j, Nodes, Relationships,Properties.

UNIT V ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT 9

Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning

TOTAL:45 PERIODS

OUTCOMES:

CO1: Develop semantic web related simple applications
CO2 : Address Privacy and Security issues in Social Networking
CO3: Explain the data extraction and mining of social networks
CO4: Discuss the prediction of human behavior in social communities
CO5: Describe the applications of social networks

TEXT BOOKS

1. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
2. BorkoFurht, Handbook of Social Network Technologies and Application, First Edition,Springer, 2010.
3. Learning Neo4j 3.x Second Edition By Jérôme Baton, Rik Van Bruggen, Packt publishing, 2017
4. David Easley, Jon Kleinberg, Networks, Crowds, and Markets: Reasoning about a HighlyConnected World‖, First Edition, Cambridge University Press, 2010.

REFERENCES

1. Easley D. Kleinberg J., Networks, Crowds, and Markets – Reasoning about a Highly Connected World‖, Cambridge University Press, 2010.
2. Jackson, Matthew O., Social and Economic Networks‖, Princeton University Press, 2008.
3. GuandongXu ,Yanchun Zhang and Lin Li, ―Web Mining and Social Networking – Techniques and applications‖, First Edition, Springer, 2011.
4. Dion Goh and Schubert Foo, Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively‖, IGI Global Snippet, 2008.
5. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modeling‖, IGI Global Snippet, 2009.
6. John G. Breslin, Alexander Passant and Stefan Decker, The Social Semantic Web‖, Springer, 2009.

21IT1911	MODERN CRYPTOGRAPHY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about Modern Cryptography.
- To focus on how cryptographic algorithms and protocols work and how to use them.
- To build a Pseudorandom permutation.
- To construct Basic cryptanalytic techniques.
- To provide instruction on how to use the concepts of block ciphers and message authentication codes.

UNIT I INTRODUCTION 9

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations.

UNIT II FORMAL NOTIONS OF ATTACKS 9

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM-CPA and NM- CCA2, Inter-relations among the attack model

UNIT III RANDOM ORACLES 9

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudo- random Functions (PRF)

UNIT IV BUILDING A PSEUDORANDOM PERMUTATION 9

The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction.

UNIT V MESSAGE AUTHENTICATION CODES 9

Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC,Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes:One-way functions Imply Secure One-time Signatures. Shamir's Secret Sharing Scheme. Formally Analyzing Cryptographic Protocols. Zero Knowledge Proofs and Protocols.

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Interpret the basic principles of cryptography and general cryptanalysis.

CO2: Determine the concepts of symmetric encryption and authentication.

CO3: Identify the use of public key encryption, digital signatures, and key establishment.

CO4: Articulate the cryptographic algorithms to compose, build and analyze simple cryptographicsolutions.

CO5: Express the use of Message Authentication Codes.

TEXT BOOKS:

1. Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications,Springer Verlag, 2002.
2. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low PricedEdition), 2016.
3. Introduction to Modern Cryptography: Principles and Protocols (Chapman & Hall/CRC Cryptography and Network Security Series), 2007

REFERENCES:

1. ShaffiGoldwasser and MihirBellare, Lecture Notes on Cryptography, Available at http://citeseerx.ist.psu.edu/.
2. OdedGoldreich, Foundations of Cryptography, CRC Press (Low Priced Edition Available),Part 1 and Part 23, 2009.
3. William Stallings, “Cryptography and Network Security: Principles and Practice”, PHI 3rdEdition, 2006.

21IT1912	ENGINEERING SECURE SOFTWARE SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Know the importance and need for software security.
- Know about various attacks.
- Learn about secure software design.
- Understand risk management in secure software development.
- Know the working of tools related to software security.

UNIT I NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS 9

Software Assurance and Software Security - Threats to software security - Sources of software insecurity - Benefits of Detecting Software Security - Properties of Secure Software – Memory- Based Attacks: Low-Level Attacks Against Heap and Stack - Defense Against Memory-Based Attacks

UNIT II SECURE SOFTWARE DESIGN 9

Requirements Engineering for secure software - SQUARE process Model - Requirements elicitation and prioritization- Isolating The Effects of Untrusted Executable Content - Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection - Session Hijacking. Secure Design - Threat Modeling and Security Design Principles

UINT III SECURITY RISK MANAGEMENT 9

Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation andMitigation – Risk Assessment Techniques – Threat and Vulnerability Management

UNIT IV SECURITY TESTING 9

Traditional Software Testing – Comparison - Secure Software Development Life Cycle - Risk Based Security Testing – Prioritizing Security Testing With Threat Modeling – Penetration Testing – Planning and Scoping - Enumeration – Remote Exploitation – Web Application Exploitation -Exploits and Client Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection - Tools for Penetration Testing

UNIT V SECURE PROJECT MANAGEMENT 9

Governance and security - Adopting an enterprise software security framework - Security andproject management - Maturity of Practice

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Identify various vulnerabilities related to memory attacks.

CO2: Apply security principles in software development.

CO3: Evaluate the extent of risks.

CO4: Involve selection of testing techniques related to software security in the testing phase ofsoftware development.

CO5: Use tools for securing software.

TEXT BOOKS:

1. Julia H. Allen, “Software Security Engineering”, Pearson Education, 2008
2. Evan Wheeler, “Security Risk Management: Building an Information Security Risk Management Program from the Ground Up”, First edition, Syngress Publishing, 2011
3. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, “The Art of Software SecurityTesting: Identifying Software Security Flaws (Symantec Press)”, Addison-Wesley Professional,2006

REFERENCES:

1. Robert C. Seacord, “Secure Coding in C and C++ (SEI Series in Software Engineering)”, Addison-Wesley Professional, 2005.
2. Jon Erickson, “Hacking: The Art of Exploitation”, 2nd Edition, No Starch Press, 2008.
3. Mike Shema, “Hacking Web Apps: Detecting and Preventing Web Application Security Problems”, First edition, Syngress Publishing, 2012
4. Bryan Sullivan and Vincent Liu, “Web Application Security, A Beginner's Guide”, Kindle Edition, McGraw Hill, 2012
5. Lee Allen, “Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)”, Kindle Edition, Packt Publishing,2012
6. Jason Grembi, Secure Software Development: A Security Programmer's Guide, 2008.

21IT1913	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of Blockchain
- To learn Different protocols and consensus algorithms in Blockchain
- To learn the Blockchain implementation frameworks
- To understand the Blockchain Applications
- To experiment the Hyperledger Fabric, Ethereum networks

UNIT I INTRODUCTION TO BLOCKCHAIN 9

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree

UNIT II BITCOIN AND CRYPTOCURRENCY 9

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursorfor Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay

UNIT III BITCOIN CONSENSUS 9

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopolyproblem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool- Permissioned model and use cases.

UNIT IV HYPERLEDGER FABRIC & ETHEREUM 9

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

UNIT V BLOCKCHAIN APPLICATIONS 9

Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Understand emerging abstract models for Blockchain Technology

CO2: Identify major research challenges and technical gaps existing between theory and practicein the crypto currency domain.

CO3: Understand the function of Blockchain as a method of securingdistributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.

CO4: Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.

TEXT BOOKS

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. 2.Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly, 2014.

REFERENCES:

1. Daniel Drescher, “Blockchain Basics”, First Edition, Apress, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder.Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton UniversityPress, 2016.
3. Melanie Swan, “Blockchain: Blueprint for a New Economy”, O’Reilly, 2015
4. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Blockchain”, Packt Publishing, 2018.

Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

21IT1914	CYBER PHYSICAL SYSTEMS SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn about design of cyber-physical systems.
- To know about MATLAB usage.
- To learn about analysis of cyber-physical systems.
- How to implement safety assurance in these systems.
- To do the software analysis
- To know basic security measures to take in Cyber-Physical Systems

UNIT I INTRODUCTION TO CYBER-PHYSICAL SYSTEMS 6

Cyber-Physical Systems (CPS) in the real world, Basic principles of design and validation of CPS, Industry 4.0, AutoSAR, IIOT implications, Building Automation, Medical CPS.

UNIT II CPS - PLATFORM COMPONENTS 10

CPS - Platform components: CPS HW platforms - Processors, Sensors, Actuators, CPS Network - WirelessHart, CAN, Automotive Ethernet, CPS Sw stack – RTOS, Scheduling Real Time control tasks Principles of Automated Control Design: Dynamical Systems and Stability Controller Design Techniques, Stability Analysis: CLFs, MLFs, stability under slow switching, Performance under Packet drop and Noise

UNIT III USING MATLAB 9

Matlab toolboxes - Simulink, Stateflow CPS implementation: From features to software components, Mapping software components to ECUs, CPS Performance Analysis - effect of scheduling, bus latency, sense and actuation faults on control performance, network congestion

UNIT IV CPS SAFETY ASSURANCE AND SOFTWARE ANALYSIS 12

Formal Methods for Safety Assurance of Cyber-Physical Systems: Advanced Automata based modeling and analysis, Basic introduction, and examples, Timed and Hybrid Automata, Definition of trajectories, Formal Analysis: Flow pipe construction, reachability analysis Analysis of CPS Software: Weakest Pre-conditions, Bounded Model checking, CPS SW Verification: Frama-C, CBMC Secure Deployment of CPS: Attack models, Secure Task mapping and Partitioning, State estimation for attack detection Automotive Case study: Vehicle ABS hacking Power Distribution Case study: Attacks on Smart Grids

UNIT V CPS SECURITY 8

CPS vulnerabilities, threats, attacks & failures, CPS security threats, CPS vulnerabilities, Cyberphysical system attacks, CPS failures, Evaluating risks, Securing CPS, CPS security challenges, CPS security solutions, CPS forensics, Limitations, CPS protection recommendations

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After the completion of this course, student will be able to

CO1: Understand the core principles behind CPS.

CO2: Identify safety specifications and critical properties.

CO3: Understand abstraction in system designs.

CO4: Express pre and post conditions and invariants for CPS models.

CO5: Identify CPS security threats and do the software analysis.

TEXTBOOKS:

1. Raj Rajkumar, Dionisio De Niz , and Mark Klein, Cyber-Physical Systems, Addison-Wesley Professional, 2017.
2. Rajeev Alur, Principles of Cyber-Physical Systems, MIT Press, 2015.

REFERENCES

1. André Platzer, Logical Analysis of Hybrid Systems: Proving Theorems for Complex Dynamics., Springer, 2010. 426 pages,ISBN 978-3-642-14508-7.
2. Jean J. Labrosse, Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C, The publisher, Paul Temme, 2011.
3. Jean-Paul A. Yaacoub, Ola Salman, Hassan N. Noura, NesrineKaaniche, Ali Chehab, Mohamad Malli, "Cyber-physical systems security: Limitations, issues and future trends", Microprocessors and Microsystems, Vol 77, 2020, ISSN 0141-9331 (Unit 5)
4. Sajal Das, Krishna Kant, and Nan Zhang, “Handbook on Securing Cyber-Physical CriticalInfrastructure – Foundations & Challenges”, Morgan Kaufmann, 2012.
5. Awad, A.I., Furnell, S., Paprzycki, M., Sharma, S.K., Security in Cyber-Physical Systems Foundations and Applications, Springer International Publishing, 2021

Vertical V Creative Media

21CS1909	MULTIMEDIA AND ANIMATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To grasp the fundamental knowledge of Multimedia elements and systems
- To get familiar with Multimedia file formats and standards
- To learn the process of Authoring multimedia presentations
- To learn the techniques of animation in 2D and 3D and for the mobile UI
- To explore different popular applications of multimedia

UNIT I INTRODUCTION TO MULTIMEDIA 9

Definitions, Elements, Multimedia Hardware and Software, Distributed multimedia systems, challenges:security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata, Multimedia databases, Hypermedia, Multimedia Learning.

UNIT II MULTIMEDIA FILE FORMATS AND STANDARDS 9

File formats – Text, Image file formats, Graphic and animation file formats, Digital audio and Video file formats, Color in image and video, Color Models. Multimedia data and file formats for the web.

UNIT III MULTIMEDIA AUTHORING 9

Authoring metaphors, Tools Features and Types: Card and Page Based Tools, Icon and Object Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools, Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing Tools, audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning,simulations.

UNIT IV ANIMATION 9

Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation, Animation techniques: Keyframe, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, , Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.

UNIT V MULTIMEDIA APPLICATIONS 9

Multimedia Big data computing, social networks, smart phones, surveillance, Analytics, Multimedia Cloud Computing, Multimedia streaming cloud, media on demand, security and forensics, Online social networking, multimedia ontology, Content based retrieval from digital libraries.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- Get the bigger picture of the context of Multimedia and its applications
- Use the different types of media elements of different formats on content pages
- Author 2D and 3D creative and interactive presentations for different target multimedia applications.
- Use different standard animation techniques for 2D, 21/2 D, 3D applications
- Understand the complexity of multimedia applications in the context of cloud, security,bigdata streaming, social networking, CBIR etc.,

TEXT BOOKS:

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of Multimedia", Third Edition,Springer Texts in Computer Science, 2021.

REFERENCES:

1. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation,CRC press, 3rd Edition, 2016.
2. Gerald Friedland, Ramesh Jain, "Multimedia Computing", Cambridge University Press,2018.
3. Prabhat K.Andleigh, Kiran Thakrar, "Multimedia System Design", Pearson Education, 1st Edition, 2015.
4. Mohsen Amini Salehi, Xiangbo Li, "Multimedia Cloud Computing Systems", Springer Nature,1st Edition, 2021.
5. Mark Gaimbruno, "3D Graphics and Animation", Second Edition, New Riders, 2002.
6. Rogers David, "Animation: Master – A Complete Guide (Graphics Series)", Charles River Media, 2006.
7. Rick parent, "Computer Animation: Algorithms and Techniques", Morgan Kauffman, 3rd Edition, 2012.
8. Emilio Rodriguez Martinez, Mireia Alegre Ruiz, "UI Animations with Lottie and After Effects:Create,render, and ship stunning After Effects animations natively on mobile with React Native", PacktPublishing, 2022.

WEB REFERENCES:

1. https://itsfoss.com/
2. https://www.ucl.ac.uk/slade/know/3396
3. https://handbrake.fr/
4. https://opensource.com/article/18/2/open-source-audio-visual-production-tools
5. https://camstudio.org/
6. https://developer.android.com/training/animation/overview
7. https://developer.android.com/training/animation/overview

		L	T	P	C
21AD1909	**WEB AND SOCIAL MEDIA ANALYTICS**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To understand the basic issues and types of web and social media mining
- Familiarize the learners with the concept of web and social media analytics and understand its significance.
- Familiarize the learners with the tools of web and social media analytics.
- Enable the learners to develop skills required for analyzing the effectiveness ofweb and social media for business purposes
- To know the applications in real time systems.

UNIT I INTRODUCTION TO SOCIAL MEDIA ANALYSIS 9

Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas. Network fundamentals and models: The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization.

UNIT II COMMUNITY BUILDING AND MANAGEMENT 9

History and Evolution of Social Media-Understanding Science of Social Media –Goals for using Social Media- Social Media Audience and Influencers - Digital PR- Promoting Social Media Pages- Linking Social Media Accounts-The Viral Impact of Social Media.

UNIT III SOCIAL MEDIA POLICIES AND MEASUREMENTS 9

Social Media Policies-Etiquette, Privacy- ethical problems posed by emerging social media technologies - The Basics of Tracking Social Media.

UNIT IV WEB ANALYTICS 9

Data Collection, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Proposals & Reports, Web Data Analysis.

UNIT V SOCIAL MEDIA ANALYTICS 9

Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post- performance on FB. Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Understand about web , social media mining
- Understand the significance of web and social media analytics
- Learn tools of web and social media analytics.
- Develop skills required for analyzing the effectiveness of web and social media for business purposes
- Know the applications in real time systems.

TEXT BOOKS:

1. Matthew Ganis, Avinash Kohirkar , Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media, Pearson, 2016.
2. K. M. Shrivastava, Social Media in Business and Governance, Sterling Publishers Private Limited, 2013

REFERENCES:

1. Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014
2. Bittu Kumar, Social Networking, V & S Publishers, 2013
3. Avinash Kaushik, Web Analytics - An Hour a Day, Wiley Publishing, 2007
4. Ric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress 2004
5. Takeshi Moriguchi, Web Analytics Consultant Official Textbook, 7th Edition, 2016

21CS1911	DIGITAL MARKETING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- The primary objective of this module is to examine and explore the role and importance ofdigital marketing in today's rapidly changing business environment.
- It also focuses on how digital marketing can be utilized by organizations and howits effectiveness can be measured.

UNIT I INTRODUCTION TO ONLINE MARKET 9

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

UNIT II SEARCH ENGINE OPTIMISATION 9

Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement

UNIT III E- MAIL MARKETING 9

E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation - Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting

UNIT IV SOCIAL MEDIA MARKETING 9

Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversationsand buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.

UNIT V DIGITAL TRANSFORMATION 9

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

COURSE OUTCOMES:

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

CO1: To examine and explore the role and importance of digital marketing in today'srapidly changing business environment.

CO2: To focuses on how digital marketing can be utilized by organizations and how itseffectiveness can be measured.

CO3: To know the key elements of a digital marketing strategy.

CO4: To study how the effectiveness of a digital marketing campaign can be measured

CO5: To demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs.

TOTAL:45 PERIODS

TEXT BOOKS

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education; Firstedition , 2017;ISBN-10: 933258737X;ISBN-13: 978-9332587373.
2. Digital Marketing by Vandana Ahuja ;Publisher: Oxford University Press, 2015, ISBN-10: 0199455449
3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition, 2017; ISBN10: 9788126566938;ISBN 13: 9788126566938;ASIN: 8126566930.
4. Ryan, D.,2014, Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited,2014.
5. Barker, Barker, Bormann and Neher, Social Media Marketing: A Strategic Approach, 2E South-Western ,Cengage Learning,2017.
6. Pulizzi,J Beginner's Guide to Digital Marketing , Mcgraw Hill Education,2015.

21CS1914	MULTIMEDIA DATA COMPRESSION AND STORAGE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of compression techniques
- To understand the categories of compression for text, image and video
- To explore the modalities of text, image and video compression algorithms
- To know about basics of consistency of data availability in storage devices
- To understand the concepts of data streaming services

UNIT I BASICS OF DATA COMPRESSION 9

Introduction —Lossless and LossyCompression– Basics of Huffmann coding- Arithmetic coding- Dictionary techniques- Context based compression – Applications

UNIT II IMAGE COMPRESSION 9

Lossless Image compression – JPEG-CALIC-JPEG LS-Prediction using conditional averages – Progressive Image Transmission – Lossless Image compression formats – Applications - Facsimileencoding

UNIT III VIDEO COMPRESSION 9

Introduction – Motion Compensation – Video Signal Representation – H.261 – MPEG-1- MPEG-2- H.263.

UNIT IV DATA PLACEMENT ON DISKS 9

Statistical placement on Disks – Striping on Disks – Replication Placement on Disks – Constraint allocation on Disks – Tertiary storage Devices – Continuous Placement on Hierarchical storage system – Statistical placement on Hierarchical storage systems – Constraint allocation on Hierarchical storage system

UNIT V DISK SCHEDULING METHODS 9

Scheduling methods for disk requests – Feasibility conditions of concurrent streams– Schedulingmethods for request streams

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the basics of text, Image and Video compression
CO2: Understand the various compression algorithms for multimedia content
CO3: Explore the applications of various compression techniques
CO4: Explore knowledge on multimedia storage on disks
CO5: Understand scheduling methods for request streams

TEXT BOOKS

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Series in Multimedia Information and Systems, 2018, 5th Edition.
2. Philip K.C.Tse, Multimedia Information Storage and Retrieval: Techniques and Technologies, 2008

REFERENCES

1. David Salomon, A concise introduction to data compression, 2008.
2. Lenald Best, Best's Guide to Live Stream Video Broadcasting, BCB Live Teaching series,2017.
3. Yun-Qing Shi, Image And Video Compression For Multimedia Engineering Fundamentals Algorithms And Standards, Taylor& Francis,2019
4. Irina Bocharova, Compression for Multimedia, Cambridge University Press; 1st edition,2009

21CS1913	GAME DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of a game engine.
- To survey the gaming development environment and tool kits.
- To learn and develop simple games using Pygame environment

UNIT I 3D GRAPHICS FOR GAME DESIGN 9

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation – Controller Based Animation.

UNIT II GAME DESIGN PRINCIPLES 9

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.

UNIT III GAME ENGINE DESIGN 9

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Pathfinding.

UNIT IV OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS 9

Pygame Game development – Unity – Unity Scripts –Mobile Gaming, Game Studio, UnitySingle player and Multi-Player games.

UNIT V GAME DEVELOPMENT USING PYGAME 9

Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based arcade Games Puzzle Games.

COURSE OUTCOMES:

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

CO1:Explain the concepts of 2D and 3d Graphics

CO2:Design game design documents.

CO3: Implementation of gaming engines.

CO4: Survey gaming environments and frameworks.

CO5:Implement a simple game in Pygame.

TOTAL: 45 PERIODS

TEXTBOOKS

1. Sanjay Madhav, "Game Programming Algorithms and Techniques: A Platform Agnostic Approach", Addison Wesley,2013.
2. David H. Eberly, "3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics", Second Edition, CRC Press,2006.
3. Will McGugan, "Beginning Game Development with Python and Pygame: From Novice to Professional", Apress,2007.

REFERENCES

1. Paul Craven, "Python Arcade games", Apress Publishers,2016. Jung Hyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC, 2011

21CS1912	VISUAL EFFECTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To get a basic idea on animation principles and techniques
- To get exposure to CGI, color and light elements of VFX
- To have a better understanding of basic special effects techniques
- To have a knowledge of state of the art vfx techniques
- To become familiar with popular compositing techniques

UNIT I ANIMATION BASICS 9

VFX production pipeline, Principles of animation, Techniques: Keyframe, kinematics, Full animation, limited animation, Rotoscoping, stop motion, object animation, pixilation, rigging, shape keys, motionpaths.

UNIT II CGI, COLOR, LIGHT 9

CGI – virtual worlds, Photorealism, physical realism, function realism, 3D Modeling and Rendering: color - Color spaces, color depth, Color grading, color effects, HDRI, Light – Area and mesh lights, image based lights, PBR lights, photometric light, BRDF shading model

UNIT III SPECIAL EFFECTS 9

Special Effects – props, scaled models, animatronics, pyrotechniques, Schüfftan process, Particle effects – wind, rain, fog, fire

UNIT IV VISUAL EFFECTS TECHNIQUES 9

Motion Capture, Matt Painting, Rigging, Front Projection.Rotoscoping, Match Moving – Tracking, camera reconstruction, planar tracking, Calibration, Point Cloud Projection, Ground plane determination, 3D Match Moving

UNIT V COMPOSITING 9

Compositing – chroma key, blue screen/green screen, background projection, alpha compositing, deep image compositing, multiple exposure, matting, VFX tools - Blender, Natron, GIMP.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student will be able to:

CO1: To implement animation in 2D / 3D following the principles and techniques
CO2: To use CGI, color and light elements in VFX applications **CO3:**To create special effects using any of the state of the art tools **CO4:**To apply popular visual effects techniques using advanced tools
CO5:To use compositing tools for creating VFX for a variety of applications

TEXT BOOKS:

1. Chris Roda, Real Time Visual Effects for the Technical Artist, CRC Press, 1st Edition, 2022.
2. Steve Wright, Digital Compositing for film and video, Routledge, 4th Edition, 2017.
3. John Gress, Digital Visual Effects and Compositing**,** New Riders Press, 1st Edition, 2014.

REFERENCES:

1. Jon Gress, "Digital Visual Effects and Compositing", New Riders Press, 1st Edition, 2014.
2. Robin Brinkman, The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics", Morgan Kauffman, 2008.
3. Luiz Velho, Bruno Madeira, "Introduction to Visual Effects A Computational Approach", Routledge, 2023.
4. Jasmine Katatikarn, Michael Tanzillo, "Lighting for Animation: The art of visual storytelling , Routledge, 1st Edition, 2016.
5. Eran Dinur, "The Complete guide to Photorealism, for Visual Effects, Visualization
6. Jeffrey A. Okun, Susan Zwerman, Christopher McKittrick, " The VES Handbook of Visual Effects: Industry Standard VFX Practices and Procedures", Third Edition, 2020.and Games", Routledge, 1st Edition, 2022.
7. https://www.blender.org/features/vfx/https://natrongithub.github.io/

Vertical VI Cutting EdgeTechnologies

		L	T	P	C
21AD1910	ROBOTIC PROCESS AUTOMATION AND DEVELOPMENT	3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts of Robotic Process Automation.
- To expose to the key RPA design and development strategies and methodologies.
- To learn the fundamental RPA logic and structure.
- To explore the Exception Handling, Debugging and Logging operations in RPA.
- To learn to deploy and Maintain the software bot.

UNIT I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION 9

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

UNIT II AUTOMATION PROCESS ACTIVITIES 9

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

UNIT III APP INTEGRATION, RECORDING AND SCRAPING 9

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

UNIT IV EXCEPTION HANDLING AND CODE MANAGEMENT 9

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine.

UNIT V DEPLOYING AND MAINTAINING THE BOT 9

Case Study: Publishing using publish utility - Creation of Server - Using Server to control the bots - Creating a provision Robot from the Server - Connecting a Robot to Server - Deploy the Robot to Server - Publishing and managing updates - Managing packages - Uploading packages - Deleting packages

TOTAL: 45 PERIODS

COURSE OUTCOMES:

By the end of this course, the students will be able to:

- Enunciate the key distinctions between RPA and existing automation techniquesand platforms.
- Use UiPath to design control flows and work flows for the target process
- Implement recording, web scraping and process mining by automation
- Use UIPath Studio to detect, and handle exceptions in automation processes
- Implement and use Orchestrator for creation, monitoring, scheduling, and controlling of automated bots and processes**.**

TEXT BOOKS:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, 2018.
2. Tom Taulli , “The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems”, Apress publications, 2020.

REFERENCES:

1. 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
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018
3. A Gerardus Blokdyk, “Robotic Process Automation Rpa A Complete Guide “, 2020

		L	T	P	C
21AD1911	DATA WAREHOUSING AND DATA MINING	3	0	0	3

COURSE OBJECTIVES:

- To understand data warehouse concepts, architecture, business analysis and tools
- To understand data pre-processing and data visualization techniques
- To study algorithms for finding hidden and interesting patterns in data
- To understand and apply various classification and clustering techniques using tools.

UNIT I DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP) **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 DATA MINING – INTRODUCTION **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 DATA MINING - 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 – DensityBased Methods - Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods

UNIT V WEKA TOOL **9**

Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database - Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Design a Data warehouse system and perform business analysis with OLAP tools.
- Apply suitable pre-processing and visualization techniques for data analysis
- Apply frequent pattern and association rule mining techniques for data analysis
- Apply appropriate classification and clustering techniques for data analysis

TEXT BOOK:

1. Jiawei Han and Micheline Kamber, ―Data Mining Concepts and Techniques‖, Third Edition, Elsevier, 2012.

REFERENCES:

1. Alex Berson and Stephen J.Smith, ―Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016.
2. K.P. Soman, Shyam Diwakar and V. Ajay, ―Insight into Data Mining Theory and Practice‖, Eastern Economy Edition, Prentice Hall of India, 2006.
3. Ian H.Witten and Eibe Frank, ―Data Mining: Practical Machine Learning Tools and Techniques‖, Elsevier, Second Edition.

21IT1915	CYBER SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn cybercrime and cyberlaw.
- To understand the cyber attacks and tools for mitigating them.
- To understand information gathering.
- To learn how to detect a cyber attack.
- To learn how to prevent a cyber attack.

UNIT I INTRODUCTION 9

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.

UNIT II ATTACKS AND COUNTERMEASURES 9

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach –Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.

UNIT III RECONNAISSANCE 9

Harvester – Whois – Netcraft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches – SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing andOS Finger printing Techniques.

UNIT IV INTRUSION DETECTION 9

Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.

UNIT V INTRUSION PREVENTION 9

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the basics of cyber security, cyber crime and cyber law (K2)

CO2: Classify various types of attacks and learn the tools to launch the attacks (K2)

CO3 Apply various tools to perform information gathering (K3)

CO4: Apply intrusion techniques to detect intrusion (K3)

CO5: Apply intrusion prevention techniques to prevent intrusion (K3)

TEXTBOOKS

1. Anand Shinde, “Introduction to Cyber Security Guide to the World of Cyber Security”, Notion Press,2021 (Unit 1)
2. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, ComputerForensics and Legal Perspectives”, Wiley Publishers, 2011
3. https://owasp.org/www-project-top-ten/

REFERENCES

1. David Kim, Michael G. Solomon, “Fundamentals of Information Systems Security”, Jones &Bartlett Learning Publishers, 2013
2. Patrick Engebretson, “The Basics of Hacking and Penetration Testing: Ethical Hacking andPenetration Testing Made easy”, Elsevier, 2011
3. Kimberly Graves, “CEH Official Certified Ethical hacker Review Guide”, Wiley Publishers,2007
4. William Stallings, Lawrie Brown, “Computer Security Principles and Practice”, Third Edition,Pearson Education, 2015
5. Georgia Weidman, “Penetration Testing: A Hands-On Introduction to Hacking”, No StarchPress, 2014 (Lab)

21CS1916	QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

UNIT I QUANTUM COMPUTING BASIC CONCEPTS 9

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

UNIT II QUANTUM GATES AND CIRCUITS 9

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

UNIT III QUANTUM ALGORITHMS 9

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

UNIT IV QUANTUM INFORMATION THEORY 9

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

UNIT V QUANTUM CRYPTOGRAPHY 9

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

COURSE OUTCOMES:

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

CO1: Understand the basics of quantum computing.

CO2: Understand the background of Quantum Mechanics.

CO3: Analyze the computation models.

CO4: Model the circuits using quantum computation,environments and frameworks.

CO5: Understand the quantum operations such as noise and error–correction.

TOTAL:45 PERIODS

TEXTBOOKS:

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

REFERENCES

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

21CS1917	3D PRINTING AND DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To discuss on basics of 3D printing
- To explain the principles of 3D printing technique
- To explain and illustrate inkjet technology
- To explain and illustrate laser technology
- To discuss the applications of 3D printing

UNIT I INTRODUCTION 9

Introduction; Design considerations – Material, Size, Resolution, Process; Modelling and viewing - 3D; Scanning; Model preparation – Digital; Slicing; Software; File formats

UNIT II PRINCIPLE 9

Processes – Extrusion, Wire, Granular, Lamination, Photopolymerisation; Materials - Paper, Plastics, Metals, Ceramics, Glass, Wood, Fiber, Sand, Biological Tissues, Hydrogels, Graphene; Material Selection - Processes, applications, limitations;

UNIT III INKJET TECHNOLOGY 9

Printer - Working Principle, Positioning System, Print head, Print bed, Frames, Motion control; Print head Considerations – Continuous Inkjet, Thermal Inkjet, Piezoelectric Drop-On-Demand; MaterialFormulation for jetting; Liquid based fabrication – Continous jet, Mulitjet; Powder based fabrication
– Colourjet.

UNIT IV LASER TECHNOLOGY 9

Light Sources – Types, Characteristics; Optics – Deflection, Modulation; Material feeding and flow
– Liquid, powder; Printing machines – Types, Working Principle, Build Platform, Print bed Movement, Support structures;

UNIT V INDUSTRIAL APPLICATIONS 9

Product Models, manufacturing – Printed electronics, Biopolymers, Packaging, Healthcare, Food,Medical, Biotechnology, Displays; Future trends.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Outline and examine the basic concepts of 3D printing technology
CO2: Outline 3D printing workflow`
CO3: Explain and categorise the concepts and working principles of 3D printing using inkjettechnique
CO4: Explain and categorise the working principles of 3D printing using laser technique
CO5: Explain various method for designing and modeling for industrial applications

TOTAL: 45 PERIODS

TEXT BOOKS

1. Christopher Barnatt, 3D Printing: The Next Industrial Revolution, CreateSpace IndependentPublishing Platform, 2013.
2. Ian M. Hutchings, Graham D. Martin, Inkjet Technology for Digital Fabrication, John Wiley &Sons, 2013.

REFERENCES:

1. Chua, C.K., Leong K.F. and Lim C.S., Rapid prototyping: Principles and applications, secondedition, World Scientific Publishers, 2010
2. Ibrahim Zeid, Mastering CAD CAM Tata McGraw-Hill Publishing Co., 2007
3. Joan Horvath, Mastering 3D Printing, APress, 2014

Vertical for AI&DS -II

		L	T	P	C
21AD1912	**SPEECH PROCESSING AND ANALYTICS**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- Understand natural language processing basics
- Apply classification algorithms to text documents
- Build question-answering and dialogue systems
- Develop a speech recognition system
- Develop a speech synthesizer

UNIT-I INTRODUCTION TO SPEECH PROCESSING 9

Human and machine speech production: Models for speech production. Various types of speech sounds and their characteristics, Speech hearing: Mechanism for human hearing: Learning to recognize human sounds, acquired knowledge vs vocabulary - based methods.

UNIT-II ANALYSIS OF SPEECH 9

Frequency and time domain based methods: FFT, computation of pitch, spectrograms, LPC, cepstrum, ZCR, etc. Representation of acoustic events. Components of a Speech recognition system: Input, feature analysis, modelling and decision rule, vocabulary.

UNIT-III DATA COMPRESSION 9

Vector Quantization, codebook design, Lloyd's quantizer design, K-means algorithm, LBG algorithm for speech. Speech modelling: Stochastic processes: Markov processes, Hidden Markov modelling.

UNIT-IV SPEECH AUTOMATION METHODS 9

Automatic speech recognition - architecture - applying hidden markov model - feature extraction: mfcc vectors - computing acoustic likelihoods - search and decoding - embedded training - multipass decoding: n-best lists and lattices- a* (stack) decoding - context-dependent acoustic models: triphones - discriminative training - speech recognition by humans.

UNIT-V SPEECH RECOGNITION SYSTEM 9

Implementation of a speech recognition system: Time/space consideration, designing the interface, self-learning mechanism.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Explain existing and emerging deep learning architectures for text and speech processing

CO2: Apply deep learning techniques for NLP tasks, language modelling and machine translation

CO3: Explain co-reference and coherence for text processing

CO4: Build question-answering systems, chat bots and dialogue systems

CO5: Apply deep learning models for building speech recognition and text-to-speech systems

TOTAL: 45 PERIODS

TEXTBOOK

1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Third Edition, 2022.

REFERENCES:

1. Dipanjan Sarkar, “Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data”, APress,2018.
2. Tanveer Siddiqui, Tiwary U S, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, “Fundamentals of Speech Recognition” 1st Edition, Pearson, 2009.
4. Steven Bird, Ewan Klein, and Edward Loper, “Natural language processing with Python”, O’REILLY.

21AD1913	HEALTH CARE ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the health data formats, health care policy and standards
- Learn the significance and need of data analysis and data visualization
- Understand the health data management frameworks
- Learn the use of machine learning and deep learning algorithms in healthcare
- Apply healthcare analytics for critical care applications

UNIT I INTRODUCTION TO HEALTHCARE ANALYSIS 9

Overview - History of Healthcare Analysis Parameters on medical care systems- Health care policy- Standardized. code sets – Data Formats – Machine Learning Foundations: Tree Like reasoning , Probabilistic reasoning and BayesTheorem, Weighted sum approach.

UNIT II ANALYTICS ON MACHINE LEARNING 9

Machine Learning Pipeline – Pre-processing –Visualization – Feature Selection – Training model parameter – Evaluation model : Sensitivity , Specificity , PPV ,NPV, FPR ,Accuracy , ROC , Precision Recall Curves , Valued target variables –Python: Variables and types, Data Structures and containers , Pandas Data Frame :Operations – Scikit –Learn : Pre-processing , Feature Selection.

UNIT III HEALTH CARE MANAGEMENT 9

IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database – Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare.

UNIT IV HEALTHCARE AND DEEP LEARNING 9

Introduction on Deep Learning – DFF network CNN- RNN for Sequences – Biomedical Image and Signal Analysis Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System.

UNIT V CASE STUDIES 9

Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data Analysis

OUTCOMES:

CO1: Use machine learning and deep learning algorithms for health data analysis
CO2: Apply the data management techniques for healthcare data
CO3: Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications
CO4: Design health data analytics for real time applications
CO5: Design emergency care system using health data analysis

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Chandan K.Reddy, Charu C. Aggarwal, “Health Care data Analysis”, First edition, CRC, 2015.
2. Vikas Kumar, “Health Care Analysis Made Simple”, Packt Publishing, 2018.

REFERENCES:

1. Nilanjan Dey, Amira Ashour , Simon James Fong, Chintan Bhatl, “Health Care Data Analysis and Management, First Edition, Academic Press, 2018.
2. Hui Jang, Eva K.Lee, “HealthCare Analysis : From Data to Knowledge to Healthcare Improvement”, First Edition, Wiley, 2016.
3. Kulkarni , Siarry, Singh ,Abraham, Zhang, Zomaya , Baki, “Big Data Analytics in HealthCare”, Springer, 2020.

21AD1914	OPTIMIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objective of this course is to enable the student to

- Formulate and solve linear programming problems (LPP)
- Evaluate Integer Programming Problems, Transportation and Assignment Problems.
- Obtain a solution to network problems using CPM and PERT techniques.
- Able to optimize the function subject to the constraints.
- Identify and solve problems under Markovian queuing models.

UNIT I DEVELOPMENT OF O.R AND ALLOCATION 9

Introduction of Operations Research - Types of operation research models, mathematical formulation of LPP- Graphical Methods to solve LPP- Simplex Method- Two-Phase method, big-M method,

UNIT II INTEGER PROGRAMMING AND TRANSPORTATION PROBLEMS 9

Integer programming: Branch and bound method- Degeneracy; Assignment problem, formulation, optimal solution, variants of assignment problem- Traveling salesman problem.

UNIT III SEQUENCING AND REPLACEMENT 9

Sequencing: Introduction, flow, shop sequencing, n jobs through two machines, n jobs through three machines, job shop sequencing, and two jobs through "m" machines. Replacement: Introduction: Replacement of items that deteriorate with time, when money value is not counted and counted, replacement of items that fail completely, group replacement.

UNIT IV THEORY OF GAMES AND INVENTORY 9

Theory Of Games: Introduction – Terminology, Solution of games with saddle points and without saddle points, 2×2 games, dominance principle, m X 2 & 2 X n games, Graphical method. Inventory: Introduction, Single item, Deterministic models, Purchase inventory models with one price break and multiple price breaks, Stochastic models, demand may be discrete variable or continuous variable, Single period model and no setup cost.

UNIT V WAITING LINES, DYNAMIC PROGRAMMIMG AND SIMULATION 9

Waiting Lines: Introduction, Terminology, Single Channel, Poisson arrivals and exponential service times with infinite population and finite population models, Multichannel, Poisson arrivals and exponential service times with infinite population. Dynamic Programming: Introduction, Terminology, Bellman‟s Principle of optimality, Applications of dynamic programming, shortest path problem, linear programming problem. Simulation: Introduction, Definition, types of simulation models, steps involved in the simulation process - Advantages and Disadvantages, Application of Simulation to queuing and inventory

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Formulate and solve linear programming problems (LPP)

CO2: Evaluate Integer Programming Problems, Transportation and Assignment Problems.

CO3: Obtain a solution to network problems using CPM and PERT techniques.

CO4: Able to optimize the function subject to the constraints.

CO5: Identify and solve problems under Markovian queuing models

TEXT BOOKS:

1. Mykel Kochenderfer and Tim Wheeler, "Algorithm for Optimization", MIT Press, 2019.
2. Xin-She Yang, "Optimization Techniques and Applications with Examples", 2018 John Wiley & Sons, Inc.

REFERENCES:

1. ND Vohra, Quantitative Techniques in Management, Tata McGraw Hill, 4th Edition, 2011.
2. Hiller F.S, Liberman G.J, Introduction to Operations Research, 10th Edition McGraw Hill, 2017.
3. Jit. S. Chandran, Mahendran P. Kawatra, KiHoKim, Essentials of Linear Programming, Vikas Publishing House Pvt.Ltd. New Delhi, 1994.
4. Ravindran A., Philip D.T., and Solberg J.J., Operations Research, John Wiley, 2nd Edition, 2007.

21AD1915	BIO INSPIRED OPTIMIZATION COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objective of this course is to enable the student to

- Understand the basics of biological underpinnings and compare with the neural networks and methods
- To understand latest trends and apply mathematical models
- To learn bio inspired algorithms
- Apply to Evaluate the system based on energy efficiency.
- To identify the challenges and gaps in the recent trends and apply the technology to solve the issues.

UNIT-I EVOLUTION **9**

Biological Underpinnings- Applications in computing and engineering- Evolutionary computation and genetic programming- Mathematical Models, Search spaces and biased sampling- Multiplicative weights update algorithm for recombination- selection and mutation, Novelty Search, Automatically evolving neural network architectures.

UNIT-II IMMUNOLOGY **9**

Computer Security- Probabilistic models- Differential equation models- Current research.

UNIT-III SOCIAL INSECTS **9**

Applications to computing and engineering- Ant Colony Optimization (ACO) algorithms-Partical swarm optimization- Multi-agent systems, Computational models and theory

UNIT-IV METABOLIC SCALING **9**

Biological underpinnings- Predicting power consumption on chips- Internet topology- Current research- Novelty Search.

UNIT-V EPIDEMIOLOGY AND ECOLOGY **9**

Network topology and susceptibility to attack- Red Queen dynamics and arms races in cybersecurity- Epidemic spreading- Predator/prey models- SIR and SIS- Current research- TBD

OUTCOMES:

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

CO1: Remember the basics of biological underpinnings and compare with the neural networks and methods.

CO2: Understand the latest trends and apply mathematical models

CO3: Analyse and optimise the problems based on bio inspired algorithms

CO4: Evaluate the system based on energy efficiency

CO5: Identify the challenges and gaps in the recent trends and apply the technology to solve the issues.

TOTAL: 45 PERIODS

TEXTBOOK:

1. Nancy Arana-Daniel, Carlos Lopez-Franco, Alma Y. Alanis, “Bio-inspired Algorithms for Engineering”, Butterworth-Heinemann; Illustrated edition, 2018.
2. S. Balamurugan, Anupriya Jain, Sachin Sharma, Dinesh Goyal, Sonia Duggal, Seema Sharma, “Nature-Inspired Algorithms and Applications”, 2021.

REFERENCES:

1. A. E. Elben and J. E. Smith, “Introduction to Evolutionary Computing”, Springer, 2010.
2. Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.
3. Leandro Nunes de Castro, " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007

21AD1916	GAME THEORY	L	T	P	C
		3	0	0	3

OBJECTIVES:

• To introduce the student to the notion of a game, its solutions concepts, and other basic notions and tools of game theory, and the main applications for which they are appropriate, including electronic trading markets.

• To formalize the notion of strategic thinking and rational choice by using the tools of game theory, and to provide insights into using game theory in 41odeIIing applications.

• To draw the connections between game theory, computer science, and economics, especially emphasizing the computational issues.

• To introduce contemporary topics in the intersection of game theory, computer science, and economics.

• To apply game theory in searching, auctioning and trading.

UNIT I INTRODUCTION 9

Introduction -Making rational choices: basics of Games -strategy -preferences -payoffs - Mathematical basics - Game theory -Rational Choice -Basic solution concepts-noncooperative versus cooperative games -Basic computational issues -finding equilibria and learning in games- Typical application areas for game theory (e.g. Google's sponsored search, eBay auctions, electricity trading markets).

UNIT II GAMES WITH PERFECT INFORMATION **9**

Games with Perfect Information - Strategic games - prisoner's dilemma, matching pennies - Nash equilibria -mixed strategy equilibrium - zero-sum games

UNIT III GAMES WITH IMPERFECT INFORMATION **9**

Games with Imperfect Information - Bayesian Games - Motivational Examples - General Definitions - Information aspects – Illustrations- Extensive Games with Imperfect - Information - Strategies - Nash Equilibrium -Repeated Games - The Prisoner's Dilemma - Bargaining.

UNIT IV NON-COOPERATIVE GAME THEORY **9**

Non-cooperative Game Theory -Self-interested agents -Games in normal form -Analyzing games: from optimality to equilibrium -Computing Solution Concepts of Normal -Form Games -Computing Nash equilibria of two-player, zero-sum games -Computing Nash equilibria of twoplayer, general- sum games -Identifying dominated strategies.

UNIT V MECHANISM DESIGN **9**

Aggregating Preferences -Social Choice -Formal Model -Voting -Existence of social functions -Ranking systems - Protocols for Strategic Agents: Mechanism Design -Mechanism design with unrestricted preferences.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to

CO1: Discuss the notion of a strategic game and equilibria and identify the characteristics of main applications of these concepts.

CO2: Discuss the use of Nash Equilibrium for other problems.

CO3: Identify key strategic aspects and based on these be able to connect them to appropriate game theoretic concepts given a real world situation.

CO4: Identify some applications that need aspects of Bayesian Games.

CO5: Implement a typical Virtual Business scenario using Game theory

TEXT BOOKS:

1. Thomas Ferguson, Game Theory, World Scientific, 2018.
2. Prajit Dutta, Strategies and Games, MIT Press
3. M. J. Osborne, An Introduction to Game Theory. Oxford University Press, 2012.
4. M. Machler, E. Solan, S. Zamir, Game Theory, Cambridge University Press, 2013.

REFERENCES

1. YoavShoham, Kevin Leyton-Brown, Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, Cambridge University Press 2008.
2. Zhu Han, DusitNiyato, WalidSaad, TamerBasar and Are Hjorungnes, “Game Theory in Wireless and Communication Networks”, Cambridge University Press, 2012.
3. Y.Narahari, “Game Theory and Mechanism Design”, IISC Press, World Scientific.

21AD1917	COGNITIVE SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know the theoretical background of cognition.
- To understand the link between cognition and computational intelligence.
- To explore probabilistic programming language.
- To study the computational inference models of cognition.
- To study the computational learning models of cognition.

UNIT I PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE 9

Philosophy: Mental-physical Relation – From Materialism to Mental Science – Logic and the Sciences of the MindPsychology: Place of Psychology within Cognitive Science – Science of Information Processing –Cognitive Neuroscience – Perception – Decision – Learning and Memory – Language Understanding and Processing.

UNIT II INFORMATION PROCESSING MODELS OF THE MIND 9

Symbols and symbol systems– Intelligent action and the physical symbol system– Syntax and the language of thought – ID3 and the physical symbol system hypothesis– The perceptron convergence rule– The backpropagation algorithm**.**

UNIT III THE ORGANIZATION OF THE MIND 9

The ACTRPM architecture– Strategies for brain mapping– Combining ERPs and singleunit recordings– Two hypotheses about visuospatial attention– Functional connectivity vs effective connectivity– Exploring mindreading - Implicit and explicit understanding of false belief– Consciousness and priming.

UNIT IV INFERENCE MODELS OF COGNITION 9

Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence – Data Analysis Algorithms for Inference.

UNIT V LEARNING MODELS OF COGNITION 9

Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models– Learning (Deep) Continuous Functions – Mixture Models.

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand the underlying theory behind cognition.
CO2: Connect to the cognition elements computationally.
CO3: Implement mathematical functions through WebPPL.
CO4: Develop applications using cognitive inference model.
CO5: Develop applications using cognitive learning model.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. José Luis Bermúdez, " Cognitive Science: An Introduction to the Science of the Mind", Cambridge university press, 2020
2. Vijay V Raghavan,Venkat N.Gudivada, VenuGovindaraju, C.R. Rao, Cognitive Computing: Theory and Applications: (Handbook of Statistics 35), Elsevier publications, 2016
3. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley Publications, 2015

REFERENCES:

1. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, "Probabilistic Models of Cognition", Second Edition, 2016.

OPEN ELECTIVE - I

21CE1010	AIR POLLUTION AND CONTROL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous air pollutant and its emerging trends.
-

UNIT I INTRODUCTION 9

Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution – Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility- Ambient Air Quality and Emission standards –Ambient and stack sampling and Analysis of Particulate and Gaseous Pollutants.

UNIT II METEOROLOGY 9

Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Atmospheric Diffusion Theories – Dispersion models, Plume rise.

UNIT III CONTROL OF PARTICULATE CONTAMINANTS 9

Factors affecting Selection of Control Equipment – Gas Particle Interaction – Working principle, Design and performance equations of Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations.

UNIT IV CONTROL OF GASEOUS CONTAMINANTS 9

Factors affecting Selection of Control Equipment – Working principle, Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters – Process control and Monitoring - Operational Considerations.

UNIT V INDOOR AIR QUALITY MANAGEMENT 9

Sources, types and control of indoor air pollutants, sick building syndrome and Building related illness- Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventive measures.

TOTAL HOURS: 45 PERIODS

OUTCOMES

- An understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management
- Ability to identify, formulate and solve air and noise pollution problems
- Ability to design stacks and particulate air pollution control devices to meet applicable standards.
- Ability to select control equipment's.
- Ability to ensure quality, control and preventive measures.

TEXT BOOKS

1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, "Air Pollution Control Engineering", Tokyo, springer science + science media LLC,2004.
2. Noel de Nevers, "Air Pollution Control Engineering", Waveland press,Inc 2017.
3. Anjaneyulu. Y, "Air Pollution and Control Technologies", Allied Publishers (P) Ltd., India 2002.

REFERENCE BOOKS

1. David H.F. Liu, Bela G. Liptak, "Air Pollution", Lweis Publishers, 2000.
2. Arthur C. Stern, "Air Pollution (Vol.I – Vol.VIII)", Academic Press, 2006.
3. Wayne T.Davis, "Air Pollution Engineering Manual", John Wiley & Sons, Inc, 2000.
4. M.N Rao and HVN Rao, "Air Pollution", Tata Mcgraw Hill Publishing Companylimited,2007.
5. C.S.Rao, "Environmental Pollution Control Engineering", New Age International(P)Limited Publishers,2006.

21CE1001	ENERGY CONSERVATION AND MANAGEMENT	L	T	P	C	
		3	0	0	3	

OBJECTIVES

- To impart knowledge on the principle of Energy Conversion and Management , Energy and environment, air pollution, climate change
- To provide details of Energy Conservation, Energy Management &. Audit.

UNIT I ENERGY SCENARIO AND ENERGY CONSERVATION ACT 2001 9

Classification of Energy, Indian energy scenario, Sectorial energy consumption (domestic, industrial and other sectors), energy needs of growing economy, energyintensity, long term energy scenario, energy pricing, energy security, energy conservation and its importance, energy strategy for the future.

Energy conservation Act 2001 and its features, notifications under the Act, Schemes of Bureau of Energy Efficiency (BEE) including Designated consumers, State Designated Agencies, Electricity Act 2003, Integrated energy policy, National action plan on climate change, ECBC code for Building Construction.

UNIT II FINANCIAL MANAGEMENT, ENERGY MONITORING AND TARGETING 9

Investment-need, financial analysis techniques simple payback period, return on investment, net present value, internal rate of return, cash flows, risk and sensitivityanalysis; financing options, energy performance contracts and role of Energy Service Companies (ESCOs). Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques – energy consumption, production, cumulative sum of differences (CUSUM). Energy Management Information Systems (EMIS)

UNIT III ENERGY MANAGEMENT & AUDIT 9

Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, Bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel and energy substitution, energy audit instruments and metering.

UNIT IV ENERGY EFFICIENCY IN THERMAL UTILITIES AND SYSTEMS 9

Boilers: Types, combustion in boilers, performances evaluation, analysis of losses, feed water treatment, blow down, energy conservation opportunities. Boiler efficiency calculation, evaporation ratio and efficiency for coal, oil and gas. Soot blowing and soot deposit reduction, reasons for boiler tube failures, start up, shut down and preservation.

Steam System: Properties of steam, assessment of steam distribution losses, steamleakages, steam trapping, condensate and flash steam recovery system, identifying opportunities for energy savings. Steam utilization, Performance assessment of steam system, thermo-compressor, steam pipe insulation, condensate pumping, steam dryers.

Waste Heat Recovery: Classification, advantages and applications, commercially viable waste heat recovery devices, saving potential.

UNIT V ENERGY AND ENVIRONMENT, AIR POLLUTION, CLIMATE CHANGE **9**

United Nations Framework Convention on Climate Change (UNFCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), CDM Procedures case of CDM – Bachat Lamp Yojna and industry; Prototype Carbon Fund (PCF).

TOTAL HOURS: 45 PERIODS

OUTCOMES

- To summarized the energy conservation scenario, energy and environment, air pollution, climate change, and various acts and policy for the energy conservation.
- To infer the concept of financial management, energy monitoring and targeting.
- To apply the knowledge of energy audit for the energy management and operation of energy audit instruments.
- To analyze the energy saving area and improvement in efficiency of various thermal utilities and systems.
- To evaluate the net present worth in financial management and performance assessment of various thermal utilities and systems.

TEXT BOOKS

1. Energy Management Handbook, W.C. Turner, John Wiley and Sons, A Wiley Inter science publication.
2. Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, 2nd Edition, CRC Press

REFERENCE BOOKS

1. Handbook of Energy Audits, Albert Thumann, 6th Edition, The Fairmont Press.
2. Bureau of Energy Efficiency Reference book: No.1, 2, 3, 4.
3. Carbon Capture and Sequestration: Integrating Technology, Monitoring, and Regulationedited by E J Wilson and D Gerard, Blackwell Publishing.

21GE1004	HOSPITAL WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- Understand the hazardous materials used in hospital and its impact on health
- Understand various waste disposal procedures and management.
- Understand the various facility guidelines of administrative area safety and control of hazardous energy
- Understand the inputs of healthcare immunizations and medication safety.

UNIT I HEALTHCARE HAZARD CONTROL AND UNDERSTANDING ACCIDENTS 9

Healthcare Hazard Control: Introduction, Hazard Control, Hazard Control Management and responsibilities, Hazard Analysis, Hazard Control and Correction, Personal Protective Equipment, Hazard Control Committees and System Safety. Understanding Accidents: Accident Causation Theories, Human Factors, Accident Deviation Models, Accident Reporting, Accident Investigations, Accident Analysis, Organizational Functions That Support Accident Prevention, Workers' Compensation.

UNIT II BIOMEDICAL WASTE MANAGEMENT 9

Biomedical Waste Management : Types of wastes, major and minor sources of biomedical waste, Categories and Classification of biomedical waste, hazard of biomedical waste, need for disposal of biomedical waste, waste minimization, waste segregation and labelling, waste handling, collection, storage and transportation, treatment and disposal.

UNIT III HAZARDOUS MATERIALS 9

Hazardous Materials : Hazardous Substance Safety, OSHA Hazard Communication Standard, DOT Hazardous Material Regulations, Healthcare Hazardous Materials, Medical Gas Systems, Hazardous Waste Operations and Emergency Response Standard, Respiratory Protection.

UNIT IV FACILITY SAFETY 9

Facility Safety : Introduction, Facility Guidelines: Institute, Administrative Area Safety, Slip, Trip, and Fall Prevention, Safety Signs, Colours, and Marking Requirements, Tool Safety, Machine Guarding, Compressed Air Safety, Electrical Safety, Control of Hazardous Energy, Landscape and Grounds Maintenance, Fleet and Vehicle Safety.

UNIT V INFECTION CONTROL, PREVENTION AND PATIENT SAFETY 9

Healthcare Immunizations, Centres for Disease Control and Prevention, Disinfectants , Antiseptics, OSHA Blood borne Pathogens Standard and Healthcare Opportunistic Infections. Patient Safety: An Organizational Function, Errors and Adverse Events, Safety Cultures, Patient-Centred Healthcare.

TOTAL HOURS: 45 PERIODS

OUTCOMES

- Analyse various hazards, accidents and its control.
- Design waste disposal procedures for different biomedical wastes.
- Categorize different biomedical wastes based on its properties.
- Outline the Hazardous safety and its Healthcare hazardous Material regulations.
- Design different safety facility in hospitals.
- Propose various regulations and safety norms.

TEXT BOOKS

1. Tweedy, James T., Healthcare hazard control and safety management-CRC Press_Taylor andFrancis (2014).
2. Anantpreet Singh, SukhjitKaur, Biomedical Waste Disposal, Jaypee Brothers Medical Publishers (P) Ltd (2012).
3. Solid and Hazardous Waste Management, Second Edition by M. N. Rao (Author), Razia Sultana (Author)-BS Publications.
4. Infectious and Medical Waste Management By Peter A. Reinhardt –CRC Press

REFERENCE BOOKS

1. R.C.Goyal, "Hospital Administration and Human Resource Management", PHI – Fourth Edition,2006
2. J. Landrum, "Medical Waste Management and disposal", Elsevier, 1991

21CY1001	INDUSTRIAL NANOTECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn about basis of nanomaterial science.
- To learn about preparation of nanomaterials.
- To learn about characterizations of nanomaterials.
- To learn about applications of nanomaterials in medicine and engineering

UNIT I INTRODUCTION OF NANOTECHNOLOGY 9

Origin of nanoscale Science and Technology - Implications for Physics, Chemistry, Biology and Engineering - Classifications of nanostructured materials- nanoparticles- quantum dots, nanowires- ultra-thinfilms - multilayered materials. Effects of nanoscale materials on physicochemical, mechanical, electronic and optical properties.

UNIT II PREPARATION METHODS 9

Bottom-up synthesis and top-down approach - co-precipitation, sol-gel method, electro deposition, self-assembly, sputtering, mechanical ball milling and vapour phase deposition.

UNIT III CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique (XRD), Scanning Electron Microscope (SEM) - environmental techniques - Transmission Electron Microscopy including high-resolution imaging (HRTEM), Surface Analysis techniques - Atomic Force Microscope (AFM), Scanning Probe Microscope (SPM), Scanning Tunneling microscope (STM) and Nano indentation.

UNIT IV NANOTECHNOLOGY IN MEDICINE 9

Nano biotechnology: Nano-probes in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery, Bio-imaging, Quantum dots for cancer treatment nanorobotics for surgery - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS) for healthcare - nano-crystalline silver for bacterial inhibition.

UNIT V NANOTECHNOLOGY IN ENGINEERING 9

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip. Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery. Sensors – Classification, Types of sensors, properties, biosensors,nanosensors,nanobiosensors. Nanotoxicity.

TOTAL HOURS: 45 PERIODS

OUTCOMES

- Familiarize about the science of nanomaterial's.
- Demonstrate the preparation of nanomaterial's
- Develop the knowledge in characteristic nanomaterial.
- Understand about the role of nanotechnology in the field of medicine.
- Understand applications of nanoscience in technology.
- Understand applications of nanoscience in sensors.

TEXT BOOKS

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale Charecterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.
3. Christof M. Niemeyer, Chad A. Mirkin, Nanobiotechnology, Concepts, Applications and Prospectives, Wiley, 2004.

REFERENCE BOOKS

1. G Timp, "Nanotechnology", AIP press/Springer, 1999.
2. Malsch, Neelina H, (et), Biomedical Nanotechnology, Washington, DC; CRC Press, 2005
3. AkhleshLakhtakia,"The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.
4. Hocine Yahia Shape Memory Implants, Springer Verlag, 2000.

21EE1003	LOGIC AND DISTRIBUTED CONTROL SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To give an introductory knowledge about PLC and the programming languages.
- To give basic knowledge in the architecture and local control unit of distributed control system.
- To give basic knowledge about Computer Controlled Systems
- To give adequate information in the interfaces used in DCS.

UNIT - I **PLC & SCADA** **9**

PLC: Evolutions of PLCs – Programmable Controllers – Architecture, I/O modules – Comparative study of Industrial PLCs. SCADA: Remote terminal units- Master station - Communication architectures

UNIT - II **BASICS OF PLC PROGRAMMING(LADDER)** **9**

Basics of PLC programming – Ladder Logic – Relay type instructions – Timer/Counter instructions – Program control instructions – Data manipulation and math instructions – Programming Examples **.**

UNIT - III **PLC PROGRAMMING (OTHER LANGUAGES)** **9**

Functional block programming - Sequential function chart – Instruction list – Structured text programming – PLC controlled sequential Process Examples.

UNIT - IV **DISTRIBUTED CONTROL SYSTEM** **9**

DCS: Evolution & types – Hardware architecture – Field control station – Interfacing of conventional and smart field devices (HART and FF enabled) with DCS Controller – Communication modules – Operator and Engineering Human interface stations – Study of any one DCS available in market.

UNIT - V **ADVANCED TOPICS IN AUTOMATION** **9**

Introduction to Networked Control systems – Plant wide control – Internet of things – Cloud based Automation – OLE for Process Control – Safety PLC – Case studies: PLC - SCADA – DCS.

TOTAL HOURS: 45 HOURS

OUTCOMES: (Minimum of 5 in simple statements)

1. Understand components such as PLC, SCADA, DCS,I/O modules and field devices of an industrial automation system.
2. Develop the program using PLC for industrial applications.
3. Program a PLC using ladder logic .
4. Describe the functionality of SCADA.
5. Understand the systems used in distributed control systems.

TEXT BOOKS: (Market Available & Available in library)

1. F.D. Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, Third edition, 2010.
2. Michael P. Lukas, Distributed Control Systems: Their Evaluation and Design, Van Nostrand Reinhold Co., 1986.
3. D. Popovic and V.P.Bhatkar,' Distributed computer control for industrial Automation' Marcel Dekker, Inc., Newyork ,1990.

REFERENCES:

1. Clarke, G., Reynders, D. and Wright, E., "Practical Modern SCADA Protocols: DNP3,4. 60870.5 and Related Systems", Newnes, 1st Edition, 2004.
2. Hughes, T.A., "Programmable Logic Controllers: Resources for Measurements and Control Series", 3rd Edition, ISA Press, 2004.

McMillan, G.K., "Process/Industrial Instrument and Controls Handbook", 5thEdition, McGraw- Hill handbook, New York, 1999.

21EC1011	TELE HEALTH TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know telecommunication basics and practices
- Learn the key principles for telemedicine and health.
- Understand telemedical technology.
- Know telemedical standards, mobile telemedicine and it applications.

UNIT I TELEMEDICINE AND HEALTH 9

History and Evolution of telemedicine, Organs of telemedicine, Global and Indian scenario, Ethical and legal aspects of Telemedicine - Confidentiality, Social and legal issues, Safety and regulatory issues, Advances in Telemedicine.

UNIT II TELEMEDICAL TECHNOLOGY 9

Principles of Multimedia - Text, Audio, Video, data, Data communications and networks, PSTN, POTS, ANT, ISDN, Internet, Air/ wireless communications Communication infrastructure for telemedicine – LAN and WAN technology. Satellite communication, Mobile communication.

UNIT III TELEMEDICAL STANDARDS 9

Data Security and Standards: Encryption, Cryptography, Mechanisms of encryption, phases of Encryption. Protocols: TCP/IP, ISO-OSI, Standards to followed DICOM, HL7, H. 320 series Video Conferencing, Security and confidentiality of medical records, Cyber laws related to telemedicine.

UNIT IV MOBILE TELEMEDICINE 9

Tele radiology: Image Acquisition system Display system, Tele pathology, Medical information storage and management for telemedicine- patient information, medical history, test reports, medical images, Hospital information system.

UNIT V TELEMEDICAL APPLICATIONS 9

Telemedicine – health education and self-care. · Introduction to robotics surgery, Telesurgery. Telecardiology, Teleoncology, Telemedicine in neurosciences, Business aspects - Project planning and costing, Usage of telemedicine.

TOTAL HOURS: 45 PERIODS

OUTCOMES

- Apply multimedia technologies in telemedicine
- Explain protocols behind encryption techniques for secure transmission of data
- Apply telehealth in healthcare

TEXT BOOKS

1. Norris, A.C. Essentials of Telemedicine and Telecare, Wiley, 2002
2. Wootton, R., Craig, J., Patterson, V. (Eds.), Introduction to Telemedicine. Royal Society of Medicine Press Ltd, Taylor and Francis 2006 Wiley 1999 (unit-3,4&5)

REFERENCE BOOKS

1. OCarroll, P.W., Yasnoff, W.A., Ward, E., Ripp, L.H., Martin, E.L. (Eds), Public Health Informatics and Information Systems, Springer, 2003.
2. Ferrer-Roca, O., Sosa – Iudicissa, M. (Eds.), Handbook of Telemedicine. IOS Press (Studies in Health Technology and Informatics, Volume 54, 2002.
3. Simpson, W. Video over IP. A practical guide to technology and applications. Focal Press Elsevier, 2006.
4. Bemmel, J.H. van, Musen, M.A. (Eds.) Handbook of Medical Informatics. Heidelberg, Germany: Springer, 1997
5. Mohan Bansal " Medical Informatics", Tata McGraw-Hill, 2004.

OPEN ELECTIVE – II

21EE1001	BASIC CIRCUIT THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce electric circuits and its analysis
- To impart knowledge on solving circuit equations using network theorems
- To introduce the phenomenon of resonance in coupled circuit
- To educate on obtaining the transient response of circuits.
- To introduce Phasor diagrams and analysis of three phase circuits
- To introduce electric circuits and its analysis

UNIT - I BASIC CIRCUITS ANALYSIS 9

Resistive elements – Ohm's Law Resistors in series and parallel circuits – Kirchhoff's laws – Mesh current and node voltage - methods of analysis.

UNIT - II NETWORK REDUCTION AND THEOREMS FOR DC AND AC CIRCUITS 9

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Norton Theorems – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem – Millman's theorem.

UNIT - III TRANSIENT RESPONSE ANALYSIS 9

L and C elements -Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. sinusoidal input.

UNIT - IV THREE PHASE CIRCUITS 9

A.C. circuits – Average and RMS value - Phasor Diagram – Power, Power Factor and Energy.Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power measurement in three phase circuits.

UNIT - V RESONANCE AND COUPLED CIRCUITS 9

Series and parallel resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits

TOTAL: 45 PERIODS

COURSE OUTCOMES

1. Ability to comprehend the basics of circuit analysis.
2. Ability of solve electrical circuits using theorems
3. Ability to analyze the transient response
4. Able to comprehend the three phase circuits
5. Able to understand coupled circuits

TEXT BOOKS:

1. William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, “Engineering Circuits Analysis”, McGraw Hill publishers, edition, New Delhi, 2013.
2. Charles K. Alexander, Mathew N.O. Sadiku, “Fundamentals of Electric Circuits”, Second Edition, McGraw Hill, 2013.
3. Allan H. Robbins, Wilhelm C. Miller, “Circuit Analysis Theory and Practice”, Cengage Learning India, 2013
4. Sudhakar A and Shyam Mohan SP, “Circuits and Network Analysis and Synthesis”, McGraw Hill, 2015.

REFERENCES:

1. Chakrabarti A, “Circuits Theory (Analysis and synthesis), DhanpathRai& Sons, New Delhi, 1999.
2. Jegatheesan, R., “Analysis of Electric Circuits,” McGraw Hill, 2015.
3. Joseph A. Edminister, MahmoodNahri, “Electric circuits”, Schaum‟s series, McGrawHill, New Delhi, 2010.
4. M E Van Valkenburg, “Network Analysis”,Prentice-Hall of India Pvt Ltd, New Delhi, 2015
5. Mahadevan, K., Chitra, C., “Electric Circuits Analysis,” Prentice-Hall of India Pvt Ltd., New Delhi, 2015.

21CY1002	ENERGY TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To gain knowledge about different energy sources
- To attain knowledge in energy conservation

Unit I ENERGY 9

Introduction to energy – Global energy scene – Indian energy scene - Units of energy, conversion factors, general classification of energy, energy crisis, environmental aspects of energy utilisation, energy alternatives.

Unit II CONVENTIONAL ENERGY 9

Conventional energy resources, Thermal, hydel and nuclear reactors, thermal, hydel and nuclear power plants, efficiency, merits and demerits of the above power plants, combustion processes, fluidized bed combustion.

Unit III NON-CONVENTIONAL ENERGY

Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, solar energy application in India, application of nano technology in solar energy conversion, energy plantations. Wind energy, types of windmills, wind electric power generation, wind power in India, economics of wind farm, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy, hydrogen energy.

Unit IV BIOMASS ENARGY 9

Biomass origin - Resources – Biomass estimation. Thermochemical conversion – Biological conversion, Chemical conversion – Hydrolysis & hydrogenation, solvolysis, biocrude, biodiesel power generation gasifier, biogas, bioCNG, integrated gasification.

Unit V ENERGY CONSERVATION 9

Energy conservation - Act; Energy management definition, importance, duties and responsibilities; Energy audit – need, Types methodology, reports, instruments. Benchmalcing and energy performance, material and energy balance, thermal energy management – waste to energy conservation technologies (plastic to petrol).

COURSE OUTCOMES

- Become intellectual in energy studies
- Understand conventional Energy sources.
- Understand the concept of various non-conventional energy resources
- Attain knowledge in biomass sources and develop design parameters for equipmentsto be used in chemical process industries
- Understand energy conservation in process industries

TEXT BOOKS

1. Rao, S. and Parulekar, B.B., Energy Technology, Khanna Publishers, 2005.
2. Rai, G.D., Non-conventional Energy Sources, Khanna Publishers, New Delhi, 1984.
3. Nagpal, G.R., Power Plant Engineering, Khanna Publishers, 2008.
4. Energy Management, Paul W.O‟Callaghan McGraw – Hill, 1993
5. Khan B.H. Non-Conventional Energy Resources, The McGraw Hills, 2nd Edition 2016.

REFERENCE BOOKS

1. NejatVezirog, Alternate Energy Sources, IT, McGraw Hill, New York.
2. El. Wakil, Power Plant Technology, Tata McGraw Hill, New York, 2002.
3. Sukhatme. S.P., Solar Enery - Thermal Collection and Storage, Tata McGraw hill, New Delhi, 1981
4. Handbook of Energy Audit by 7th edition Albert Thumann, P.E., C.E.M & William J Younger C.E.M, Faiment Press 2008
5. John W Twidell and Tony D Weir Renewable Energy Resources, Taylor and Francis, 2nd Edition 2006.

21EC1004	ELECTRONIC DEVICES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To acquaint the students with the construction, theory and operation of the basic electronic devices such as PN junction diode, Bipolar and Field effect Transistors, Power control devices, LCD and other Opto-electronic devices.

UNIT I SEMICONDUCTOR DIODE 9

PN junction diode, Current equations, Energy Band diagram, Diffusion and drift current densities, forward and reverse bias characteristics, Transition and Diffusion Capacitances, Switching Characteristics, Breakdown in PN Junction Diodes.

UNIT II BIPOLAR JUNCTION TRANSISTORS 9

N PN -PNP - Operations-Early effect-Current equations – Input and Output characteristics of CE, CB, CC - h-parameter model, Ebers Moll Model, Multi Emitter Transistor.

UNIT III FIELD EFFECT TRANSISTORS 9

JFETs – Drain and Transfer characteristics,-Current equations-Pinch off voltage and its significance- MOSFET- Characteristics- Threshold voltage -Channel length modulation, D-MOSFET, E-MOSFET- Characteristics – Comparison of MOSFET with JFET.

UNIT IV SPECIAL SEMICONDUCTOR DEVICES 9

M Metal-Semiconductor Junction- MESFET, FINFET, PINFET, CNTFET, DUAL GATE MOSFET, Zener diode-Varactor diode - Gallium Arsenide device, LDR.

UNIT V POWER DEVICES AND DISPLAY DEVICES 9

UJT, SCR, Diac, Triac, Power BJT- Power MOSFET- DMOS-VMOS, LCD, Photo transistor, Opto Coupler, CCD.

Total :45 PERIODS

OUTCOMES

- Explain the V-I characteristics of semiconductor diode.
- Classify the configurations of BJT and understand its equivalence circuits.
- Understand the drain – transfer characteristics of FET.
- Illustrate the characteristics of special semiconductor devices.
- Outline the concepts of power devices.
- Outline the concepts of display devices.

TEXT BOOKS

1. Donald A Neaman, ―Semiconductor Physics and Devices‖, Fourth Edition, Tata McGrawHill Inc. 2012.
2. Salivahanan. S, Suresh Kumar. N, Vallavaraj.A, ―Electronic Devices and circuits‖, Third Edition, Tata McGraw- Hill, 2008.

REFERENCE BOOKS

1. Robert Boylestad and Louis Nashelsky, ―Electron Devices and Circuit Theory Pearson Prentice Hall, 10th edition, July 2008.
2. R.S.Sedha, ― A Text Book of Applied Electronics S.Chand Publications, 2006.
3. Yang, ―Fundamentals of Semiconductor devices, McGraw Hill International Edition, 1978.

21CE1009	ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart the knowledge and skills to identify, assess and mitigate the environmental and social impacts of developmental projects

UNIT I INTRODUCTION 9

Impacts of Development on Environment – Rio Principles of Sustainable Development- Environmental Impact Assessment (EIA) – Objectives – Historical development – EIA Types – EIA in project cycle –EIA Notification and Legal Framework.

UNIT II ENVIRONMENTAL ASSESSMENT 9

Screening and Scoping in EIA – Drafting of Terms of Reference, Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise, flora and fauna - Matrices – Networks – Checklist Methods - Mathematical models for Impact prediction.

UNIT III ENVIRONMENTAL MANAGEMENT PLAN 9

Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna – Environmental Monitoring Plan – EIA Report Preparation – Public Hearing- Environmental Clearance

UNIT IV SOCIO ECONOMIC ASSESSMENT 9

Baseline monitoring of Socio economic environment – Identification of Project Affected Personal – Rehabilitation and Resettlement Plan- Economic valuation of Environmental impacts – Cost benefit Analysis-

UNIT V CASE STUDIES 9

EIA case studies pertaining to Infrastructure Projects – Roads and Bridges – Mass Rapid Transport Systems - Airports - Dams and Irrigation projects - Power plants.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Carry out scoping and screening of developmental projects for environmental and social assessments
- Explain different methodologies for environmental impact prediction and assessment

- Plan environmental impact assessments and environmental management plans
- Evaluate environmental impact assessment reports

TEXTBOOKS

1. Canter, R.L, "Environmental impact Assessment ", 2nd Edition, McGraw Hill Inc, New Delhi,1995.
2. Lohani, B., J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L. Tu, "Environmental Impact Assessment for Developing Countries in Asia", Volume 1 – Overview, Asian Development Bank,1997.
3. Peter Morris, RikiTherivel "Methods of Environmental Impact Assessment", Routledge Publishers,2009.

REFERENCES

1. Becker H. A., Frank Vanclay,"The International handbook of social impact assessment" conceptual and methodological advances, Edward Elgar Publishing,2003.
2. Barry Sadler and Mary McCabe, "Environmental Impact Assessment Training Resource Manual", United Nations Environment Programme,2002.
3. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I and II", Blackwell Science New York, 1998.
4. Ministry of Environment and Forests EIA Notification and Sectoral Guides, Government of India, New Delhi, 2010.

21GE1003	HOSPITAL MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the fundamentals of hospital administration and management
- To know the market related research process
- To explore various information management systems and relative supportive services
- To learn the quality and safety aspects in hospital

UNIT I OVERVIEW OF HOSPITAL ADMINISTRATION 9

Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning- Equipment Planning – Functional Planning - Role of hospital administration – Hospitalsystem – Need for scientific planning and design of hospitals

UNIT II HUMAN RESOURCE MANAGEMENT IN HOSPITAL 9

Principles of HRM – Functions of HRM – Profile of HRD Manager – Human Resource Inventory – Manpower Planning – Significance – Importance of HR Planning – Factors influencing HR Planning Process – Job Analysis

UNIT III RECRUITMENT AND TRAINING 9

Different Departments of Hospital, Recruitment, Selection, Training Guidelines – Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer Performance Appraisals: Techniques & Practices

UNIT IV SUPPORTIVE SERVICES 9

Medical Records Department – Central Sterilization and Supply Department – Pharmacy – FoodServices - Laundry Services –Transportation services – Mortuary services – Hospital security services

UNIT V COMMUNICATION AND SAFETY ASPECTS IN HOSPITAL 9

Purposes – Planning of Communication, Modes of Communication – Telephone, ISDN, Public Address and Piped Music – CCTV. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules – Challenges of e-health – electronic medical records

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the principles of Hospital administration
- Identify the importance of Human resource management
- List various marketing research techniques
- Identify Information management systems and its uses
- Explain the principles of Hospital administration

TEXT BOOKS

1. R.C.Goyal, “Hospital Administration and Human Resource Management”, PHI – Fourth Edition,2006
2. G.D.Kunders, “Hospitals – Facilities Planning and Management – TMH, New Delhi – Fifth Reprint2007
3. Stephen P. Robbins and Mary Coulter, Management (Prentice Hall of India Pvt. Ltd., New Delhi)
4. J.E. Park and K. Park, Textbook of Preventive and Social Medicine (M/S BanarsidasBhanot Publishers, Jabalpur)
5. Elaine La Monica, Management in Health Care (Macmillan Press Ltd, London) References
6. B.M. Sakharkar, Principles of Hospital Administration and Planning (Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi)

21EC1002	MEDICAL ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES

The student should be made:

1. To gain knowledge about the various physiological parameters both electrical and nonelectrical and the methods of recording and also the method of transmitting these parameters
2. To study about the various assist devices used in the hospitals
3. To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.

UNIT I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING 9

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

UNIT II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT 9

pH, PO2, PCO2, Colorimeter, Blood flow meter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.

UNIT III ASSIST DEVICES 9

Cardiac pacemakers, DC Defibrillator, Dialyser, Ventilators, Magnetic Resonance Imaging Systems, Ultrasonic Imaging Systems.

UNIT IV PHYSICAL MEDICINE AND BIOTELEMETRY 9

Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry.

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION 9

Telemedicine, Insulin Pumps, Radio pill, Endomicroscopy, Brain machine interface, Lab on a chip.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Know the human body electro- physiological parameters and recording of bio-potentials
2. Comprehend the non-electrical physiological parameters and their measurement – body temperature, blood pressure, pulse, blood cell count, blood flow meter etc.
3. Interpret the various assist devices used in the hospitals viz. pacemakers, defibrillators, dialyzers and ventilators
4. Comprehend physical medicine methods eg. ultrasonic, shortwave, microwave surgical diathermies, and bio-telemetry principles and methods
5. Know about recent trends in medical instrumentation

TEXT BOOK:

1. Khandpur, R.S., “Handbook of Biomedical Instrumentation”, TATA McGraw-Hill, New Delhi, 2003.

REFERENCES:

1. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hall of India, New Delhi, 2007.
2. John G.Webster, “Medical Instrumentation Application and Design”, 3rd Edition, Wiley India Edition, 2007

21EC1006	SIGNALS AND SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basic properties of signals.
- To analyze the basic systems using properties.
- To analyze the characteristics of continuous time signals in the Fourier and Laplace domain
- To analyze LTI – Continuous time systems in Time domain and Frequency domain
- To analyze the characteristics of Discrete time signals in the Fourier and Z transform domain
- To analyze LTI - Discrete time systems in Time domain and Frequency domain

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 9

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_Classificationofsignals – Continuous time (CT) and Discrete Time (DT) signals, Periodic &Aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of ystems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 9

Fourier Series for periodic signals -Analysis of Continuous Time Signals using Fourier Transform – nverse FT -Properties of FT, CT analysis using Laplace Transform-Unilateral LT and Bilateral LT- nverse LT- Properties of Unilateral LT.

UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 9

mpulse response - convolution integrals – Graphical method - Properties of convolution integral- Overall mpulse response for interconnected systems - Fourier and Laplace transforms in Analysis of CT systems Solving of Differential Equation.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 9

Baseband signal sampling -Analysis of Discrete Time Signals using Discrete Time Fourier Transform

(DTFT)- Inverse DTFT–Properties of DTFT- Analysis of Discrete Time Signals using Z-Transform – Inverse Z-Transform - Properties of Z-Transform.

UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 9

Impulse response – Convolution sum –Graphical method - Properties of Discrete Convolution- Overall iimpulse response for interconnected systems -Solving of Difference equations- Solution of Difference equation using DTFT- solution of difference equation using Z-transform.

TOTAL : 45 PERIODS

OUTCOMES

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

- Understand the basics of signals and its classifications
- Analyze the basic systems and its classifications
- Determine the frequency Response for Deterministic signal and also analyze in S-domain
- Apply the Fourier and Laplace Transform for the analysis of LTI -Continuous Time systems
- Analyze the Characteristics of DT signals by using DTFT and Z-transform
- Apply the Fourier and Z- Transform for the analysis of LTI –Discrete Time systems

TEXT BOOKS

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, “Signals and Systems”,Pearson,2015.
2. S. Haykin and B. Van Veen, "Signals and Systems", 2nd Edition, Wiley, 2007.

REFERENCE BOOKS

1. B.P.Lathi,“Principles of Linear Systems and Signals”,Second Edition,Oxford,2009.
2. R.E.Zeimer,W.H.Tranter and R.D.Fannin,“Signals &Systems-Continuous and Discrete” ,Pearson,2007.
3. John Alan Stuller,“An Introduction to SignalsandSystems”,Thomson,2007.

21ME1006	SYSTEM ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Illustrate the life cycle phases and framework for systems engineering.
- Describe about systems engineering process.
- Apply ergonomic and system dynamic models for evaluation of alternatives.
- Create knowledge on Reliability, Markov and Time series models for analysis f alternatives.
- Describe about decision assessment methods in systems engineering.

UNIT I INTRODUCTION **9**

Definitions of Systems Engineering, Systems Engineering Knowledge, Life cycles, Life-cycle phases, logical steps of systems engineering, Frame works for systems engineering.

UNIT II SYSTEMS ENGINEERING PROCESSES **9**

Formulation of issues with a case study, Value system design, Functional analysis, Business Process Reengineering, Quality function deployment, System synthesis, Approaches for generation of alternatives.

UNIT III ANALYSIS OF ALTERNATIVES - I **9**

Cross-impact analysis, Structural modeling tools, System Dynamics models with case studies, Economic models: present value analysis – NPV, Benefits and costs over time, ROI, IRR; Work and Cost breakdown structure.

UNIT IV ANALYSIS OF ALTERNATIVES – II **9**

Reliability, Availability, Maintainability, and Supportability models; Stochastic networks and Markov models, Queuing network optimization, Time series and Regression models, Evaluation of large scale models

UNIT V DECISION ASSESSMENT **9**

Decision assessment types, Five types of decision assessment efforts, Utility theory, Group decision making and Voting approaches, Social welfare function; Systems Engineering methods for Systems Engineering Management

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, students will be able to

CO1: Be able to recognize life cycle phases in systems engineering.
CO2: Apply steps in systems engineering process for large scale problems.
CO3: Able to develop system dynamic models for analyzing alternatives.
CO4: Gain ability to evaluate alternatives in large scale problems.
CO5: Be able Attain confidence in assessment and arrive decisions forcomplex problems.

TEXT BOOKS

1. Andrew P. Sage, James E. Armstrong Jr. “Introduction to Systems Engineering”, John Wiley and Sons, Inc, 2000.
2. Alexander Kossiakoff, Steven M. Biemer, Samuel J. Seymour, David A. Flanigan "Systems Engineering Principles and Practice", 3rd Edition

REFERENCE BOOKS

1. Andrew P.Sage, “Systems Engineering”, John Wiley & Sons, 1992.
2. Andrew P.Sage, William B.Rouse, “Hand book of Systems Engineering and Management”, John Wiley & Sons, 1999.

21ME1008	SUPPLY CHAIN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Describe the role and drivers of and supply chain management in achieving competitiveness.
- Explain about Supply Chain Network Design.
- Illustrate about the issues related to Logistics in Supply Chain
- Appraise about Sourcing and Coordination in Supply Chain.
- Application of Information Technology and Emerging Concepts in Supply Chain.

UNIT - I INTRODUCTION 9

. Role of Logistics and Supply chain Management: Scope and Importance - Evolution of Supply Chain – Examples of supply Chains - Decision Phases in Supply Chain - Competitive and Supply chain Strategies – Drivers of Supply Chain Performance and Obstacles.

UNIT - II SUPPLY CHAIN NETWORK DESIGN 9

Role of Distribution in Supply Chain – Factors influencing Distribution network design – Design options for Distribution Network- Distribution Network in Practice - Role of network Design in Supply Chain – Framework for network Decisions.

UNIT - III LOGISTICS IN SUPPLY CHAIN 9

Role of transportation in supply chain – Factors affecting transportations decision – Design option for transportation network – Tailored transportation – Routing and scheduling in transportation - 3PL- 4PL- Global Logistics - Reverse Logistics; Reasons, Activities and issues.

UNIT - IV SOURCING AND COORDINATION IN SUPPLY CHAIN 9

Role of Sourcing in supply chain - Supplier selection - Contracts - Design Collaboration - Sourcing planning and analysis - Supply chain co-ordination - Bull whip effect – Effect of lack of co-ordination in supply chain and obstacles – Building strategic partnerships and trust within a supply chain.

UNIT - V IT AND EMERGING CONCEPTS IN SUPPLY CHAIN 9

The role IT in supply chain-The supply chain IT framework - Customer Relationship Management – Internal supply chain management – supplier relationship management – future of IT in supply chain – E-Business in supply chain- Introduction to Warehouse Management, Risks in Supply Chain, Lean supply Chains, Sustainable supply Chains.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, students will be able to

CO1: Ability to understand the scope of Supply Chain Management and the Drivers of SC performance
CO2: Ability to design suitable SC network for a given situation
CO3: Ability to solve the issues related to Logistics in SCM
CO4: Ability to understand Sourcing, Coordination and current issues in SCM
CO5: Ability to appraise about the applications of IT in SCM and apply SCM concepts in selected enterprise

TEXT BOOKS

1. Sunil Chopra, Peter Meindl and D.V. Kalra, “Supply Chain Management: Strategy, Planning, and Operation", Pearson Education, 2016.

REFERENCE BOOKS

1. Ravi Ravindran A, Donald P. Warsing, Jr, “Supply Chain Engineering: Models and Applications”, “CRC Press, 2012.
2. Srinivasan G.S, “Quantitative models in Operations and Supply Chain Management”, PHI, 2010

21CY1003	WASTE WATER TREATMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To provide basic under standings about the requirements of water, its preliminary treatment
- To give the students a broad understanding of all issues related to the analysis and design of water supply and wastewater disposal systems.

UNIT I WATER AS A RESOURCE, ITS QUALITY & PARAMETERS 9

Water sources- water quantity- maintenance of water cycle- impurities in water- effects of impurities in water- water quality parameters- physical, chemical & biological. Characteristics of potable water- wastewater effluent standards -water quality indices. Need for water and wastewater treatment - associated environmental laws- drinking water and wastewater discharge standards, water reuse and recycling concepts.

UNIT II INDUSTRIAL WATER TREATMENT 9

ltration – size and shape characteristics of filtering media – sand filters hydraulics of filtration – design considerations – radial, up flow, high rate and multimedia filters, pressure filter. Water softening – lime soda, zeolite and demineralization processes- industrial water treatment for boilers.

UNIT III CONVENTIONAL TREATMENT METHODS 9

Taste and odour control – adsorption – activated carbon treatment – removal of color – iron and manganese removal – aeration, oxidation, ion exchange and other methods – effects of fluorides – fluoridation and de fluoridation –desalination - conventional activated sludge process and its modifications – trickling filter, bio-towers and rotating biological contactors-corrosion prevention and control – factors influencing corrosion – Lange Lier index – corrosion control measures.

UNIT IV WASTE WATER TREATMENT 9

Description and design of wastewater collection system- Quantity and quality of wastewater- wastewater treatment plant layout and related issues- Sewage and waste water treatments systems: A. Primary treatment methods - B. Secondary treatment methods and - C. Tertiary treatment methods. Equalization neutralization – screening and grid removal – sedimentation – oil separation gas stripping of volatile organics – biological oxidation – lagoons and stabilization basins – aerated lagoons - Chemical oxidation - types of reactors and reactors analysis

UNIT V DOMESTIC WASTE WATER TREATMENT METHODS & RECENT TRENDS 9

Water purification systems in natural systems - Rate of water supplies for urban and rural systems. Unit operations and processes, treatment flow-diagrams for different sources of water. Watersupply norms -Advanced water treatment, Automation in Water Supply and Smart Water Supply Systems, Package treatment units, implications of 24x7 supply, Water Economics & Pricing and application of nano materials package treatment units

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, students will be able to

- Understand water quality standards and parameters
- Understand the principles and operation of water treatment systems
- Attain knowledge about the conventional treatment methods used in water
- Analyze the various planning & design of waste water collection & conveyance and treatment systems.
- Understand the need for advanced water treatment with automation in treatment, water economics and patented material

Text Books

1. Metcalf and Eddy, "Wastewater Engineering", 4th ed., McGraw Hill Higher Edu., 2002.
2. W. Wesley Eckenfelder, Jr., "Industrial Water Pollution Control", 2nd Edn., McGraw Hill Inc., 1989.

Reference Books

1. S.P. Mahajan, "Pollution control in process industries", 27th Ed. Tata McGraw Hill Publishing Company Ltd., 2012.
2. M. Lancaster, "Green Chemistry: An Introductory Text", 2nd edition, RSC publishing, 2010.
3. C.S. Rao, "Environmental Pollution Control Engineering", New Age International, 2007.
4. Water Supply and Pollution Control. Authors: Warren Viessman Jr. and Mark J. Hammer. 7th Edition 2005. Publisher: Pearson Education
5. Wastewater Microbiology, 2nd Edition. Wiley-Liss; 2nd edition (February 16, 1999)