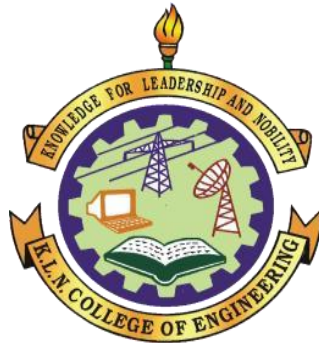


# **K.L.N.COLLEGE OF ENGINEERING**

**Pottapalayam–630612, Sivagangai District**

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



Estd:1994

## **CURRICULUM AND SYLLABUS**

**I to VIII Semesters**

**REGULATIONS 2020**

**For Under Graduate Program**

**B.TECH. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**CHOICE BASED CREDIT SYSTEM**

**(For the students admitted during the academic year 2021-2022)**



**K.L.N. COLLEGE OF ENGINEERING, POTTAPALAYAM**  
(An Autonomous Institution, Affiliated to Anna University, Chennai)



### **VISION OF THE INSTITUTION**

To become a Centre of Excellence in Technical Education and Research in producing Competent and Ethical professionals to the society.

### **MISSION OF THE INSTITUTION**

To impart Value and Need based curriculum to the students with enriched skill development in the field of Engineering, Technology, Management and Entrepreneurship and to nurture their character with social concern and to pursue their career in the areas of Research and Industry.

### **VISION OF THE DEPARTMENT**

To become a centre of Excellence in producing competent and futuristic professionals in Artificial Intelligence and Data Science through quality Education and Research to the Society and Industry.

### **MISSION OF THE DEPARTMENT**

To produce intellectual, innovative and ethical professionals by imparting technical and industry oriented skills with ethical values in Artificial Intelligence and allied areas to pursue their career in Industry and Research.



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### **PROGRAM SPECIFIC OUTCOMES (PSOs)**

PSO 1: Ability to apply major key algorithms, techniques and theoretical findings in the field of Artificial Intelligence, Machine Learning and Deep Learning.

PSO 2: Ability to incorporate data science theories and methodologies into new research in data management, data visualization, and statistical analysis of data.

### **PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

PEO 1: To excel in professional career and pursue higher education in the field of artificial intelligence and data science.

PEO 2: To apply their knowledge and skills to develop innovative solutions for real world problem through lifelong learning.

PEO 3: To excel as socially committed engineers or entrepreneurs with good communication and team work skills with high regard to ethical and moral values.



**K.L.N. COLLEGE OF ENGINEERING, POTTAPALAYAM**  
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**PO1: Engineering Knowledge**

Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2: Problem Analysis**

Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3: Design/Development of Solutions**

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.

**PO4: Conduct Investigations of Complex Problems**

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5: Modern Tool Usage**

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.

**PO6: The Engineer and Society**

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.

**PO7: Environment and Sustainability**

Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO8: Ethics**

Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9: Individual and Team Work**

Function effectively as an individual, and as a member or leader in diverse teams, and in multi disciplinary settings.

**PO10: Communication**

Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11: Project Management and Finance**

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 multi disciplinary environments.

**PO12: Life-Long Learning**

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



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## **REGULATIONS2020**

**For Under Graduate Program**

**B. TECH. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**CHOICE BASED CREDIT SYSTEM**

### **CATEGORY OF COURSES**

- i. **Humanities and Social Sciences(HS)Courses** include Technical English, Environmental Science and Engineering ,Engineering Ethics and human values, Communication Skills and Management courses.
- ii. **Basic Sciences(BS)Courses** include Mathematics, Physics, and Chemistry.
- iii. **Engineering Sciences (ES) Courses** include Engineering Practices, Engineering Graphics, Basics of Electrical / Electronics / Mechanical / Computer Engineering /Instrumentation etc.
- iv. **Professional Core (PC) Courses** include the core courses relevant to the chosen programme of study.
- v. **Professional Elective (PE) Courses** include the elective courses relevant to the chosen programme of study.
- vi. **Open Elective(OE)Courses** include courses from other departments which a student can choose from the list specified in the curriculum of the students B.E. /B.Tech. Programmes.
- vii. **Employability Enhancement Courses(EEC)**include Project Work and/or Internship, Seminar, Professional Practices, Case Study and Industrial/Practical Training.
- viii. **Mandatory Courses (MC)** include Personality and Character development and the courses recommended by the regulatory bodies such as AICTE, UGC, etc



**K.L.N. COLLEGE OF ENGINEERING, POTTAPALAYAM**  
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**REGULATIONS 2020**  
**CHOICE BASED CREDIT SYSTEM**  
(For the students admitted during the academic year 2021-2022)  
**B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**I TO VIII SEMESTERS CURRICULUM AND SYLLABI**

**SEMESTER I**

(Common to all B.E. / B.Tech Programmes)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	20HS101	English for Technical Communication	HS	3	3	0	0	3
2.	20BS101	Fundamentals of Engineering Mathematics	BS	4	3	1	0	4
3.	20BS102	Engineering Physics	BS	3	3	0	0	3
4.	20BS103	Engineering Chemistry	BS	3	3	0	0	3
5.	20GE101	Problem Solving using Python Programming	ES	3	3	0	0	3
<b>PRACTICAL</b>								
6.	20BS1L1	Basic Science Laboratory	BS	3	0	0	3	1.5
7.	20GE1L1	Python Programming Laboratory	ES	4	0	0	4	2
8.	20GE1L2	Industrial Practices Workshop	ES	3	0	0	3	1.5
<b>Total Credits</b>								<b>21</b>

**SEMESTER II**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	20HS201	Advanced Technical Communication (Common to all B.E. / B.Tech programmes)	HS	3	3	0	0	3
2.	20BS201	Laplace Transform and Advanced Calculus (Common to all B.E. / B.Tech programmes)	BS	4	3	1	0	4
3.	20AD201	Foundation for Data Science	PC	3	3	0	0	3
4.	20GE201	Engineering Graphics (Common to all B.E. / B.Tech programmes)	ES	4	2	0	2	3
5.	20GE205	Basic Electrical and Electronics Engineering (Common to B.E. CSE, B.Tech IT & B.Tech AIDS programmes)	ES	3	3	0	0	3
6.	20CS201	Programming in C (Common to B.E. EEE, B.E. CSE, B.Tech IT & B.Tech AIDS programmes)	PC	3	3	0	0	3
<b>PRACTICAL</b>								
7.	20HS2L1	Communication Skills Laboratory (Common to B.E. Mech, B.E. CSE, B.Tech IT & B.Tech AIDS programmes)	HS	2	0	0	2	1
8.	20CS2L1	C Programming Laboratory (Common to B.E. EEE, B.E. CSE, B.Tech IT & B.Tech AIDS programmes)	PC	4	0	0	4	2
9.	20AD2L1	Foundation for Data Science Laboratory	PC	4	0	0	4	2
<b>Total Credits</b>								<b>24</b>

**SEMESTER III**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	20BS303	Discrete Mathematics (Common to B.E. CSE, B.Tech IT & B.Tech AIDS programmes)	BS	4	3	1	0	4
2.	20AD301	Digital Principles and Computer Organization	ES	4	3	1	0	4
3.	20CS302	Data Structures and Algorithms (Common to B.E. CSE, B.Tech IT & B.Tech AIDS programmes)	PC	3	3	0	0	3
4.	20HS301	Universal Human Values (Common to all B.E. / B.Tech programmes)	HS	3	2	1	0	3
<b>THEORY CUM PRACTICAL</b>								
5.	20AD302	Object Oriented Programming using Java	PC	5	3	0	2	4
<b>PRACTICAL</b>								
6.	20CS3L1	Digital Systems Laboratory (Common to B.E. CSE, B.Tech IT & B.Tech AIDS programmes)	ES	4	0	0	4	2
7.	20CS3L2	Data Structures and Algorithms Laboratory (Common to B.E. CSE, B.Tech IT & B.Tech AIDS programmes)	PC	4	0	0	4	2
<b>Total Credits</b>								<b>22</b>

**SEMESTER IV**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	20BS404	Probability and Statistics (Common to B.Tech IT & B.Tech AIDS programmes)	BS	4	3	1	0	4
2.	20CS402	Database Management Systems (Common to B.E. CSE, B.Tech IT & B.Tech AIDS programmes)	PC	3	3	0	0	3
3.	20AD401	Embedded System and Internet of Things	PC	3	3	0	0	3
4.	20HS401	Environmental Science and Engineering (Common to all B.E. / B.Tech programmes)	HS	2	2	0	0	2
<b>THEORY CUM PRACTICAL</b>								
5.	20CS404	Operating Systems (Common to B.E. CSE, B.Tech IT & B.Tech AIDS programmes)	PC	5	3	0	2	4
6.	20AD402	Data Visualization	PC	5	3	0	2	4
<b>PRACTICAL</b>								
7.	20CS4L1	Database Management Systems Laboratory (Common to B.E. CSE, B.Tech IT & B.Tech AIDS programmes)	PC	4	0	0	4	2
8.	20AD4L1	Embedded Systems and Internet of Things Laboratory	PC	4	0	0	4	2
9.	20HS4L2	Professional Communication Laboratory (Common to B.E. EEE, B.E. CSE, B.Tech IT & B.Tech AIDS programmes)	EEC	2	0	0	2	1
<b>Total Credits</b>								<b>25</b>

**KLNCE UG AI&DS R2020 (AY 2021-2022 admitted)**

**SEMESTER V**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	20AD501	Artificial Intelligence	PC	3	3	0	0	3
2.	20AD502	Machine Learning Techniques	PC	3	3	0	0	3
3.	20CS502	Software Engineering (Common to B.Tech IT & B.Tech AIDS programmes)	PC	3	3	0	0	3
4.		Professional Elective - I	PE	-	-	-	-	3
5.		Professional Elective - II	PE	-	-	-	-	3
6.	20MC501	Constitution of India (Common to all B.E. / B.Tech programmes)	MC	1	1	0	0	0
<b>PRACTICAL</b>								
7.	20AD5L1	Machine Learning Techniques Laboratory	PC	4	0	0	4	2
8.	20CS5L2	Software Engineering Laboratory (Common to B.Tech IT & B.Tech AIDS programmes)	PC	4	0	0	4	2
<b>Total Credits</b>								<b>19</b>

**SEMESTER VI**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	20AD601	Natural Language Processing	PC	3	3	0	0	3
2.	20AD602	Image and Video Analytics	PC	3	3	0	0	3
3.		Professional Elective - III	PE	-	-	-	-	3
4.		Professional Elective - IV	PE	-	-	-	-	3
5.		Open Elective - I	OE	3	3	0	0	3
6.		Management Elective	HS	3	3	0	0	3
<b>PRACTICAL</b>								
7.	20AD6L1	Image and Video Analytics Laboratory	PC	4	0	0	4	2
8.	20CS6L1	Mobile Application Development Laboratory (Common to B.E. CSE, B.Tech IT & B.Tech AIDS programmes)	PC	4	0	0	4	2
<b>Total Credits</b>								<b>22</b>

**SEMESTER VII**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	20CS701	Data Analytics (Common to B.E. CSE & B.Tech AIDS programmes)	PC	3	3	0	0	3
2.	20AD701	Artificial Intelligence for Robotics	PC	3	3	0	0	3
3.	20AD702	Cloud Computing	PC	3	3	0	0	3
4.		Professional Elective - V	PE	-	-	-	-	3
5.		Professional Elective - VI	PE	-	-	-	-	3
6.		Open Elective - II	OE	3	3	0	0	3
<b>PRACTICAL</b>								
7.	20AD7L1	Data Exploration Laboratory	PC	4	0	0	4	2
8.	20AD7L2	Cloud Computing Laboratory	PC	4	0	0	4	2
9.	20AD7L3	Mini Project	EEC	4	0	0	4	2
<b>Total Credits</b>								<b>24</b>

**SEMESTER VIII**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>PRACTICAL</b>								
1.	20AD8L1	Project Work	EEC	20	0	0	20	10
<b>Total Credits</b>								<b>10</b>

**TOTAL NO. OF CREDITS: 167**

**PROFESSIONAL ELECTIVE COURSES: VERTICALS**

<b>Cloud Computing and Data Center Technologies</b>	<b>Cyber Security and Data Privacy</b>	<b>Full Stack Development for IT</b>	<b>Innovative Computing Technologies</b>	<b>Expert Systems</b>
Virtualization	Social Network Analysis	Principles of Programming Languages	Data and Information Security	Business Intelligence System
Data Warehousing and Data Mining	Cyber Physical Systems	UI and UX Design	Quantum Computing	Data Communication and Computer Networks
Cloud Services Management	Digital and Mobile Forensics	Cloud Services Management	Neural Networks and Deep Learning	Neural Networks and Deep Learning
Software Defined Networks	Cryptocurrency and Blockchain Technologies	Software Testing and Automation	Cryptocurrency and Blockchain Technologies	Robotic Process Automation
Storage Technologies	Web Application Security	Web Application Security	Cyber Security	Text and Speech Analysis
Computer Vision	Engineering Secure Software Systems	Information Retrieval Techniques	3D Printing and Design	Sensors and Devices
Security and Privacy in Cloud	Security and Privacy in Cloud	DevOps	Agile Methodologies	Ethics and AI
Reinforcement Learning Techniques	Malware Analysis	Reinforcement Learning Techniques	Virtual Reality and Augmented Reality	Health Care Analytics

**PROFESSIONAL ELECTIVE (PE)**

**SEMESTER VI**

**PROFESSIONAL ELECTIVE COURSES: VERTICALS**

**Vertical I : Cloud Computing and Data Center Technologies**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	20ADV11	Virtualization	PE	4	2	0	2	3
2	20CSV21	Data Warehousing and Data Mining	PE	3	3	0	0	3
3	20CSV31	Cloud Services Management	PE	3	3	0	0	3
4	20CSV41	Software Defined Networks	PE	3	3	0	0	3
5	20ADV51	Storage Technologies	PE	3	3	0	0	3
6	20CSV61	Computer Vision	PE	3	3	0	0	3
7	20SCV71	Security and Privacy in Cloud	PE	3	3	0	0	3
8	20ITV81	Reinforcement Learning Techniques	PE	3	3	0	0	3

**Vertical II : Cyber Security and Data Privacy**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	20CSV12	Social Network Analysis	PE	3	3	0	0	3
2	20ITV22	Cyber Physical Systems	PE	3	3	0	0	3
3	20SCV32	Digital and Mobile Forensics	PE	4	2	0	2	3
4	20ITV42	Cryptocurrency and Blockchain Technologies	PE	3	3	0	0	3
5	20SCV52	Web Application Security	PE	3	3	0	0	3
6	20CSV62	Engineering Secure Software Systems	PE	3	3	0	0	3
7	20SCV71	Security and Privacy in Cloud	PE	3	3	0	0	3
8	20SCV82	Malware Analysis	PE	4	2	0	2	3

**Vertical III : Full Stack Development for IT**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	20ITV13	Principles of Programming Languages	PE	3	3	0	0	3
2	20CSV23	UI and UX Design	PE	4	2	0	2	3
3	20CSV31	Cloud Services Management	PE	3	3	0	0	3
4	20ITV43	Software Testing and Automation	PE	3	3	0	0	3
5	20SCV52	Web Application Security	PE	3	3	0	0	3
6	20ITV63	Information Retrieval Techniques	PE	3	3	0	0	3
7	20ITV73	DevOps	PE	4	2	0	2	3
8	20ITV81	Reinforcement Learning Techniques	PE	3	3	0	0	3

**Vertical IV : Innovative Computing Technologies**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	20ADV14	Data and Information Security	PE	3	3	0	0	3
2	20ITV24	Quantum Computing	PE	3	3	0	0	3
3	20ADV34	Neural Networks and Deep Learning	PE	4	2	0	2	3
4	20ITV42	Cryptocurrency and Blockchain Technologies	PE	3	3	0	0	3
5	20SCV54	Cyber Security	PE	3	3	0	0	3
6	20ITV64	3D Printing and Design	PE	3	3	0	0	3
7	20CSV74	Agile Methodologies	PE	3	3	0	0	3
8	20CSV84	Virtual Reality and Augmented Reality	PE	3	3	0	0	3

**Vertical V : Expert Systems**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	20ADV15	Business Intelligence System	PE	3	3	0	0	3
2	20ADV25	Data Communication and Computer Networks	PE	3	3	0	0	3
3	20ADV34	Neural Networks and Deep Learning	PE	3	2	0	2	3
4	20ADV45	Robotic Process Automation	PE	3	3	0	0	3
5	20ADV55	Text and Speech Analysis	PE	3	3	0	0	3
6	20ADV65	Sensors and Devices	PE	3	3	0	0	3
7	20ADV75	Ethics and AI	PE	3	3	0	0	3
8	20ADV85	Health Care Analytics	PE	3	3	0	0	3

**OPEN ELECTIVE I (OE I)**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20OE103	Refrigeration and Air Conditioning	OE	3	3	0	0	3
2.	20OE201	Fundamentals of Renewable Energy System	OE	3	3	0	0	3
3.	20OE202	Principles of Measurements and Instrumentation	OE	3	3	0	0	3
4.	20OE203	Introduction to Nano science	OE	3	3	0	0	3
5.	20OE303	Fundamentals of Wireless Communication	OE	3	3	0	0	3
6.	20OE601	Fundamentals of Electric Vehicles	OE	3	3	0	0	3
7.	20OE602	Supply Chain Management	OE	3	3	0	0	3
8.	20OE603	Automotive Safety Systems	OE	3	3	0	0	3
9.	20OE701	Biomedical Instrumentation and Measurements	OE	3	3	0	0	3
10.	20OE801	Linear Algebra and Number Theory	OE	3	3	0	0	3

**OPEN ELECTIVE II (OE II)**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20OE106	Fundamentals of Product Design	OE	3	3	0	0	3
2.	20OE108	Industrial Safety Practices	OE	3	3	0	0	3
3.	20OE206	Fundamentals of Fibre Optics and Lasers	OE	3	3	0	0	3
4.	20OE305	Fundamentals of Image Processing	OE	3	3	0	0	3
5.	20OE306	Consumer Electronics	OE	3	3	0	0	3
6.	20OE308	Introduction to VLSI Technology	OE	3	3	0	0	3
7.	20OE507	Concepts of Ethical Hacking	OE	3	3	0	0	3
8.	20OE605	Lean Manufacturing Practices	OE	3	3	0	0	3
9.	20OE706	Industrial Computer Networks	OE	3	3	0	0	3
10.	20OE708	Instrumentation for Agro Food Industry	OE	3	3	0	0	3

**MANAGEMENT ELECTIVE**

**VI SEMESTER**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20HS5A1	Management Concepts and Organizational Behaviour	HS	3	3	0	0	3
2.	20HS5A2	Industrial Marketing	HS	3	3	0	0	3
3.	20HS6A1	Intellectual Property Rights	HS	3	3	0	0	3
4.	20HS6B1	Project Management and Entrepreneurship	HS	3	3	0	0	3
5.	20HS7A2	Total Quality Management	HS	3	3	0	0	3
6.	20HS8A1	Human Relations at Work	HS	3	3	0	0	3
7.	20HS8B2	Economics for engineers	HS	3	3	0	0	3

**OPEN ELECTIVE - I (VI SEMESTER) - offered to other Departments**

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20OE901	Data Science using Python	OE	3	3	0	0	3
2.	20OE902	Introduction of Artificial Intelligence and Data Science	OE	3	3	0	0	3
3.	20OE903	Mobile app development and its applications	OE	3	3	0	0	3
4.	20OE904	Foundation of Robotics	OE	3	3	0	0	3

**OPEN ELECTIVE - II (VII SEMESTER) - offered to other Departments**

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20OE905	Artificial Neural Network and applications	OE	3	3	0	0	3
2.	20OE906	AI and Robotics	OE	3	3	0	0	3
3.	20OE907	Fundamentals of Blockchain Technologies	OE	3	3	0	0	3
4.	20OE908	Introduction to Web Application Security	OE	3	3	0	0	3

**HUMANITIES AND SOCIAL SCIENCES (HS)**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20HS101	English for Technical Communication	HS	3	3	0	0	3
2.	20HS201	Advanced Technical Communication	HS	3	3	0	0	3
3.	20HS2L1	Communication Skills Laboratory	HS	2	0	0	2	1
4.	20HS301	Universal Human Values	HS	3	2	1	0	3
5.	20HS401	Environmental Science and Engineering	HS	2	2	0	0	2
<b>Total Credits (HS)</b>								<b>12</b>

**BASIC SCIENCES (BS)**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20BS101	Fundamentals of Engineering Mathematics	BS	4	3	1	0	4
2.	20BS102	Engineering Physics	BS	3	3	0	0	3
3.	20BS103	Engineering Chemistry	BS	3	3	0	0	3
4.	20BS1L1	Basic Science Laboratory	BS	3	0	0	3	1.5
5.	20BS201	Laplace Transform and Advanced Calculus	BS	4	3	1	0	4
6.	20BS303	Discrete Mathematics	BS	4	3	1	0	4
7.	20BS404	Probability and Statistics	BS	4	3	1	0	4
<b>Total Credits (BS)</b>								<b>23.5</b>

**PROFESSIONAL CORE (PC)**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20CS201	Programming in C	PC	3	3	0	0	3
2.	20CS2L1	C Programming Laboratory	PC	4	0	0	4	2
3.	20AD201	Foundation for Data Science	PC	3	3	0	0	3
4.	20AD2L1	Foundation for Data Science Laboratory	PC	4	0	0	4	2
5.	20CS302	Data Structures and Algorithms	PC	3	3	0	0	3
6.	20AD302	Object Oriented Programming using Java	PC	5	3	0	2	4

**KLNCE UG AI&DS R2020 (AY 2021-2022 admitted)**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
7.	20CS3L2	Data Structures and Algorithms Laboratory	PC	4	0	0	4	2
8.	20CS402	Database Management Systems	PC	3	3	0	0	3
9.	20AD401	Embedded System and Internet of Things	PC	3	3	0	0	3
10.	20CS404	Operating Systems	PC	5	3	0	2	4
11.	20AD402	Data Visualization	PC	5	3	0	2	4
12.	20CS4L1	Database Management Systems Laboratory	PC	4	0	0	4	2
13.	20AD4L1	Embedded Systems and Internet of Things Laboratory	PC	4	0	0	4	2
14.	20AD501	Artificial Intelligence	PC	3	3	0	0	3
15.	20AD502	Machine Learning Techniques	PC	3	3	0	0	3
16.	20CS502	Software Engineering	PC	3	3	0	0	3
17.	20AD5L1	Machine Learning Techniques Laboratory	PC	4	0	0	4	2
18.	20CS5L2	Software Engineering Laboratory	PC	4	0	0	4	2
19.	20AD601	Natural Language Processing	PC	3	3	0	0	3
20.	20AD602	Image and Video Analytics	PC	3	3	0	0	3
21.	20AD6L1	Image and Video Analytics Laboratory	PC	4	0	0	4	2
22.	20CS6L1	Mobile Application Development Laboratory	PC	4	0	0	4	2
23.	20CS701	Data Analytics	PC	3	3	0	0	3
24.	20AD701	Artificial Intelligence for Robotics	PC	3	3	0	0	3
25.	20AD702	Cloud Computing	PC	3	3	0	0	3
26.	20AD7L1	Data Exploration Laboratory	PC	4	0	0	4	2
27.	20AD7L2	Cloud Computing Laboratory	PC	4	0	0	4	2
<b>Total Credits (BS)</b>								<b>73</b>

**ENGINEERING SCIENCES (ES)**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20GE101	Problem Solving using Python Programming	ES	3	3	0	0	3
2.	20GE1L1	Python Programming Laboratory	ES	4	0	0	4	2
3.	20GE1L2	Industrial Practices Workshop	ES	3	0	0	3	1.5
4.	20GE201	Engineering Graphics	ES	4	2	0	2	3
5.	20GE205	Basic Electrical and Electronics Engineering	ES	3	3	0	0	3
6.	20AD301	Digital Principles and Computer Organization	ES	4	3	1	0	4
7.	20CS3L1	Digital Systems Laboratory	ES	4	0	0	4	2
<b>Total Credits (ES)</b>								<b>18.5</b>

**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20HS4L2	Professional Communication Laboratory	EEC	2	0	0	2	1
2.	20AD7L3	Mini Project	EEC	4	0	0	4	2
3.	20AD8L1	Project Work	EEC	20	0	0	20	10
<b>Total Credits (EEC)</b>								<b>13</b>

**MANDATORY COURSES (MC)**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20MC501	Constitution of India	MC	1	1	0	0	-

**SUMMARY**

S.NO.	CATEGORY	NUMBER OF CREDITS									
		I SEM	II SEM	III SEM	IV SEM	V SEM	VI SEM	VII SEM	VIII SEM	Total Credits	Credit %
1.	Humanities and Social Sciences /Management Elective(HS)	3	4	3	2		3			15	8.98
2.	Basic Sciences (BS)	11.5	4	4	4					23.5	14.07
3.	Engineering Sciences (ES)	6.5	6	6						18.5	11.08
4.	Employability Enhancement Courses (EEC)				1			2	10	13	7.78
5.	Professional Core (PC)		10	9	18	13	10	13		73	43.71
6.	Professional Elective (PE)					6	6	6		18	10.78
7.	Open Elective (OE)						3	3		6	3.59
8.	Mandatory Courses (MC)					-				-	-
<b>Credits per Semester</b>		21	24	22	25	19	22	24	10	167	
<b>Credits per Year</b>		45		47		41		34		167	
<b>Total Credits</b>		<b>167</b>									

		L	T	P	C
20HS101	ENGLISH FOR TECHNICAL COMMUNICATION	3	0	0	3

**OBJECTIVES:**

- This course is designed for entry level Engineering and Technology curriculum enabling the students to learn, acquire and apply for their learning and career.
- The course is aimed at providing effective skills for promoting communication skills through English.
- Students will benefit in conversing with the peers, faculty and fellow professionals.
- The outcome of this course contains refined level of English proficiency by acquiring all four skills, listening, speaking, reading and writing to prepare them for global readiness.

**PRE-REQUISITE: NIL**

**UNIT I FOCUSING LANGUAGE DEVELOPMENT 9**

**Listening:** Listening to TV News, Guest Lecturers, note – taking. **Speaking:** Pronunciation Common Vocabulary – Technical Vocabulary – Answering Peer Questions – Conversation with Teacher. **Reading:** News magazines, Reading for unfamiliar words, Variety of News Items. **Writing:** Word formation – Auxiliary verbs – Modal Verbs – Sentence Types – Affirmative, Negative, Interrogative, Concord – Dialogue Writing, Letter to Principal / Director – Instructions using Auxiliary.

**UNIT II GRAMMAR AND TECHNICAL READING 9**

**Listening:** Listening to Peer Conversations – Brief Speeches – Listening for Specific Information – Recap of Speeches. **Speaking:** Wh Questions, Day today conversations, Telephonic enquiries official/formal enquiries. **Reading:** Technical Essays – Identifying Sentence Types – Classifying the verb patterns. **Writing:** Tenses – Simple Present, Present Progressive, Present Perfect, Present Perfect Continuous – Voice – Active & Passive – Précis Writing – Essay Writing

**UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 9**

**Listening:** TV interviews, Commentaries, Digital Videos for World Information. **Speaking:** Telephonic Conversation – Classroom Activities – Conversing Information. **Reading:** Coherence, Development of Thoughts. **Writing:** Tenses – Simple Past, Past Progressive, Past Perfect, Past perfect continuous – Impersonal Passive-Narrating the past events, Letter to friend/father about Industrial Visit/Functions held – Narrating the past experience using Impersonal Passive voice

**UNIT IV READING AND LANGUAGE DEVELOPMENT 9**

**Listening:** Listening to Dialects of English – British & American Regional. **Speaking:** Role Plays, Extempore, Responding to specific questions. **Reading:** Comprehensive passages, Reading for specific points. **Writing:** Tenses – Simple Future, Future progressive, Future Perfect, Future Perfect continuous – Definition – Phrases of Reason

– Cause & Effect, Recommendations, Argumentative Essays, Letter to the Editor on Social Issues – Analytical Essays on Social hazards using Cause and Effect.

## UNIT V EXTENDED WRITING

9

**Listening:** Listening to Technical Seminar speeches – Listening to achievers, eminent personalities – Dialects – Australian – African – Asian. **Speaking:** Welcome address, Compeering, Vote of Thanks, Peer debates. **Reading:** Texts on self-confidence, motivation, success path. **Writing:** Contracted forms, Conditionals, Articles, Preposition, Tense – „going to” - Error Spotting, Sequence Words – Rearranging – Writing a Book Review – Summary writing – Rearranging Sentences using Sequence Words, Note Making

**TOTAL: 45 PERIODS**

### OUTCOMES:

**On Completion of the course, the students should be able to:**

- Listen, Comprehend and Correspond with others at various contexts. **(AD)**
- Speak legibly and fluently under various life-time situations by applying proper communication modules. **(AD)**
- Read and understand a variety of writings and technical text by analyzing the meaning and language. **(AD)**
- Apply clear and legible writing skills in error free style in coherent manner. **(AD)**
- Remember and use various communicative skills in precise and efficient way on technological contexts. **(AD)**
- Form situational conversations and technical writing styles for interpersonal and effective communication. **(AD)**

### TEXT BOOKS:

1. Board of Editors. Using English “A Course book for Undergraduate Engineers and Technologists”. Orient Black Swan Limited, Hyderabad, 2015
2. Richards, C. Jack. “Interchange Students” Book-2” New Delhi: CUP, 2015

### REFERENCES:

1. Murphy, “Raymond English Grammar in Use with Answers: Reference and Practice for Intermediate Students”, Cambridge: CUP, 2004
2. Thomson, A.J. and Martinet, A.V. A Practical English Grammar, OUP, New Delhi:1986
3. Anne Laws, “Writing Skills”, Orient Black Swan, Hyderabad, 2011
4. Board of Editor, “English for Technical Communication”, Great Mind Publication, Chennai, 2018

<b>20BS101</b>	<b>FUNDAMENTALS OF ENGINEERING MATHEMATICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**OBJECTIVES:**

- To relate various methods of Matrix Algebra to handle practical problems arising in the field of engineering.
- The main aim of this course is to achieve conceptual understanding and to retain the best traditions of Calculus.
- The syllabus is designed to provide the basic tools of Calculus of Single and Multivariable, mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.

**PRE-REQUISITE :NIL**

**UNIT I      MATRICES** 12

Introduction to Matrices-Eigenvalues and Eigenvectors of a real matrix–Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a Quadratic form to Canonical form by Orthogonal transformation – Nature of Quadratic forms.

**UNIT II     DIFFERENTIAL CALCULUS** 12

Representation of functions - Limit of a function- Continuity - Derivatives - Differentiation rules-Differentiation of Polynomials, Exponential, Trigonometric, Hyperbolic, Logarithmic and Implicit functions- Maxima and Minima of functions of single variable

**UNIT III    FUNCTIONS OF SEVERAL VARIABLES** 12

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** 12

Definite and Indefinite integrals - Substitution rule - Techniques of integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions, Improper integrals

**UNIT V     ORDINARY DIFFERENTIAL EQUATIONS** 12

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Find the Eigen values and Eigen vectors to diagonalize a matrix, reduce quadratic form to canonical form. **(K3)**
- Apply the concept of limits, continuity and rules of differentiation to differentiate some standard functions and apply the techniques of differentiation to differentiate various types of functions. **(K3)**
- Understand the concepts of Concavity and Convexity by finding the Critical points, point of Inflection and to find Maxima and Minima functions of Single variable. **(K3)**
- Find the derivatives of functions of two variables and apply them to calculate the maxima and minima. **(K3)**
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts. **(K3)**
- Apply various techniques to solve higher order differential equations with constant and variable coefficients. **(K3)**

**TEXT BOOKS:**

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2017.
2. T. Veerarajan., "Engineering Mathematics I", The Tata Mc Graw Hill Publication-New Delhi, First Edition, 2018

**REFERENCES:**

1. James Stewart, "Calculus, Early Transcendental", Cengage Learning, 7th Edition, New Delhi, 2015. [For units II & III].
2. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 9<sup>th</sup> Edition, New Delhi, 2006.
3. Wiley, "Calculus- International Student version", 10th Edition, Wiley India Pvt. Ltd, New Delhi 2017.
4. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
5. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics II", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 9th Edition, 2014

<b>20BS102</b>	<b>ENGINEERING PHYSICS</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- To inculcate the fundamental knowledge in properties of matter and crystal physics.
- To enrich the knowledge on Laser, fiber optics and ultrasonics and their applications relevant to various streams of Engineering and Technology.
- To introduce quantum physics and its applications.

**PRE-REQUISITE: NIL**

**UNIT I    PROPERTIES OF MATTER** 9

Elasticity – Hooke’s Law – Stress-strain diagram and its uses – Three modulus of elasticity (qualitative) – Poisson’s ratio – factors affecting elastic modulus and tensile strength – twisting couple – torsional pendulum: theory and experiment – bending of beams – bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment – I-shaped girders

**UNIT II    LASER AND FIBER OPTICS** 9

Lasers: Interaction of radiation with atomic energy states – Einstein’s A and B coefficients derivation – Population inversion – resonant cavity, optical amplification (qualitative) – solid state lasers – Nd:YAG laser, Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle – types of optical fibers (material, refractive index, mode) – losses associated with optical fibers – fiber optic sensors: pressure and displacement sensor

**UNIT III    ULTRASONICS** 9

Ultrasonics – classification (qualitative) – properties – generation – magnetostriction and piezoelectric methods – detection of ultrasound – cavitations – velocity measurement – acoustic grating – Industrial applications (Drilling, Welding, Soldering and Cleaning) – SONAR – NDT – Pulse Echo system through Transmission and Reflection modes – A, B and C scan displays - Medical application – sonogram

**UNIT IV    QUANTUM PHYSICS** 9

Black body radiation – Planck’s theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – wave function and its physical significance – Schrödinger’s wave equation – time independent and time dependent equations – particle in a one- dimensional rigid box – tunneling (qualitative) – scanning tunneling microscope

**UNIT V    CRYSTAL PHYSICS** 9

Crystalline and amorphous materials – unit cell, crystal systems, Bravais lattices, lattice planes - Miller indices – Inter planar spacing in cubic lattice – coordination number and packing factor for SC, BCC, FCC, HCP structures – growth of single crystals: solution and melt growth techniques – Mechanisms of plastic deformation, slip and twinning

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Demonstrate the properties of elasticity and measure the different moduli of elasticity. **(K3)**
- Discuss the characteristics of laser and optical fiber. **(K2)**
- Explain the concepts of ultrasonics in engineering. **(K2)**
- Explain black body radiation, properties of matter waves and Schrodinger equation. **(K2)**
- Classify the Bravais lattices and different types of crystal structures. **(K3)**
- Summarize the informations on growth of crystals and deformations. **(K2)**

**TEXT BOOKS:**

1. R. K. Gaur and S. L. Gupta, "Engineering Physics", Dhanpat Rai Publications, 2012.
2. B. K. Pandey and S. Chaturvedi, "Engineering Physics", Cengage Learning India, 2018.
3. V.Rajendran, "Engineering Physics", Tata McGraw Hill Education Private Limited, 2011.

**REFERENCES:**

1. D.Halliday, R. Resnick and J. Walker, "Principles of Physics", Wiley publisher, 10<sup>th</sup> Edition, 2015.
2. R.A.Serway and J.W. Jewett, "Physics for Scientists and Engineers", Cengage Learning, 2014.
3. P.A.Tipler and G. Mosca, "Physics for Scientists and Engineers with Modern Physics", W.H.Freeman, 2007.
4. D.K.Bhattacharya and T. Poonam, "Engineering Physics", Oxford University Press, 2017

<b>20BS103</b>	<b>ENGINEERING CHEMISTRY</b>	L T P C
		3 0 0 3

**OBJECTIVES:**

- To make the students, familiar with boiler feed water requirements, related problems and water treatment techniques.
- To learn the principle of electrochemical cell, types of corrosion and its control.
- To develop an understanding of the basic concepts of phase rule and its applications to one and two component systems and appreciate the purpose and significance of alloys.
- To be familiar with different types of fuel and their characteristics and also functioning of energy storage devices.
- To understand the techniques of spectra and chromatography for analytical purpose

**PRE-REQUISITE: NIL**

**UNIT I WATER AND ITS TREATMENT 9**

Characteristics of water; Hard water, Soft water, difference; Hardness – types of hardness, expression of hardness, units, removal of hardness (boiling, soda lime process), estimation of hardness of water by EDTA method (problems); Boiler feed water – requirements – disadvantages of using hard water in boilers (scale and sludge, priming and foaming, caustic embrittlement, boiler corrosion); Treatment of boiler feed water – internal treatment (carbonate, phosphate, and calgon conditioning) external treatment – ion exchange process, zeolite process; Purification of water - reverse osmosis, electro dialysis, Application of nanomaterials in water purification

**UNIT II ELECTROCHEMISTRY AND CORROSION 9**

Electrochemical cell - redox reaction, electrode potential- origin of electrode potential-oxidation potential- reduction potential, - electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion- causes- factors, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method – corrosion inhibitors. Metallic coating – Electroplating – Factors - Electroplating of Copper and Electroless plating of Nickel

**UNIT III PHASE RULE AND ALLOYS 9**

Phase rule - introduction, definition of terms with examples; One component system - water system; Reduced phase rule - two component system, classification, lead-silver system; Alloys – introduction, definition, properties of alloys, significance of alloying; Functions and effects of alloying elements; Heat treatment of steel - annealing, hardening, tempering, carburizing, nitriding; Ferrous alloys- nichrome and stainless steel (18/8); Non-ferrous alloys – brass and bronze

**UNIT IV FUELS AND BATTERIES 9**

Fuels – classification, characteristics; Petrol – characteristics, knocking, octane number; Diesel – characteristics, cetane number; Natural gas (CNG), LPG, Power alcohol, Biodiesel, Gasohol; Combustion of fuels – calorific value, GCV and NCV (Problems), calculation of theoretical air for combustion (Problems), Ignition temperature, explosive range, flue gas analysis (Orsat apparatus); Batteries – primary and secondary batteries, lead-acid battery, lithium ion battery, Fuel cell (hydrogen oxygen fuel cell).

**UNIT V ANALYTICAL TECHNIQUES**

9

Spectroscopic techniques – UV-visible (Principle and Instrumentation – Block Diagram only and applications), IR (Principle and Instrumentation – Block Diagram only and applications),  $^1\text{H}$  NMR ((Principle and Instrumentation – Block Diagram only) – Chromatography – HPLC - Flame photometry – Estimation of sodium by Flame photometry

**TOTAL: 45 PERIODS****OUTCOMES:****On Completion of the course, the students should be able to:**

- Determine hardness of water and the water treatment methods.(K2)
- Apply Nernst equation to determine the EMF of the cell and explain various corrosion control methods.(K3)
- Describe the phase diagram of one component and two component system and various methods of heat treatment of steel.(K2)
- Classify the various types of fuels by their characteristics and explain the flue gas analysis by or sat method.(K2)
- Illustrate the working of lead acid battery, lithium ion battery and fuel cell.(K2)
- Describe the instrumentation and working of UV, IR,  $^1\text{H}$ NMR, HPLC, and flame photometry.(K2)

<b>20GE101</b>	<b>PROBLEM SOLVING USING PYTHON PROGRAMMING</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- To know the basics of Computers and algorithmic problem solving
- To understand Python programs with conditional and looping constructs.
- To define Python functions and strings.
- To use Python data structures – lists, tuples, sets and dictionaries.
- To do input/output with files in Python.

**PRE-REQUISITE:NIL**

**UNIT I COMPUTER FUNDAMENTALS AND PROBLEM SOLVING 9**

Introduction to Computer System – Block Diagram of Computer, Types of Memory, I/O Devices, Application Programs, System Programs – Loader, linker, assembler, compiler, interpreter, Programming process – source code to executable code, Problem Solving Strategies – Problem analysis, Algorithms, Flow Charts, Pseudo Code. Illustrative problems: odd or even number, Leap year, Biggest of three numbers, square root of a number, Sum of n numbers, Armstrong number, Palindrome, Fibonacci Series, Prime number, Bubble Sort and Linear Search

**UNIT II DATA, EXPRESSIONS, CONTROL FLOW STATEMENTS 9**

Python interpreter and interactive mode, values and types – int, float, boolean, string, and list, variables, expressions, statements, tuple assignment, operators and precedence of operators, comments, Control Flow Statements – Conditionals – conditional (if), alternative (if-else), chained conditional (if-elif-else), Iteration – state, while, for, break, continue, pass, Illustrative programs – exchange the values with and without using temporary variables, circulate the values of n variables, distance between two points

**UNIT III FUNCTIONS, STRINGS 9**

Functions – function definition and use, flow of execution, parameters and arguments, function composition, Fruitful functions – return values, parameters, local and global scope, recursion, Strings – string slices, immutability, string functions and methods, string module, Illustrative programs – square root, GCD, exponentiation, Factorial of a number, linear search, binary search

**UNIT IV LISTS, TUPLES, SETS, DICTIONARIES 9**

Lists – list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters, Lists as arrays, Tuples – tuple assignment, tuple as return value, Sets - Creating a set, Modifying a set, Removing elements from a set, Set operations- Set Union, Set intersection, Set difference, Set membership test, Iterating through a set, Set methods, Built-in functions with set, Frozenset - Dictionaries – operations and methods, Advanced list processing –List comprehension, Illustrative programs – selection sort, insertion sort, Matrix addition and subtraction, sum an array of numbers

**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 – Math and Rand, Illustrative programs – word count, copy file, merge two files

**TOTAL: 45 PERIODS****OUTCOMES:****On Completion of the course, the students should be able to:**

- Explain Components of a Computer System, types of programming languages, types of software with examples and purpose. **(K3)**
- Perform problem analysis, use algorithms and prepare flow charts, pseudo code for solving simple problems. **(K3)**
- Use Conditional, iteration constructs of python programming and apply to solve simple problems. **(K3)**
- Use Functions, recursive function, String functions in python programming and apply to perform linear and binary search. **(K3)**
- Explain the various operations for manipulating Tuples, Sets, Dictionaries and Use List to perform simple and sorting operations. **(K3)**
- Explain file handling operations, exception handling, modules and packages and illustrate programs for word count, file copy, merge operations and exception handling. **(K3)**

**TEXT BOOKS:**

1. E. Balagurusamy, “Problem solving and Python Programming”, First edition, McGraw Hill Education (India) Private Limited, 2017.
2. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, 2<sup>nd</sup> edition, Updated for Python 3, Shroff/O, Reilly Publishers, 2016
3. (<http://greenteapress.com/wp/think-python/>)

**REFERENCES:**

1. Yashavant Kanetkar, Aditya Kanetkar, “Let Us Python”, 2<sup>nd</sup> Edition, BPB Publications, 2020.
2. John V Guttag, “Introduction to Computation and Programming Using Python: With Application to Understanding Data”, 2nd Edition, PHI Publisher, 2017.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach”, Pearson India Education Services Pvt. Ltd., 2016.
4. Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd., 2015.
5. Paul Gries, Jennifer Campbell and Jason Montojo, “Practical Programming: An Introduction to Computer Science using Python 3.6”, 3rd edition, Shroff/O” Reilly Publishers, 2018.
6. Dr. A. Kannan, Dr. L. Sai Ramesh, “Problem Solving and Python Programming”, Updated Edition, United Global Publishers Pvt. Ltd., April 2018

20BS1L1

BASIC SCIENCE LABORATORY

L T P C  
0 0 3 1.5

## PHYSICS LABORATORY

**OBJECTIVES:**

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

**PRE-REQUISITE: NIL****LIST OF EXPERIMENTS****(Any five to be carried out & one demonstration experiment)**

- Determination of Rigidity modulus – Torsional Pendulum.
  - Determination of Young's modulus – Non Uniform Bending.
  - Determination of wavelength and particle size using diode laser.
    - Determination of acceptance angle in an optical fiber.
  - Determination of velocity of sound and compressibility of liquid using ultrasonic interferometer
  - Determination of band gap of a semiconductor diode
  - Determination of thickness of a thin wire – Air wedge method
  - Determination of dispersive power of a prism – Spectrometer\*
  - Determination of wavelength of mercury spectrum – Spectrometer grating.
- \*Demonstration experiment

**OUTCOMES:****On Completion of the course, the students should be able to:**

- Calculate rigidity modulus and Young's modulus of a given material.(K3)
- Examine the size of a given particle, parameters of optical fiber and compute the thickness of a given thin wire.(K3)
- Calculate the velocity of ultrasound, compressibility of a given liquid and band gap of a given semiconductor diode.(K3)
- Predict dispersive power of prism and wavelength of mercury spectrum.(K2)

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Torsional pendulum set	6
2	Travelling microscope & accessories	6
3	Laser kit	6
4	Ultrasonic interferometer	6
5	Semiconductor band gap kit	6
6	Air wedge set up	6
7	Spectrometer & prism	6
8	Spectrometer & Grating	6

**CHEMISTRY LABORATORY**

**OBJECTIVES:**

- To make the students to acquire practical skill in the determination of water quality parameters through volumetric analysis.
- To have hands on experience in using instruments like pH meter, conductivity meter, potentiometer.
- To acquaint the students with the determination of molecular weight of polymer by viscometer.

**PRE-REQUISITE: NIL**

**LIST OF EXPERIMENTS**  
**Any Five experiments to be given**

1. Determination of total, temporary & permanent hardness of water by EDTA method.
2. Determination of alkalinity in water sample.
3. Determination of dissolved oxygen content of water sample by Winkler's method.
4. Determination of strength of given hydrochloric acid using pH meter.
5. Estimation of iron content of the given solution using potentiometer.
6. Conductometric titration of a strong acid Vs a strong base.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
9. Corrosion Experiment – Weight Loss Method.
10. Estimation of sodium present in water using flame photometer.

**TOTAL(Physics & Chemistry): 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Estimate the Chemical quality parameter of a water sample.(K3)
- Estimate the strength of acid by conduct metric and pH metric titration. (K3)
- Estimate the amount of iron content in a given solution using potentiometer and the amount of sodium in water using flame photometer. (K3)
- Determine the molecular weight of polyvinyl alcohol using Ostwald viscometer and rate of corrosion by weight loss method. (Demo) (K2)

**REFERENCE:**

1. Vogel's "Text book of quantitative chemical analysis" (8<sup>th</sup> edition, 2014)

**LIST OF APPARATUS AND EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Burette	30
2	Pipette	30
3	Beaker (100ml)	30
4	Conical Flask (250ml)	30
5	Conductivity meter	10
6	Potentiometer	10
7	pH meter	10
8	Viscometer	10
9	Flame Photometer	1
10	Electronic Balance	1

<b>20GE1L1</b>	<b>PYTHON PROGRAMMING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	4	2

**OBJECTIVES:**

- To write, test, and debug simple Python programs using conditional statements.
- To implement Python programs using loops.
- To use functions for structuring Python programs.
- To implement Python programs using lists.
- To write Python programs for implementing file operations.

**PRE-REQUISITE : NIL**

**LIST OF PROGRAMS**

1. Biggest of three numbers, odd or even number, Leap year.
2. GCD, Armstrong Number, Palindrome, Fibonacci Series, Prime number
3. Find the square root and exponentiation of a number with and without built-in functions
4. Linear search and Binary search using Recursion.
5. Find the maximum of a list of numbers
6. Selection sort, Insertion sort
7. First n prime numbers
8. Transpose of a Matrix
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Merge two files

**TOTAL: 60 PERIODS**

**PLATFORM NEEDED :** Python 3 interpreter for Windows / Linux

**COURSE OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Develop simple Python programs using conditional and iterative constructs. **(K3)**
- Develop simple Python programs using built-in functions and user-defined functions. **(K3)**
- Develop a Python program using recursion to implement linear and binary search. **(K3)**
- Develop a Python program using list to implement selection and insertion sort. **(K3)**
- Develop Python programs to implement matrix operations. **(K3)**
- Develop a Python program to implement file handling. **(K3)**

<b>20GE1L2</b>	<b>INDUSTRIAL PRACTICES WORKSHOP</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	3	1.5

**OBJECTIVES:**

- To provide exposure to the students with Hands on Experience on various Basic Industrial Practices in Civil, Mechanical, Electrical and Electronics Engineering.

**PRE-REQUISITE:NIL**

**GROUP A (CIVIL & MECHANICAL)  
LIST OF EXPERIMENTS**

**I. CIVIL ENGINEERING PRACTICE**

**UNIT I CARPENTRY PRACTICE**

1. Study of carpentry tools.
2. Preparation of Cross lap joint
3. Preparation of Dovetail joint
4. Preparation of T joint

**UNIT II PLUMBING PRACTICE**

1. Study of plumbing tools, pipeline joints, its location and functions: valves, taps, couplings, unions, reducers and elbows in household fittings.
2. Exercise on Preparation of plumbing line sketches for water supply and sewage works.
3. Exercise on providing of basic water line connection for a residential house using plumbing components.
4. Exercise on providing Water line pipe connections for household utilities like water heater, wash basin etc.,

**II. MECHANICAL ENGINEERING PRACTICE**

**UNIT III SHEET METAL PRACTICE**

1. Study of sheet metal forming tools.
2. Preparation of a Model of rectangular tray.
3. Preparation of a Model of Conical Funnel.

**UNIT IV MACHINING PRACTICE**

1. Study of machining tools.
2. Exercise on Simple turning, Facing, Chamfering
3. Exercise on Taper turning.
4. Exercise on Drilling and Tapping.

## **UNIT V METAL JOINING PROCESS**

1. Study of welding tools.
2. Exercise to join two metal plates by single butt joint using arc welding.
3. Exercise to join two metal plates by T Fillet joint using arc welding.
4. Exercise to join two metal plates by lap joint using arc welding

### **DEMONSTRATION**

1. Gas welding process.
2. Refrigeration and Air conditioning process.

## **GROUP B (ELECTRICAL & ELECTRONICS) LIST OF EXPERIMENTS**

### **I. ELECTRICAL ENGINEERING PRACTICE**

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

### **II. ELECTRONICS ENGINEERING PRACTICE**

1. Study of Electronic components – Resistor colour coding, Capacitor, Inductor- Measurement using LCR meter, Transistor & Diode – Terminal identification using Multimeter.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Measurement of AC signal parameter (peak-peak, rms value, period & frequency) using CRO and AFO.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR

**TOTAL: 45 PERIODS**

<b>LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS</b>		
<b>CIVIL</b>		
<b>S. No</b>	<b>Component Name</b>	<b>No. of Components</b>
1	Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, coupling, unions, elbows, plugs and other fittings	15 sets
2	Carpentry Vice (fitted to work bench)	15 nos
3	Standard wood working tools	15 sets
4	Models of industrial trusses, door joints, furniture joints	5 each
5	Power Tools a. Rotary Hammer b. Demolition Hammer c. Circular Saw d. Planer e. Hand Drilling Machine f. Jigsaw	2 nos 2 nos 2 nos 2 nos 2 nos 2 nos
<b>MECHANICAL</b>		
1	Arc welding transformer with cables and holders	5 nos
2	Welding booth with exhaust facility	5 nos
3	Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 sets
4	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 nos
5	Centre Lathe	2 nos
6	Power Tool: Angle Grinder	2 nos
7	Study purpose items: Refrigerator and Air Conditioner	One each
<b>ELECTRICAL</b>		
1	Assorted electrical components for house wiring	10 sets
2	Electrical measuring instruments	10 sets
3	Study purpose items: Iron box, fan and regulator, emergency lamp	1 each
4	Megger (250V/500V)	1 no.
5	Power Tools a. Range Finder b. Digital Live-wire detector	2 nos 2 nos

<b>ELECTRONICS</b>		
1	Soldering guns	10 nos
2	Assorted electronic components for making circuits	50 nos
3	Small PCBs	10 nos
4	Multimeters	10 nos
5	Regulated of power supply, CRO	1 no. each

**COURSE OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Prepare different carpentry joints and pipe connections with different joints. (K3)
- Make the models using sheet metal. (K3)
- Carry out the basic machining operations. (K3)
- Prepare arc welded joints using welding equipment(K3)
- Demonstrate wiring for a simple residential house; identify the ratings of tube lamp, and calculate the different Electrical quantities. (K3)
- Measure the electronics equipment using LCR meter, Transistor & Diode – Terminal identification using Multimeter. (K3)
- Experimentally analyze AC signal parameters using CRO and AFO and to verify the Truth tables of Logic gates. (K3)
- Experimentally design a Simple circuit using soldering in a PCB, measure ripple factor of Half Wave Rectifier and Full Wave Rectifier. (K3)

		L	T	P	C
<b>20HS201</b>	<b>ADVANCED TECHNICAL COMMUNICATION</b>	3	0	0	3

**OBJECTIVES:**

- This course is designed for Engineering and Technology curriculum enabling the students to learn, acquire and apply updated elements of English communication.
- The course is aimed at providing effective skills for procuring communication skills for business and advanced technology.
- Students will benefit by learning the four skills – Listening, Speaking, Reading and Writing – to meet the global requirements for their career and higher studies.

**PRE-REQUISITE:NIL**

**UNIT I TECHNICAL WRITING 9**

**Listening:** Listening to audio-visuals on personal Interviews, Speeches from Company CEOs, TV Debates. **Speaking:** Wishing, Greeting, Enquiring Hobbies. **Reading:** Editorials, Letter to the Editor Columns, Technical Papers. **Writing:** Analytical writings, Emphasis Techniques, Letter Writing – Business Correspondence, Abstract Writing, Common Errors, Footnotes, Compound words, Preparation of Agenda

**UNIT II BUSINESS ENGLISH AND LANGUAGE DEVELOPMENT 9**

**Listening:** Listening to Audio-Visual documentary, TV Programs of Celebrities Forum. **Speaking:** Self-Expression, Introducing the fellow students, Talking about celebrities, leaders **Reading:** Company Correspondence, Business Correspondence, Technical Text for Vocabulary **Writing:** Bibliography, Sentence Completion, Cloze exercises, Verbal Analogy, Letter – Business enquiry orders, payments, Minutes Preparation

**UNIT III VISUAL BASED LANGUAGE DEVELOPMENT 9**

**Listening:** Visuals on Group Discussion-Understanding the nuances of GD – Approach – Content – Methodology. **Speaking:** Discussing main points on burning issues, Social issues – Expressing ideas and suggestions. **Reading:** Etiquettes of Non-Verbal Communication. **Writing:** List of common expressions for specified situations – Sentence linkers – Formal Expressions – Suggestions – Reported Speech - Letter to the Editor on Common Issues – Writing the Points in Indirect Form – Check Lists – Numerical Expressions

**UNIT IV EMPLOYABILITY CORRESPONDENCE 9**

**Listening:** Listening to Visuals of Technical Paper presentation – Technical and HR interviews **Speaking:** Peer-to-Peer Interview – Mock Interview – Telephone Conversations. **Reading:** Comparative Analyses – Instructions on Public Spots – Time Management concepts – Email Correspondence. **Writing:** Compare and Contrast – Cause and Effect – Purpose and Function – Job Application Letter – Drafting Resume / CV, – Inferring the graphical / Pictorial representations – Bar chart – Pie chart, Instruction – common and technical instructions for a process or a component

**UNIT V TECHNICAL REPORT WRITING**

9

Listening: Key note speeches – Annual Reports of institutions / companies. Speaking: Answering to the Mock Panel Interview – Sharing of interview experiences – presenting a Technical Paper. Reading: Annual Reports – Company Reports – Newspaper reports – Comprehension passages. Writing: Homophones – Abbreviations and Acronyms – SI Units – Report Writing with recommendations – Inferring the Graph – Flow Chart – Tables – Technical Papers

**TOTAL: 45 PERIODS****OUTCOMES:****On Completion of the course, the students should be able to:**

- Listen, Understand and create technical correspondence at advanced level. **(AD)**
- Respond or answer to the contextual questions, interview questions, form instructions, draft reports. **(AD)**
- Speak and analyze social issues, come out with effective ideas for discussion, understand the passages for meaning and vocabulary. **(AD)**
- Assess error free technical writings, create legible and coherent technical papers, derive ideas of the given texts in a precise form. **(AD)**
- Remember the updated elements of communication skills, nuances of non-verbal communication, business communication. **(AD)**
- Create technical instructions, process instructions, self-appraisals, Resumes, reports on various situations. **(AD)**

**TEXT BOOKS:**

1. Board of editors. "Fluency in English A Course book for Engineering and Technology". Orient Blackswan, Hyderabad: 2016
2. Raman, Meenakshi and Sharma, Sangeetha "Technical Communication Principles and Practice". Oxford University Press: New Delhi, 2014.

**REFERENCES:**

1. Booth-L. Diana, "Project Work", Oxford University Press, Oxford: 2014
2. Grussendorf, Marion, "English for Presentations", Oxford University Press, Oxford: 2007
3. Means, L. Thomas and Elaine Langlois, "English & Communication For Colleges". Cengage Learning, USA: 2007
4. Board of Editor, "Advanced Technical Communication", Great Mind Publication, Chennai : 2019.

<b>20BS201</b>	<b>LAPLACE TRANSFORM AND ADVANCED CALCULUS</b>	L	T	P	C
		3	1	0	4

**OBJECTIVES:**

- To make the student familiar with topics such as Multiple Integrals, Vector Calculus, Analytic Functions, Complex Integration and Laplace Transform.
- To learn the concept of basic Vector Calculus which can be widely used for Modeling the various laws of Physics.
- To understand the various methods of Complex Analysis and Laplace Transform can be used for efficiently solving the problems that occur in various branches of Engineering disciplines

**PRE-REQUISITE:NIL**

**UNIT I LAPLACE TRANSFORM 12**

Existence Conditions – Transforms of Elementary Functions – Transform of Unit Step Function and Unit Impulse Function – Basic Properties – Shifting Theorems -Transforms of Derivatives and Integrals – Initial and Final Value Theorems – Inverse Transforms – Convolution Theorem – Transform of Periodic Functions – Application to Solution of Linear Second Order Ordinary Differential Equations with Constant Coefficients

**UNIT II MULTIPLE INTEGRALS 12**

Double integrals – Change of order of integration – Double integrals in Polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of Solids – Change of Variables in Double and Triple integrals

**UNIT III VECTOR CALCULUS 12**

Gradient and Directional Derivative – Divergence and Curl - Vector Identities – Irrotational and Solenoidal Vector fields – Line Integral over a Plane curve – Surface Integral - Area of a Curved Surface - Volume Integral – Green’s, Gauss divergence and Stoke’s theorems – Verification and Application in evaluating Line, Surface and Volume Integrals.

**UNIT IV ANALYTIC FUNCTIONS 12**

Analytic functions – Necessary and Sufficient Conditions for Analyticity in Cartesian and Polar Coordinates – Properties – Harmonic Conjugates – Construction of Analytic Function – Conformal Mapping – Mapping by Functions  $w = z+c$ ,  $cz$ ,  $1/z$ ,  $z^2$  -Bilinear transformation

**UNIT V COMPLEX INTEGRATION 12**

Line integral – Cauchy’s Integral Theorem – Cauchy’s Integral Formula – Taylor’s and Laurent’s Series – Singularities – Residues – Residue Theorem – Application of Residue Theorem for Evaluation of Real Integrals – Use of Circular Contour

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Determine the Laplace transform of standard functions using properties. [K3]
- Apply Laplace transform and inverse transform to solve the initial value problems. [K3]
- Solve the multiple integrals and apply the concept to find areas, volumes. [K3]
- Determine the line, surface and volume integrals using Green's, Gauss and Stokes theorems. [K3]
- Determine Analytic functions, Bilinear Transformations and apply the concept of conformal mapping to find the images of given curves. [K3]
- Determine the Contour Integrals using Cauchy's Integral and Residue theorems. [K3]

**TEXT BOOKS:**

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44<sup>th</sup> Edition, 2017.
2. T. Veerarajan., "Engineering Mathematics I", The Tata Mc Graw Hill Publication-New Delhi, First Edition 2018

**REFERENCES:**

1. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 9th Edition, New Delhi, 2006.
2. James Stewart, "Calculus, Early Transcendental", Cengage Learning, 7th Edition, New Delhi, 2015.
3. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics II", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 9th Edition, 2014.
4. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics II", Narosa Publications, New Delhi, 5th Edition, 2016.
5. Sastry, S.S. "Engineering Mathematics", Vol.I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014

<b>20AD201</b>	<b>FOUNDATIONS FOR DATA SCIENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- Learn the data analysis basics with Python
- Study Data Analysis and interpretation with Numpy on statistical parameters
- Understand various methods of Data Preparation and Manipulation with Pandas
- Learn Data Visualization using matplotlib and seaborn
- Learn Machine learning fundamentals concepts such as Feature Engineering and various techniques

**PRE-REQUISITE:NIL**

**UNIT I INTRODUCTION TO DATA ANALYSIS 9**

Data Analysis - Mathematics and Statistics Basic Concepts - The Data Analysis Process - Data Extraction - Data Pre-processing/Cleaning - Data Preparation/Visualization - Data Modelling / Visualization - Quantitative and Qualitative Analysis - Errors and Debugging - Profiling and Timing Code

**UNIT II INTRODUCTION TO NUMPY 9**

Python data types - NumPy Arrays with Computations - Aggregations: Min, Max, and Everything In Between-Broadcasting - Comparisons, Masks, and Boolean Logic - Sorting Arrays - Structured Data with NumPy's Arrays

**UNIT III DATA MANIPULATION WITH PANDAS 9**

Introducing Pandas Objects - Data Indexing and Selection - Operating on Data in Pandas - Handling Missing Data - Hierarchical Indexing - Combining Datasets - Vectorized String Operations - Working with Time Series - High-Performance Pandas: eval() and query()

**UNIT IV VISUALIZATION WITH MATPLOTLIB 9**

Various Plots - Simple Line - Scatter Plots - Error Visualization - Density and Contour Plots - Histograms, Binnings, and Density - Customizing Plots-Multiple Subplots - Three-Dimensional Plotting in Matplotlib - Geographic Data with Basemap - Visualization with Seaborn

**UNIT V MACHINE LEARNING FUNDAMENTALS 9**

Machine Learning concepts using Scikit-learn- Hyperparameters and Model Validation - Feature Engineering - Basics of Classification, Clustering - Support Vector Machines - Decision Trees and Random Forests- Principal Component Analysis

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Understand the various analysis methods in Numpy and Pandas. **(K2)**
- Perform calculations that measure the central tendency and dispersion of data. **(K2)**
- Solving the problems based on Time series analysis data. **(K3)**
- Visualize various statistical quality control charts. **(K2)**
- Understand the various fundamentals of Machine Learning. **(K2)**
- Apply the concepts of various machine learning techniques to solve problems. **(K3)**

**TEXT BOOKS:**

1. Jake VanderPlas, 2016, Python Data Science Handbook: Essential Tools for Working with Data, 1sted, O'Reilly Media, Inc

**REFERENCES**

1. Nelli, F 2015, Python Data Analytics, 1sted, Apress, USA.
2. McKinney, W 2017, Python for Data Analysis, 2<sup>nd</sup> ed, O'Reilly Media, Inc.
3. John V Guttag 2013, Introduction to Computation and Programming Using Python, Revised and Expanded Edition, MIT Press.
4. Timothy A. Budd 2015, Exploring Python, Mc-Graw Hill Education Private Ltd.  
Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016

20GE201

ENGINEERING GRAPHICS

L	T	P	C
2	0	2	3

**OBJECTIVES:**

- To develop graphic skills for communication of concepts, ideas and design of engineering products.
- To expose national standards related to technical drawings

**PRE-REQUISITE:NIL**

**CONCEPTS AND CONVENTIONS (Not for Examination)**

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

**UNIT I PROJECTION OF POINTS AND LINES**

6+6

Orthographic projection – Principles - Principal planes - Projection of points in all quadrants - Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method

**UNIT II PROJECTION OF PLANE SURFACES**

6+6

Projection of planes (Polygonal and Circular surfaces) inclined to both the principal planes by rotating object method

**UNIT III PROJECTION OF SOLIDS**

6+6

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

**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES**

6+6

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

**UNIT V ISOMETRIC PROJECTION AND FREEHAND SKETCHING**

6+6

Principles of Isometric Projection – Isometric scale – Isometric projections of simple solids - truncated Prisms and Pyramids. Visualization concepts and Free Hand sketching: Principles – Representation of Three-Dimensional objects – Layout of views - Freehand sketching of multiple views from pictorial views of objects

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Familiarize with the fundamentals and standards of engineering graphics. **(K2)**
- Draw the orthographic projections of points, lines and planes. **(K3)**
- Draw the projections of simple solids like prisms, pyramids, cylinder and cone. **(K3)**
- Draw the projections of sectional views of solids and develop its lateral surfaces. **(K3)**
- Draw the isometric projection of simple objects, truncated prism and pyramids. **(K3)**
- Draw the free hand sketching of simple objects. **(K3)**

**TEXT BOOKS:**

1. Natarajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 30th Edition, 2017.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 15th Edition, 2018.

**REFERENCES**

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019.
2. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education, 3rd Edition, 2012.

**PUBLICATION OF BUREAU OF INDIAN STANDARDS:**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001: Technical drawings - General principles of presentation.
4. IS 11669 – 1986 : General principles of dimensioning on technical drawings.
5. SP 46 (2003): Engineering Drawing Practice for Colleges.
6. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods

**SPECIAL POINTS APPLICABLE TO EXAMINATIONS ON ENGINEERING GRAPHICS:**

1. There will be five questions, each of either-or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

<b>20GE205</b>	<b>BASIC ELECTRICAL AND ELECTRONICS ENGINEERING</b> (Qualitative Treatment only)	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- To learn the fundamental laws, theorems of electrical circuits and also to analyze them.
- To study the basic principles of electrical machines and their performances.
- To study the different energy sources and their utilizations.
- To study the fundamentals of electronic circuits.
- To understand the principles and operations of operational amplifiers

**PRE-REQUISITE:NIL**

**UNIT I ELECTRICAL CIRCUITS ANALYSIS 9**

Ohms Law, Kirchhoff,s Law-Instantaneous power- series and parallel circuit analysis with resistive, capacitive and inductive network - nodal analysis, mesh analysis- network theorems - Thevenins theorem, Norton theorem, maximum power transfer theorem and superposition theorem, -star delta conversion

**UNIT II ELECTRICAL MACHINES 9**

DC and AC Rotating Machines: Types, Construction, principle, Emf and torque equation, Basics of Stepper Motor- Transformers-Introduction- types and construction, working principle of Ideal transformer-Emf equation- All day efficiency calculation

**UNIT III UTILIZATION OF ELECTRICAL POWER 9**

Renewable energy sources-wind and solar panels. Illumination by lamps- Sodium Vapour, Mercury vapour, Fluorescent tube. Domestic refrigerator -Electric circuit, construction and working principle. Protection-need for earthing. Energy Tariff calculation for domestic loads

**UNIT IV ELECTRONIC CIRCUITS 9**

Semiconductors, Types -PN Junction-VI Characteristics of Diode, zener diode, BJT-operations of PNP and NPN transistors- Transistors configurations –Common Base, Common Emitter &Common Collector configurations- Amplifiers

**UNIT V OPERATIONAL AMPLIFIERS AND DIGITAL ELECTRONICS 9**

Op amps- Amplifiers, oscillator, rectifiers, differentiator, integrator, ADC, DAC, Number Systems, Complements-1"s and 2"s Complements- Basic Digital Logic gates, Universal gates- NAND and NOR Implementation

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Discuss the essentials of electric circuits and analysis. **(K2)**
- Analyze Electrical circuits and apply various network theorems to solve loop currents and branch voltages. **(K3)**
- Discuss the basic operation of electric machines and transformers. **(K2)**
- Explain the renewable sources and common domestic loads. **(K2)**
- Discuss the basics of semiconductor devices and applications. **(K2)**
- Discuss about applications of Op-amps and basics of digital circuits. **(K2)**

**TEXT BOOKS:**

1. D.P. Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering", Mc Graw Hill, 2019, Fourth Edition.
2. M.S. Sukhija and T.K. Nagsarkar, "Basic Electrical and Electronic Engineering", Oxford, 2019.

**REFERENCES**

1. S.B. Lal Seksena and Kaustuv Dasgupta, "Fundamentals of Electrical Engineering", Cambridge, 2017
2. B.L Theraja, "Fundamentals of Electrical Engineering and Electronics". Chand & Co, 2018.
3. S.K.Sahdev, "Basic of Electrical Engineering", Pearson, 2019.
4. John Bird, "Electrical and Electronic Principles and Technology", Sixth Edition, Elsevier, 2017.
5. Mittle, Mittal, "Basic Electrical Engineering", 2nd Edition, Tata McGraw-Hill Edition, 2017.
6. C.L.Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy", New Age international pvt.ltd., Revised 4th Edition 2018

<b>20CS201</b>	<b>PROGRAMMING IN C</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- To understand the basic C programming constructs.
- To learn about usage of arrays and strings.
- To understand the concepts of functions, pointers, structures and unions.
- To expose to file handling operations in C

**PRE-REQUISITE:NIL**

**UNIT I BASICS OF C PROGRAMMING 9**

Introduction to programming paradigms– Structure of C program– C programming– Data Types, Storage classes, Constants, Enumeration Constants – Keywords, Operators– Precedence and Associativity, Expressions – Input/output statements, Assignment statements –Decision making statements, Switch statement, Looping statements –Pre-processor directives – Compilation process

**UNIT 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

**UNIT III FUNCTIONS AND POINTERS 9**

Introduction to functions– Function prototype, function definition, function call, Built- in functions (string functions, math functions), Recursion, Example Program– Computation of Sine series, Scientific calculator using built-in functions, Binary Search using recursive functions –Pointers, Pointer operators, Pointer arithmetic, Arrays and pointers – Array of pointers, Example Program– Sorting of names, Parameter passing– Pass by value, Pass by reference, Example Program– Swapping of two numbers and changing the value of a variable using pass by reference

**UNIT IV STRUCTURES AND UNIONS 9**

Structure – Nested structures, Pointer and Structures, Array of structures, Example Program – using structures and pointers, typedef, Self referential structures, Union, Dynamic memory allocation, Illustrative programs – allocating block of memory, sum of n numbers using malloc, calloc

**UNIT V FILE PROCESSING 9**

Files – File operations, Types of file processing– Sequential access, Random access Sequential access file - Example Program– Finding average of numbers stored in sequential access file, Random access file -Example Program– Transaction processing using random access files, Command line arguments

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Use basic constructs of C programming to develop simple programs. [K3]
- Apply one dimensional and two dimensional arrays for implementing matrix operations and string operations. [K3]
- Make use of function concept for solving simple mathematical problems. [K3]
- Develop programs to implement pointer arithmetic and arrays with pointers. [K3]
- illustrate simple programs for structures and unions and design real time application programs [K4]
- Analyze file operations and develop programs to implement various file access procedures. [K3]

**TEXT BOOKS:**

1. Balagurusamy, E, "Programming in ANSI C", Eighth Edition, Tata Mcgraw-Hill, 2019.
2. Yashavant Kanetkar, "Let Us C", BPB Publications, 17th Edition, 2020.
3. Kernighan, B.W and Ritchie, D.M, "The C Programming language", Second Edition, Pearson Education, 2015

**REFERENCES**

1. Paul Deitel and Harvey Deitel, "C How to Program", Seventh edition, Pearson Education India, 2015.
2. Juneja, B. L and Anita Seth, "Programming in C", CENGAGE Learning India pvt. Ltd., 2011.
3. PradipDey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013.
4. Byron Gottfried, "Schaum"s outlines- Programming with C", McGraw-Hill Education, Fourth edition, 2018.
5. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016

<b>20HS2L1</b>	<b>COMMUNICATION SKILLS LABORATORY</b>	L	T	P	C
		0	0	2	1

**OBJECTIVES:**

- This course is framed for imparting practical approach in learning and enhancing communication skill to develop in students.
- Students will be able to identify appropriate expressions in speaking and writing.
- They will also be able to understand the style and perfection of language in reading and listening various contexts of engineering and technology.
- The course will benefit to the students to gain confidence for every day communication, aptitude test and interviews.

**PRE-REQUISITE:NIL**

<b>UNIT I LISTENING</b>	6
Listen and takes notes of Lecture, Listen and Write appropriate word, Talks on Engineering and Technology, Developing effective listening skills, barriers to effective listening	
<b>UNIT II SPEAKING</b>	6
Self-Introduction, Role play of Celebrities, Sharing memorable incidents	
<b>UNIT III READING</b>	6
Reading Online Blogs, Reading Advertisement in Online, Newspaper archives reading	
<b>UNIT IV WRITING</b>	6
Process Description, narrating experiences, Creating Email blogs, Review Writing – Books, Movies, and Journal	
<b>UNIT V SUMMARIZED ACTIVITIES</b>	6
Reading – cloze exercises, Identifying redundant words, Jargon words, Foreign words, Technical terms. Writing – Error free sentences, Sequential paragraphs, Essay writing on various levels – basic, middle, and advanced. Speaking – Face to face conversation on specific topics, interviewing celebrities, getting acquaintance with new people, sharing information with persons from abroad.	

**TOTAL: 30 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Express ideas and concepts on par global communication (AD)
- Involve inter-personal communication with flair and error-free verbatim(AD)
- Face interviews confidently and respond in proper language ability(AD)
- Participate in group discussion and share innovative ideas in technical environments(AD)
- Adapt multi-national exposure on employment(AD)
- Master all-round competency in delivering apt communication for employability (AD)

**TEXT BOOKS:**

1. E. Suresh Kumar et al. "Communication for Professional Success". Orient Blackswan: Hyderabad, 2015

**REFERENCES**

1. Butterfield, "Jeff Soft Skills of Everyone". Cengage Learning: New Delhi, 2015
2. "Interact English Lab Manual for Undergraduate Students", Orient BlackSwan: Hyderabad,2016.
3. Raman, Meenakshi and Sangeetha Sharma. "Professional Communication". Oxford University Press: Oxford, 2014.
4. S. Hariharanetal. "Soft Skills". MJP Publishers: Chennai, 2010.

	L	T	P	C
<b>20CS2L1</b>				
<b>C PROGRAMMING LABORATORY</b>				
	0	0	4	2

**OBJECTIVES:**

- To develop programs in C using basic constructs.
- To develop applications in C using strings, pointers, functions, structures.
- To develop applications in C using file processing.

**PRE-REQUISITE:NIL****LIST OF PROGRAMS**

1. Programs using I/O statements, expressions and decision-making constructs.
2. Program for finding given year is leap year or not and finding given number is Armstrong number or not.
3. Design a calculator to perform the operations namely, addition, subtraction, multiplication, division and square of a number.
4. Given a set of numbers like <10, 36, 54, 89, 12, 27>, find sum of weights based on the following conditions
  - 5 if it is a perfect cube.
  - 4 if it is a multiple of 4 and divisible by 6.
  - 3 if it is a prime number
 Sort the numbers based on the weight in the increasing order as shown below  
 <10,its weight>,<36,its weight><89,its weight>
5. Matrix addition and subtraction
6. Matrix multiplication and transpose of a matrix
7. Program using string with and without using string functions: string copy and Reverse the String.
8. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions.
9. From a given paragraph perform the following using built-in functions
  - a. Find the total number of words.
  - b. Capitalize the first word of each sentence.
  - c. Replace a given word with another word.
10. Program using recursion – factorial and Fibonacci series
11. Sort the list of numbers using pass by reference.
12. Generate salary slip of employees using structures and pointers.
13. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.
14. Count the number of account holders whose balance is less than the minimum balance using sequential access file
15. **Mini project (Any one project : Maximum 4 per Team)**
  - Railway reservation system
  - Library Management System
  - University Result Publication System
  - Hospital Management System

- Student Automation System
- Payroll System
- Banking System
- Inventory System

**PLATFORM NEEDED:** Turbo C++ Compiler

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Develop simple programs using decision making and looping statements. **(K3)**
- Utilize array concepts to perform matrix addition, subtraction and multiplication. **(K3)**
- Utilize string operations and develop programs to show string copy and reverse. **(K3)**
- Develop programs using user defined functions, built-in functions and recursion. **(K3)**
- Design applications using sequential and random access files. **(K3)**
- Design simple real time projects using the concepts of structures and union. **(K3)**

<b>20AD2L1</b>	<b>FOUNDATIONS FOR DATA SCIENCE LABORATORY</b>	L	T	P	C
		0	0	4	2

**OBJECTIVES:**

- Learn the data analysis basics with Python
- Study Data Analysis and interpretation with Numpy on statistical parameters
- Understand various methods of Data Preparation and Manipulation with Pandas
- Learn Data Visualization using matplotlib and seaborn
- Learn Machine learning fundamentals concepts such as Feature Engineering and various techniques

**PRE-REQUISITE:NIL**

**Implementation of the following problems using Statistical Packages**

1. NumPy Arrays Computations - Aggregations-Sorting -Arrays-Structured Data
2. Pandas Dataframe- Manipulations from CSV
3. Data Acquisition using python web Scraping
4. Classification and tabulation of data and Graphical and diagrammatic presentation of data.
5. Perform calculations that measure the central tendency and dispersion of data and Implementation of measures of Skewness, moments and kurtosis.
6. Determination of point and interval estimates.
7. Solving linear regression, polynomial regression and non-linear regression based problems and solving multiple regression and correlation analysis based problems.
8. Solving the problems based on Time series analysis and forecasting and implementing statistical quality control charts.
9. Apply Classification, Clustering and SVM techniques for Web Scraped Datasets
10. Decision Trees and Random Forests-PCA for Intrusion Detection
11. Mini Project

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Understand the various analysis methods in Numpy and Pandas. **(K3)**
- Apply the concept of Classification and tabulation of data. **(K3)**
- Perform calculations that measure the central tendency and dispersion of data and Implementation of measures of Skewness, moments and kurtosis. **(K3)**
- Solving the problems based on Time series analysis and forecasting and implementing statistical quality control charts. **(K3)**
- Apply the concepts of various machine learning techniques to solve problems. **(K3)**

20BS303

DISCRETE MATHEMATICS

L	T	P	C
3	1	0	4

**OBJECTIVES:**

- To understand the basic concepts of Logic, Combinatorics and Graph Theory.
- To make the student familiarize the Applications of Algebraic Structures.
- To understand the concepts and significance of Lattices and Boolean Algebra which are widely used in Computer Science and Engineering.

**PRE-REQUISITE:NIL**

**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.

**UNIT II COMBINATORICS**

12

Mathematical Induction–Strong Induction and Well ordering–The basics of Counting–The Pigeonhole Principle – Permutations and Combinations – Recurrence Relations – Solving Linear Recurrence Relations–Generating Functions–Inclusion and Exclusion Principle and its Applications.

**UNIT III REPRESENTATION OF STANDARD 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.

**UNIT IV ALGEBRAIC STRUCTURES**

12

Algebraic Systems – Semi Groups and Monoids - Groups – Subgroups – Homomorphism’s – Normal Subgroup and Cosets – Lagrange’s Theorem – Definitions and Examples of Rings and Fields.

**UNIT V LATTICES AND BOOLEAN ALGEBRA**

12

Partial Ordering – Posets – Lattices as Posets – Properties of Lattices - Lattices as Algebraic Systems – Sub Lattices – Direct Product and Homomorphism – Some special Lattices – Boolean Algebra.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Apply the basic formula to formulate the normal forms and Predicate calculus.(K3)
- Solve combinatorial problems using the basic counting techniques. (K3)

- Solve recurrence relations using generating functions. **(K3)**
- Apply the concepts of graph theory in the computer science and technologies field. **(K3)**
- Apply the concepts and properties of algebraic structures such as groups, rings and fields. **(K3)**
- Determine the partial ordering, lattices as posets and Boolean algebra using logical relation. **(K3)**

### **TEXT BOOKS**

1. Tremblay.J.P. and Manohar.R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Publishing company Limited, New Delhi, 30th Reprint, 1997.
2. Veerarajan .T, "Discrete Mathematics with graph theory and combinatorics", Tata Mc Graw – Hill companies, New Delhi, 4th Reprint, 2008.

### **REFERENCES:**

1. Grimaldi. R.P., "Discrete and Combinatorial Mathematics: An Applied Introduction", Pearson Education Asia, Delhi, 5thEdition, 2007.
2. Rosen.K.H., "Discrete Mathematics and its Applications", Tata McGraw Hill Publishing company Limited,New Delhi, 7th Edition, 2011.
3. Koshy.T. "Discrete Mathematics with Applications", Elsevier Publications, 2011.
- 4.Venkatraman.M.K., Sridharan.V.,Chandrasekaran.C., "Discrete Mathematics", National Publishing company, 1stEdition ,2001.
5. Tamilarasi.A & NatarajanA.M., "Discrete Mathematics And Its Application", Khanna Publishers, 3rd Edition ,2006.



**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Apply K map technique to simplify the Boolean function. **(K3)**
- Build combinational circuits that perform arithmetic operations. **(K3)**
- Design and Analyze Synchronous sequential circuits such as counters. **(K3)**
- Design and simulate various combinational and sequential circuits using HDL. **(K3)**
- Describe data representation, instruction formats, addressing modes and the operational concept of a digital computer. **(K2)**
- Discuss the implementation schemes of control unit and pipeline performance. **(K2)**

**TEXT BOOKS:**

1. M. Morris R. Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog", Sixth Edition, Pearson Education, 2018.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw Hill, 2012.

**REFERENCES:**

1. G. K. Kharate, "Digital Electronics", Oxford University Press, 2012
2. John F. Wakerly, "Digital Design Principles and Practices", Fifth Edition, Pearson Education, 2018.
3. Charles H. Roth Jr, Larry L. Kinney, "Fundamentals of Logic Design", Sixth Edition, CENGAGE Learning, 2013.
4. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The

<b>20CS302</b>	<b>DATA STRUCTURES AND ALGORITHMS</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- To understand the concepts of ADTs
- To understand the basics of algorithm analysis
- To Learn linear data structures – lists, stacks, and queues
- To apply Tree and Graph structures
- To understand sorting, searching and hashing algorithms and their analysis.

**PRE-REQUISITE:**

Course code: 20CS201

Course Name: Programming in C

<b>UNIT I</b>	<b>INTRODUCTION TO DATA STRUCTURES AND ALGORITHM ANALYSIS</b>	10
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Introduction: Data Structures, Notion of an algorithm, Algorithm Efficiency and Analysis Framework, Asymptotic Notations and their properties. Linear Data Structures: Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation – –singly linked lists- circularly linked lists- doubly-linked lists – applications of lists – Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal). Implementation of algorithmic problems.

<b>UNIT II</b>	<b>LINEAR DATA STRUCTURES – STACKS, QUEUES</b>	8
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Stack ADT – Operations – Applications – Evaluating arithmetic expressions- Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – Priority Queue – deQueue – applications of Queues.

<b>UNIT III</b>	<b>NON LINEAR DATA STRUCTURES – TREES</b>	9
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Tree ADT – tree traversals – Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree – B+ Tree – Heap – Applications of heap.

<b>UNIT IV</b>	<b>NON LINEAR DATA STRUCTURES – GRAPHS</b>	9
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Definition – Representation of Graph – Types of graph – Breadth-first traversal – Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Applications of graphs

<b>UNIT V</b>	<b>SEARCHING, SORTING AND HASHING TECHNIQUES</b>	9
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Divide and Conquer Methodology: Comparison of Searching Techniques: Linear Search – Binary Search, Mathematical analysis of Binary Search. Sorting – Merge Sort, Quick Sort, Bubble sort – Selection sort – Insertion sort – Shell sort – Radix sort. Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing

**TOTAL: 45 PERIODS**

## **OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Explain the concept of asymptotic notations and algorithmic efficiency with properties. **(K2)**
- Describe abstract data types and implement various algorithmic problems using arrays and linked list. **(K2)**
- Apply the different linear data structures like stack and queue to various computing problems. **(K3)**
- Build different types of trees and graphs and apply various operations and their applications. **(K3)**
- Analyze different sorting and searching techniques based on time and space complexity of the algorithms designed using divide and conquer methods. **(K4)**
- Develop suitable hashing algorithm for indexing data items into specific locations in a hash table considering collision resolution techniques. **(K3)**

## **TEXT BOOKS:**

1. Mark Allen Weiss, — Data Structures and Algorithm Analysis in C, 2nd Edition Reprint, Pearson Education, 2002.
2. Reema Thareja, — Data Structures Using C, Second Edition , Oxford University Press, 2011.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein – Introduction to Algorithms, MIT Press, Third Edition, 2009.

## **REFERENCES**

1. Stephen G. Kochan, — Programming in C, 3rd edition, Pearson Education, 2005.
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, — Fundamentals of Data Structures in C, Second Edition, University Press, 2008

<b>20HS301</b>	<b>UNIVERSAL HUMAN VALUES</b>	L	T	P	C
		2	1	0	3

**OBJECTIVES:**

- To create an awareness on Engineering Ethics and Human Values.
- To understand social responsibility of an engineer.
- To appreciate ethical dilemma while discharging duties in professional life

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION TO VALUE EDUCATION 9**

Value Education – Definition - Concept and Need for Value Education - The Evolution of Value Education: Natural acceptance, Self exploration - Fundamentals of value education - Happiness and Prosperity as parts of Value Education- fulfilling human aspirations.  
Practice sessions: To discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

**UNIT II HARMONY IN THE HUMAN BEING 9**

Human being vs Value education - I' and Body synchronization - Understanding Myself as Co-existence of the Self and the Body - Realization - Self, Body needs - Scanning of Karma -Self and Body- Understanding Sanyam and Health.  
Practice sessions: To discuss the role others have played in making material goods available to self. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

**UNIT III HARMONY IN THE FAMILY, SOCIETY AND NATURE 9**

Family as a basic unit of Human Interaction-Values in Relationships - The Basics for Trust and Respect in today's Crisis: Affection, e-Guidance, Reverence, Glory, Gratitude and Love –Harmony in society : Resolution, Prosperity, Fearlessness and Co-existence as Comprehensive Human Goal- Harmony in Nature: The Four Orders in Nature - The Holistic Perception of Harmony in Existence.  
Practice sessions: To discuss on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education. Gratitude as a universal value in relationship. Discuss with scenarios. Elicit examples from students' lives

**UNIT IV SOCIAL ETHICS 9**

The Basics for Ethical Human Conduct - Defects in Ethical Human Conduct - Holistic Alternative and Universal Order - Universal Human Order and Ethical Conduct - Human Rights violation and Social Disparities. Practice sessions: To discuss human being as cause of imbalance in nature, pollution, depletion of resources and role of technology

**UNIT V PROFESSIONAL ETHICS**

9

Value based Life and Profession - Professional Ethics and Right Understanding - Competence in Professional Ethics - Issues in Professional Ethics – The Current Scenario - Vision for Holistic Technologies, Production System and Management Models.

Practice sessions: To discuss the conduct as an engineer or scientist

**TOTAL: 30 PERIODS + 15 TUTORIALS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Explain the significance of value inputs in a classroom and summarize human aspirations. **(AD)**
- Distinguish between Values & Skills to ensure happiness and prosperity. **(AD)**
- Identify the synchronization between Thyself & the Body to ensure competency of an individual. **(AD)**
- Generalize the role of a human being in ensuring harmony in society and nature. **(AD)**
- Distinguish between ethical and unethical practices and analyze harmonious social environment. **(AD)**
- Assess the importance of value based life and evaluate the role of professional ethics. **(AD)**

**TEXT BOOKS:**

1. R.R. Gaur, R. Asthana, G.P. Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd revised edition, Excel Books, New Delhi, Re print 2019.
2. A N Tripathy, Human Values, New Age International Publishers, New Delhi, 2003.

**REFERENCES**

1. E G Seebauer & Robert L. Berry, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press, 2000.
2. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd, Reprint 2011.
3. Mike Martin and Roland Schinzinger "Ethics in Engineering" McGraw Hill, New York, 4th Edition, Reprint 2017.
5. Charles E. Harries, Michael S. Protchard and Michael J. Rabins, "Engineering Ethics- concepts and Cases", Thomson Learning, 2000.
6. S.K. Chakraborty and Dabangshu Chakraborty, "Human Values and Ethics: Achieving Holistic Excellence", ICFAI University Press, 2006

<b>20AD302</b>	<b>OBJECT ORIENTED PROGRAMMING USING JAVA</b>	L	T	P	C
		3	0	2	4

**OBJECTIVES:**

- To explain the basic principle of Object-Oriented Programming (OOP)
- To interpret the characteristics of java and basics of java programming tool.
- To know the principles of inheritance and interfaces
- To define exceptions and use I/O streams
- To develop a java application with threads and generics classes
- To design and build simple Graphical User Interfaces

**PRE-REQUISITE:**

Course code: 20CS201

Course Name: Programming in C

**UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 9**

Introduction to Object Oriented Programming –Differences between Structure programming and OOPS-Characteristics of Java – The Java Environment -Java Source File -Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays, Packages - JavaDoc comments, finalize method, Automatic Garbage Collection.

**Practical 6**

1. Write a program to implement the usage of constructors, static members with different data types.
2. 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.

**UNIT II INHERITANCE AND INTERFACE 9**

Inheritance – the Object class – abstract classes and methods- final methods and classes – Interfaces –differences between classes and interfaces and extending interfaces - Object cloning, Reflection, Proxies -inner classes, Array Lists – Strings.

**Practical 6**

1. 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.
2. Design a Java interface for ADT Stack. Implement this interface using array.
3. Write a program to perform string operations using Array List. Write functions for the following

- Append - add at end
- Insert – add at particular index
- Search
- List all string starts with given letter

**UNIT III EXCEPTION HANDLING AND I/O** 9

Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Assertions, logging, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files-Sequential Access file and Random-Access file.

**Practical** 6

1. Write a Java program to implement user defined exception handling.
2. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.
3. Write a Java program to implement the concepts of sequential access file and random-access file.

**UNIT IV MULTITHREADING AND GENERIC PROGRAMMING** 9

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Inheritance & Generics – Reflection & Generics-Bounded Types – Restrictions and Limitations.

**Practical** 6

1. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number. Write a Java program to implement the concepts of sequential access file and random-access file.
2. Write a java program to find the maximum value from the given type of elements using a generic function

**UNIT V EVENT DRIVEN PROGRAMMING** 9

Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists-choices- Scrollbars – Windows –Menus – Dialog Boxes- Case Study: Design an application for automating the file processing by using the java swing with MySQL database.

**Practical** 6

1. Write a Java program to implement the usage of colors, fonts and images.
2. Design a calculator using event-driven programming paradigm of Java with the following options.
  - i. Decimal manipulations

- ii. Scientific manipulations
3. Develop a mini project for any application using Java concepts.

**TOTAL: 75 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Realize the Object-Oriented Programming concepts and Basics of Java Programming tool. **(K3)**
- Apply the concepts of inheritance and interfaces using java programs. **(K3)**
- Implement the concepts of java exceptions and I/O streams. **(K3)**
- Illustrate multithread concepts and generics in java. **(K3)**
- Develop interactive java application using AWT. **(K3)**
- Build interactive java application using Swing. **(K3)**

**TEXT BOOKS:**

1. Herbert Schildt, "Java The complete reference", 9th Edition, McGraw Hill Education, 2017.
2. Cay S. Horstmann, Gary cornell, "Core Java Volume –I Fundamentals", 9th Edition, Prentice Hall, 2013.
3. E. Balagurusamy, "Programming with Java", 6<sup>th</sup> Edition, McGraw Hill Education, 2019.

**REFERENCES**

1. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.
2. Steven Holzner, "Java 2 Black book", Dreamtech press, 2011.
3. Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000

<b>20CS3L1</b>	<b>DIGITAL SYSTEMS LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	4	2

**OBJECTIVES:**

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, array list, exception handling and file processing
- To develop applications using generic programming and event handling.

**LIST OF EXPERIMENTS**

1. Verification of Boolean Theorems using basic gates
2. Design and implementation of combinational circuits using basic gates for arbitrary functions.
3. Design and implementation of code converters.
4. Design and implement Half/Full Adder and Subtractor.
5. Design and implement combinational circuits using MSI devices:
  - a. Parity generator /checker
  - b. Magnitude Comparator
  - c. Multiplexers
6. Design and implement shift-registers.
7. Design and implement synchronous counters.
8. Design and implement asynchronous counters.
9. Coding combinational circuits using HDL.
10. Coding sequential circuits using HDL.
11. Design and implementation of a simple real time digital system (Mini Project).

**TOTAL: 60PERIODS**

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

**LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS**

**HARDWARE:**

- Digital trainer kits -30
- Digital ICs required for the experiments in sufficient numbers

**SOFTWARE:**

- HDL simulator.

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Apply Boolean simplification techniques to construct combinational logic circuits. **(K3)**
- Build combinational logic circuits to perform arithmetic operations. **(K3)**
- Construct combinational circuits using MSI devices. **(K3)**
- Construct Sequential circuits like registers and counters. **(K3)**
- Develop combinational and sequential circuits using HDL. **(K3)**
- Develop a simple real time application using Digital system. **(K3)**

<b>20CS3L2</b>	<b>DATA STRUCTURES AND ALGORITHM LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	4	2

**OBJECTIVES:**

- Write functions to implement linear and non-linear data structure operations
- Suggest appropriate linear / non-linear data structure operations for solving a given problem
- Appropriately use the linear / non-linear data structure operations for a given problem
- Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval

**LIST OF EXPERIMENTS**

1. Implementation of List and Stack Using Array
2. Implementation of List and Stack Using Linked list
3. Implementation of Queue Using Linked List
4. Perform polynomial addition using list
5. Perform Infix to postfix conversion using stack
6. Implementation of Binary tree
7. Implementation of Binary Search tree
8. Implementation of AVL Trees
9. Implementation of Heaps using Priority Queues
10. Implementation of Graph Traverses Using Breadth First Search
11. Implementation of Graph Traverses Using Depth First Search
12. Applications of Graph.
13. Case study problem for sorting and searching
14. Case study problem using linked list

**TOTAL: 60PERIODS****LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:****Software Requirement :**

Sublime editor / Turbo C

**OUTCOMES:****On Completion of the course, the students should be able to:**

- Develop the array implementation of stack, Queue and List ADTs.(K3)
- Develop the Linked list implementation of list, Stack and Queue ADTs.(K3)
- Construct Binary trees, Binary search Trees and AVL tree and its operations.(K3)
- Develop various graph traversal algorithms like BFS and DFS.(K3)
- Analyze the performance of various searching, sorting and hashing algorithms.(K4)
- Illustrate any real world problem by implement various techniques of Data structures.(K4)

<b>20BS404</b>	<b>PROBABILITY AND STATISTICS</b>	L	T	P	C
		3	1	0	4

**OBJECTIVES:**

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables of one and two dimensions.
- To acquaint the knowledge of testing of hypothesis for small and large samples and to introduce the basic concepts of classifications of design of experiments this plays very important roles in the field of agriculture and statistical quality control.

**PRE-REQUISITE: NIL**

**UNIT I PROBABILITY AND RANDOM VARIABLES 12**

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

**UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 12**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

**UNIT III TESTING OF HYPOTHESIS 12**

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

**UNIT IV DESIGN OF EXPERIMENTS 12**

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

**UNIT V STATISTICAL QUALITY CONTROL 12**

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

**TOTAL: 60 PERIODS**

### **OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Build the parameters of statistical distributions using basic probability theory concepts. **(K3)**
- Calculate the statistical measures for two dimensional random variables. **(K3)**
- Apply the concepts of correlation and regression for two dimensional random variables. **(K3)**
- Apply the concept of random processes in engineering disciplines. **(K3)**
- Solve queuing models using finite and infinite server model. **(K3)**
- Solve advanced queuing models using open network. **(K3)**

### **TEXT BOOKS:**

1. Johnson. R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. Veerarajan.T., "Probability, Statistics and Random Processes", Tata McGraw Hill, New Delhi , 2006.

### **REFERENCES**

1. Papoulis.A. and Unnikrishnapillai.S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, New Delhi, 4th Edition, 2002.
2. Spiegel.M.R., Schiller.J and Srinivasan.R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill, 3rd Edition, 2004.
3. Walpole.R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2011.
4. Kandasamy.P., Thilagvathi.K., Gunavathi.K., "Probability Random Variables & Random Processes", S.Chand & Co. Ltd., 1st Edition.
5. Subramaniam.N, "Probability and Queueing Theory ", SCM Publishers, 1st Edition.

<b>20CS402</b>	<b>DATABASE MANAGEMENT SYSTEMS</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- To learn the fundamentals of data models and to depict a database system using ER diagrams.
- To study relational database and to write SQL queries to store/retrieve data to/from database.
- To understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures for real time applications.
- To understand working procedures of query processing and query optimization techniques.
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design.
- To study concepts of advanced databases.

**PRE-REQUISITE:**

Course code: 20CS302

Course Name: Data Structures and Algorithms

**UNIT I DATABASE FUNDAMENTALS 8**

Purpose of Database System – Views of data – Database System Architecture – Introduction to Data Models – Network model – Hierarchical Model – Introduction to Relational Model – Constraints – keys – Entity Relationship Model – Entity Sets – Attributes - Extended E-R features – ER reduction to Relational Schemas

**UNIT II RELATIONAL DATABASE 10**

Structure of Relational Database – Relational Query Language – Relational Algebra – SQL Fundamentals – Basic Queries – Set Operations – Aggregate Functions – Clauses – Subqueries – Correlated Subqueries – Joins – Views – Authorization – Advanced SQL – Triggers – Cursors – Procedure – Functions – Embedded SQL – Dynamic SQL – Types of advanced Databases – Distributed Database and Object Oriented Database Architectures - XML Databases: XML Hierarchical Model, DTD, XML Schema, X-Query - Introduction to NoSQL.

**UNIT III DATABASE DESIGN 9**

Need for Database Design – Functional Dependencies – Closure of Functional Dependencies – Attribute Closure – Dependency Preservation – Decomposition – Canonical Cover – First Normal Form – Second Normal Form – Third Normal Form – Second Normal Form – Third Normal Form – Boyce Codd Normal Form – Multivalued Dependencies - Fourth Normal Form – Join Dependencies – Fifth Normal Form

**UNIT IV TRANSACTIONS**

9

Transaction Concepts – ACID properties – Transaction States – Serializability – Conflict Serializability – View Serializability – Concurrency Control – Lock Based Protocols – Deadlocks – Time Based Protocols – Stamp Based Protocols – Validation Based Protocols – Recovery System – Failure Classifications – Storage – Recovery and Atomicity – Recovery Algorithms

**UNIT V STORAGE AND QUERY PROCESSING**

9

RAID – File Organization – Organization of Records in Files – Indexing and Hashing – Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation.

**TOTAL: 45 PERIODS****OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Compare File Processing System with Database and summarize the basic concepts of Database, various Data Models and Database System Architecture. **(K2)**
- Identify Entities, Attributes and their Relationships to prepare ER diagram for real time applications. **(K3)**
- Transfer an information model into a relational database schema and use DDL, DML, DQL, DCL, TCL and advanced concepts of SQL to implement the schema. **(K3)**
- Develop simple database using XML and relate advanced databases with relational model. **(K3)**
- Construct a database by identifying dependencies and optimize it with suitable normal forms to reduce redundancy. **(K3)**
- Compare real time applications with respect to transaction, concurrency control, and data object locking protocols and select appropriate storage and recovery techniques. **(K4)**
- Identify the purpose of query processing and query optimization techniques and also demonstrate the query evaluation for given query. **(K2)**

**TEXT BOOKS:**

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, —Database System ConceptsII, Sixth Edition, Tata McGraw Hill, 2011.
2. RamezElmasri, Shamkant B. Navathe, —Fundamentals of Database SystemsII, Sixth Edition, Pearson Education, 2011.

**REFERENCES**

1. C.J.Date, A.Kannan, S.Swamynathan, —An Introduction to Database SystemsII, Eighth Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, —Database Management SystemsII, Fourth Edition, McGraw-Hill College Publications, 2015.
3. G.K.Gupta, "Database Management Systems, Tata McGraw Hill, 2011O G Palanna, "Engineering Chemistry", McGraw Hill Education (India) PVT, LTD, Chennai, 2017.

<b>20AD401</b>	<b>EMBEDDED SYSTEM AND INTERNET OF THINGS</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- To learn the internal architecture and programming of an embedded processor.
- To introduce interfacing I/O devices to the processor
- To introduce the evolution of Internet of Things (IoT).
- To build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/open platform
- To apply the concept of Internet of Things in real world scenario

**PRE-REQUISITE:**

Course code: 20CS201

Course Name: Programming in C

**UNIT I 8-BIT EMBEDDED PROCESSOR 9**

8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling.

**UNIT II EMBEDDED C PROGRAMMING 9**

Memory and I/O Devices Interfacing – Programming Embedded Systems in C – Need for RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies

**UNIT III IOT AND ARDUINO PROGRAMMING 9**

Introduction to the Concept of IoT Devices – IoT Devices Versus Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino – Arduino Programming Structure – Sketches – Pins – Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino

**UNIT IV IOT COMMUNICATION AND OPEN PLATFORMS 9**

IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi – ZigBee – GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud

**UNIT V APPLICATIONS DEVELOPMENT 9**

Complete Design of Embedded Systems – Development of IoT Applications – Home Automation – Smart Agriculture – Smart Cities – Smart Healthcare

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Explain and compare various embedded processors. **(K2)**
- Illustrate the concepts of timers and interrupts. **(K3)**
- Develop basic embedded C programs. **(K3)**
- Describe about simple embedded applications. **(K2)**
- Discuss about portable IoT using Arduino/Raspberry Pi /open platform. **(K2)**
- Determine applications of IoT in real time scenario. **(K2)**

**TEXT BOOKS:**

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearson Education, Second Edition, 2014.
2. Adrian McEwen, Hakim Cassimally "Designing the Internet of Things", John Wiley & Sons, 2014.

**REFERENCES**

1. Michael J. Pont, "Embedded C", Pearson Education, 2007.
2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.
3. Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", Elsevier, 2006.
4. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning, IOT Kindle Edition.

<b>20HS401</b>	<b>ENVIRONMENTAL SCIENCE AND ENGINEERING</b>	L	T	P	C
		2	0	0	2

**OBJECTIVES:**

- To study the scope and significance of environment
- To understand the interrelationship between living organism and environment
- To get a conceptual knowledge on various types of pollution and its effects
- To gain knowledge on various natural resources and its significances
- To provide knowledge on solid wastes, disposal methods and natural disasters and its management
- To learn social issues such as human welfare, sustainability related to population

**PRE-REQUISITE: NIL**

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 6**

Environment – definition, importance, public awareness Ecosystem – concept, structure and function– producers, consumers and decomposers - characteristic features, structure and function of the forest ecosystem and grassland ecosystem

Biodiversity– definition, types - genetic, species and ecosystem diversity – values - consumptive use, productive use, social, ethical, aesthetic and option values – hot-spots of biodiversity –threats to biodiversity: habitat loss, poaching of wildlife – endangered and endemic species of India. Assignment on Conservation of biodiversity.

**UNIT II ENVIRONMENTAL POLLUTION 6**

Definition, causes, effects and control measures of (i) Air pollution (ii) Water pollution (iii) Soil pollution (iv) Marine pollution – role of an individual in prevention of pollution – pollution case studies -Climate change - global warming, acid rain, ozone layer depletion.

**UNIT III NATURAL RESOURCES 6**

**Forest resources:** Uses, over-exploitation, deforestation, case studies

**Water resources:** Surface water and ground water - uses, over-utilization, conflicts over water, Conservation of water - rain water harvesting, dams-benefits and problems

**Mineral resources:** uses, over exploitation, environmental effects of extracting mineral resources, case studies.

**UNIT IV SOLID WASTE AND DISASTER MANAGEMENT 6**

Solid waste management -Introduction, types, effects on human beings and disposal management.

Disaster management-Introduction, causes, effects and management of flood, cyclone, earthquake, landslide disasters, case studies– roles and responsibilities of Government and community

**UNIT V HUMAN POPULATION AND SOCIAL ISSUES**

6

Population growth, population explosion – family welfare programme –women and child welfare – human rights – value education – sustainable development – resettlement and rehabilitation –waste land reclamation – role of information technology in environment and human health. Debate on women and child welfare.

**TOTAL: 30 PERIODS****OUTCOMES:****On Completion of the course, the students should be able to:**

- Describe the environment, ecosystem and their significances. **(K2)**
- Explain the threats to biodiversity. **(K2)**
- Describe the sources, effects, control methods of environmental pollution. **(K2)**
- Explain the knowledge on various natural resources and its effect on environment due to over utilization. **(K2)**
- Describe the disposal techniques of solid waste and record the consequences of natural disasters. **(K2)**
- Outline the social issues as welfare, sustainability etc., and relate with population growth. **(K2)**

**TEXT BOOKS:**

1. Anubha Kaushik and Kaushik C.P., Environmental Science and Engineering, New Age International (P) Ltd, Sixth Edition, 2018.
2. Benny Joseph, Environmental Science and Engineering, Tata McGraw-Hill Publishing Company Ltd, New Delhi, ISBN: 0070601690, 2006.

**REFERENCES**

1. Erach Bharucha, "Text book of Environmental Studies", Universities Press (I) PVT LTD, Hyderabad, 2015
2. G. Tyler Miller and Scott E.Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014
3. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2<sup>nd</sup> edition, Pearson Education, 2004

<b>20CS404</b>	<b>OPERATING SYSTEMS</b>	L	T	P	C
		3	0	2	4

**OBJECTIVES:**

- To understand the basic concepts and functions of operating systems.
- To understand Processes and Threads
- To analyze Scheduling algorithms.
- To understand the concept of Deadlocks.
- To analyze various memory management schemes.
- To understand I/O management and File systems.
- To study various operating systems like Distributed OS, Real-Time OS and basic concepts of virtualization

**PRE-REQUISITE: NIL**

**UNIT I OPERATING SYSTEM OVERVIEW 9**

Operating system overview-objectives and functions, Evolution of Operating System, 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.

**Practical 6**

1. Basic Linux Commands and Overview
2. Write Shell Script to experiment with system calls like fork, grep, pipe, open, create read, write, etc.

**UNIT II PROCESS MANAGEMENT AND CONCURRENCY CONTROL 9**

CPU Scheduling - Scheduling criteria, Scheduling algorithms; Threads- Overview, Multithreading models, Threading issues; Process Synchronization - The critical-section problem, Semaphores, Classic problems of synchronization, Monitors; Deadlock - System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock

**Practical 6**

1. Implementation of FCFS, SJF, Round Robin, Priority Scheduling Algorithms and analyzing their performance
2. Implement semaphore for solving producer-consumer problem using threads.
3. Simulate situations for testing Deadlock avoidance algorithm.

**UNIT III STORAGE MANAGEMENT 9**

Main Memory – Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation; Virtual Memory – Background, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory.

**Practical 6**

1. Implementation Of FIFO, LRU, Optimal Page Replacement Algorithms

**UNIT IV MASS STORAGE AND FILE SYSTEMS 9**

Mass Storage system – Disk Structure, Disk Scheduling and Management; File-System- File concept, Access methods, File Sharing and Protection, Allocation Methods, Free Space Management; Directory- Structure, organization, implementation.

**Practical 6**

1. Implementation of Directory organizations like – single, two-level, hierarchy
2. Implementation of Allocation methods used for files like – sequential, indexed, linked

**UNIT V ADVANCED OPERATING SYSTEMS AND VIRTUALIZATION 9**

Basics of Network Operating System, Server Operating System , Real Time Operating System and Distributed operating systems - Virtual machines- supporting multiple operating systems simultaneously on a single hardware platform; running one operating system on top of another.

**Practical 6**

1. Case Study to Learn Virtualization platforms – VM Ware, etc.
2. Installation of Raspbian OS in Raspberry pi
3. Simple C programs to execute OS services using Raspberry pi

**TOTAL: 75 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Apply the basic functions of Operating System and Process communications. **(K3)**
- Analyze the performance of CPU scheduling algorithms specifically FCFS, SJF, Priority and Round Robin. **(K4)**
- Apply various process synchronization methods and deadlock avoidance algorithm for a given scenario. **(K3)**
- Develop memory management schemes using paging and segmentation. **(K3)**
- Demonstrate various file allocation methods and directory structures. **(K3)**
- Classify different operating systems based on application requirements. **(K3)**
- Make use of virtualization platform to build virtual machines. **(K3)**

**TEXT BOOKS:**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, — Operating System Concepts, 10th Edition, John Wiley and Sons Inc., 2018.
2. William Stallings, “Operating Systems – Internals and Design Principles”, 7th Edition, Prentice Hall, 2011.

**REFERENCES**

1. Ramaz Elmasri, A. Gil Carrick, David Levine, — Operating Systems – A Spiral Approachll, Tata McGraw Hill Edition, 2010.
2. Achyut S.Godbole, Atul Kahate, — Operating Systems, McGraw Hill Education, 2016.
3. Andrew S. Tanenbaum, “Modern Operating Systems”, Fourth Edition, Pearson

<b>20AD402</b>	<b>DATA VISUALIZATION</b>	L	T	P	C
		3	0	2	4

**OBJECTIVES:**

- To learn the basics of Data Exploration
- To learn the basic concepts of Data visualization
- To study the linear and non-linear ways of Data visualization
- To explore the data visualization using R language
- To apply various data visualization techniques for a variety of tasks

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION TO DATA EXPLORATION 9**

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

**Practical 7**

1. Install standalone R.
2. Use R tool to explore various commands for descriptive data analytics using bench mark

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

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

**Practical 8**

1. Explore various variable and row filters in R for cleaning data.
2. Use R commands for probability distributions and probability statistics..

**UNIT III BASICS OF DATA VISUALIZATION 9**

Context of data visualization – Definition, Methodology The Seven Stages of Visualizing Data - Getting Started with Processing - Mapping - Time Series - Connections and Correlations - Scatter plot Maps - Trees, Hierarchies, and Recursion - Networks and Graphs – Acquiring Data – Parsing Data

**Practical 7**

1. Formulate real business problems scenarios to hypothesis and solve using R statistical testing features.

**UNIT IV DATA VISUALIZATION IN R 9**

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

**Practical** 8

1. Write and execute word count, word search and pattern search problems from large text files.
2. Explore various data preprocessing options using bench mark data sets.

**UNIT V      TECHNIQUES AND APPLICATIONS OF DATA 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

**TOTAL: 75 PERIODS**

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

R tool, RStudio and MS Excel

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Explain the basics of Data Exploration. **(K2)**
- Use Univariate and Multivariate Analysis for Data Exploration. **(K3)**
- Explain various Data Visualization methods. **(K2)**
- Apply the concept of Data Visualization on various datasets. **(K3)**
- Explain the data visualization techniques. **(K2)**
- Apply data visualization techniques using R language. **(K3)**

**TEXT BOOKS:**

1. Catherine Marsh, Jane Elliott, “Exploring Data: An Introduction to Data Analysis for Social Scientists”, Wiley Publications, Second Edition, 2008.
2. Ben Fry, “Visualizing Data: Exploring and Explaining Data with the processing Environment”, O’Reilly Publications, 2007

<b>20CS4L1</b>	<b>DATABASE MANAGEMENT SYSTEMS LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	4	2

**OBJECTIVES:**

- To write and debug Database commands.
- To implement advanced query in Database tool.
- To use functions and procedures for implementing simple logics in Database.
- To design real time applications using front end tool and Database.
- To implement Database connectivity for real time application..

**LIST OF PROGRAMS**

1. Data Definition and Data Manipulation Language Commands.
2. Data Control and Transaction Control Language Commands.
3. Aggregate Functions and Set Operations.
4. Nested Subqueries and Join Queries.
5. Views, Indexes and Synonyms.
6. Study of PL/SQL programs
7. PL/SQL - procedures
8. PL/SQL - Functions
9. PL/SQL - Triggers
10. PL/SQL - Cursor
11. Front end application development – Create Forms, Menu and Reports.
12. Implementation of Database Connectivity

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:****SOFTWARE:**

Oracle/Mysql/Visual Basics/Netbeans IDE

**TOTAL: 60PERIODS**

**OUTCOMES:****On Completion of the course, the students should be able to:**

- Develop simple Database using DDL, DML and TCL commands. **(K3)**
- Construct a Relational Database for real time application through Database constraints. **(K3)**
- Make use of subqueries and join queries to derive and execute complex queries. **(K3)**
- Develop PL/SQL programs to implement simple logics using Stored Procedure, Functions, Triggers and Cursor. **(K3)**
- Develop a frontend application to display forms, menu and reports. **(K3)**
- Model real time applications with Database Connectivity. **(K3)**

<b>20AD4L1</b>	<b>EMBEDDED SYSTEMS AND INTERNET OF THINGS LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	4	2

**OBJECTIVES:**

- To learn tools relevant to Embedded System and IoT development.
- To write simple assembly programs that uses various features of the processor.
- To explore Embedded C Programs for different embedded processors.
- To develop simple applications using Arduino/Raspberry Pi/open platform.
- To design and develop IOT application for real world scenario

**LISTOF PROGRAMS**

1. Write 8051 Assembly Language experiments using simulator.
2. Test data transfer between registers and memory.
3. Perform ALU operations.
4. Write assembly language experiments using Kit to test interfaces and interrupts using DAC, ADC, and Stepper Motor.
5. Write Basic and arithmetic Programs Using Embedded C.
6. Write Embedded C program to test interrupt and timers.
7. Develop Real time applications – clock generation, wave form generation, counter – using embedded C.
8. Explore ARM/PIC based controllers using Embedded C.
9. Explore different communication methods with IoT devices.
10. Develop simple application – testing infrared sensor – IoT Applications – using Arduino.
11. Develop simple application – testing temperature, light sensor – IOT Application – using open platform/Raspberry Pi.
12. Deploy IOT applications using platforms such as Bluemix.
13. Miniproject

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

**HARDWARE:**

- 8051 microcontroller kits - 5 Numbers
- PIC microcontroller kits - 5 Numbers
- Interfacing Kits - DAC, ADC, and Stepper Motor. – Required for Sufficient Numbers
- ARM 7 development boards – 5 Numbers
- Arduino boards & Raspberry Pi boards – 5 Numbers (Each)

**SOFTWARE:**

1. Computer with Embedded OS, Keil IDE, Python OS, Arduino IDE & Raspberry Pi OS (Raspbian)

**TOTAL: 60PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Write and implement simple assembly programs that use various features of the processor. **(K3)**
- Write an Embedded C Program, debug and interpret the results. **(K3)**
- Develop micro controller-based application. **(K3)**
- Build the real time applications using different sensors. **(K3)**
- Develop IoT applications using Arduino/Raspberry Pi/open platform. **(K3)**
- Explore deployment platforms for IoT applications. **(K3)**

<b>20HS4L2</b>	<b>PROFESSIONAL COMMUNICATION LABORATORY</b>	L	T	P	C
		0	0	2	1

**OBJECTIVES:**

- To imparting practical approach in learning and enhancing communication skill among engineering students.
- To identify appropriate expressions in speaking and writing.
- To understand the style and perfection of language in reading and listening various Contexts of engineering and technology.
- To gain confidence for every day communication, technical presentation, aptitude test and interviews.

**PRE-REQUISITE: NIL**

**UNIT I LISTENING 6**

Listen and takes notes of Lecture, Talks on Engineering and Technology, Developing Effective listening skills, barriers to effective listening, Listening self-Introduction Videos.

**UNIT II SPEAKING 6**

Self-Introduction, Introduce oneself to the audience, Sharing memorable incidents, Individual presentation practice, Introduction to Group Discussion, GD strategies activities to improve GD skills

**UNIT III READING 6**

Reading Online Blogs, Reading Advertisement in Online, Newspaper archives reading, Reading FAQ's related to job Interview, General awareness of current affairs

**UNIT IV WRITING 6**

Process Description, Narrating experiences, Creating Email blogs, Review Writing – Books, Movies, and Journals, Job Application Letter, Resume Writing

**UNIT V SUMMARIZED ACTIVITIES 6**

Reading – cloze exercises, Identifying redundant words, Jargon words, Foreign words, Technical terms

Writing – Error free sentences, Essay writing on various levels – basic, middle, and advanced, Preparing Job application letter and Resume

Speaking – Face to face conversation on specific topics, Answering Interview

Questions, Panel Interview, Participating in Group Discussions, Technical Presentation

**TOTAL: 30 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Listen and Respond global English appropriately. **(AD)**
- Participate in group discussions towards placement drive. **(AD)**
- Make effective presentations of technical topics. **(AD)**
- Communicate with effective technological skills. **(AD)**
- Read and Write the context cohesively and coherently and organize ideas logically in workplace situations. **(AD)**
- Attend job interviews and be successful in them. **(AD)**

**TEXT BOOKS:**

1. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015

**REFERENCES**

1. Butterfield, Jeff Soft Skills of Everyone. Cengage Learning: New Delhi, 2015
2. Interact English Lab Manual for Undergraduate Students,. Orient BlackSwan:Hyderabad,2016.
3. Raman, Meenakshi and Sangeetha Sharma. Professional Communication.Oxford UniversityPress: Oxford, 2014.
4. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

<b>20AD501</b>	<b>ARTIFICIAL INTELLIGENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION 9**

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents–  
Typical Intelligent Agents – Problem Solving Approach to Typical AI problems

**UNIT II PROBLEM SOLVING METHODS 9**

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search

**UNIT III KNOWLEDGE REPRESENTATION 9**

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

**UNIT IV SOFTWARE AGENTS 9**

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

**UNIT V APPLICATIONS 9**

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

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Use appropriate search algorithms for any AI problem. **(K2)**
- Represent a problem using first order and predicate logic. **(K2)**
- Provide the apt agent strategy to solve a given problem. **(K3)**
- Demonstrate software agents to solve a problem. **(K2)**
- Demonstrate applications for NLP that use Artificial Intelligence. **(K2)**
- Acquire the knowledge in AI and able to apply in real time applications. **(K3)**

**TEXT BOOKS:**

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Fourth Edition, 2021.
2. Bratko, —Prolog: Programming for Artificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

**REFERENCES**

1. M. Tim Jones, —Artificial Intelligence: A Systems Approach(Computer Science), Jones and Bartlett Publishers, Inc.; First Edition, 2008
2. Nils J. Nilsson, —The Quest for Artificial Intelligence, Cambridge University Press,2009.
3. William F. Clocksin and Christopher S. Mellish, Programming in Prolog: Using the ISO Standard, Fifth Edition, Springer, 2003.
4. Gerhard Weiss, —Multi Agent Systems, Second Edition, MIT Press, 2013.
5. David L. Poole and Alan K. Mackworth, —Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010

<b>20AD502</b>	<b>MACHINE LEARNING TECHNIQUES</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- To understand the basics of Machine Learning(ML)
- To understand the concepts of Supervised Learning
- To understand the concepts of Unsupervised Learning
- To understand the concepts of Reinforced Learning
- To design and analysis of Machine Learning Experiments

**PRE-REQUISITE: NIL**

**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 Nonlinearity Early trends in Machine learning–Data Understanding Representation and visualization – Confusion Matrix - MSE

**UNIT II SUPERVISED LEARNING 9**

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search

**UNIT III UNSUPERVISED LEARNING 9**

Unsupervised learning: K-means clustering, Hierarchical clustering, Anomaly detection, Principle Component Analysis, Independent Component Analysis, Singular value decomposition

**UNIT IV REINFORCED LEARNING 9**

Introduction to Reinforced Learning terminology, component, working of Reinforcement Learning. Reinforcement Learning Algorithm – Approaches, types – positive type, negative type. Learning Models – Introduction to Markov decision process (MDP), state and action value functions – Application of Reinforcement Learning

**UNIT V DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS 9**

Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms – *t* test, McNemar’s test, K-fold CV paired *t* test

**TOTAL: 45 PERIODS**

## **OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Explain the basic concept of Machine Learning and its performance matrix. **(K2)**
- Apply the different regression algorithms to predict the value of dependent variable based on an independent variable. **(K3)**
- Apply the classification algorithms support vector machine, decision tree, random forest and naïve bayse to label the data set. **(K3)**
- Apply the unsupervised algorithm namely k means to cluster the dataset and principle component analysis to simplify the high dimensional data set. **(K3)**
- Explain the concepts of reinforced learning algorithm and its application. **(K2)**
- Explain the various statistical testing methods in Machine Learning experiments. **(K2)**

## **TEXT BOOKS:**

1. Ameet V Joshi, Machine Learning and Artificial Intelligence, Springer Publications, 2020
2. EthemAlpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
3. Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRCPress, 2014.

## **REFERENCES**

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997.
3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, 2012, 2018.
4. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2016
5. 5SebastainRaschka, VahidMirjalili , "Python Machine Learning", Packt publishing, 3<sup>rd</sup>Edition, 2019.

<b>20CS502</b>	<b>SOFTWARE ENGINEERING</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

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

**PRE-REQUISITE: NIL**

**UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT 10**

Introduction to Software Engineering, Software Process, Process Models – Introduction to Agility-Agile process-Extreme programming-XP Process.

**UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATIONS 8**

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

**UNIT III SOFTWARE DESIGN AND UML MODEL 9**

Design Engineering: Design process and design quality, design concepts, the design model.Creating a Architectural Design: Architectural styles, Architectural Design, Architectural Mapping using Data Flow. Conceptual model of UML: basic structural modeling, use case diagram, class diagrams, sequence diagrams, collaboration diagrams, state chart diagram, activity diagram, component diagrams, deployment diagram

**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. Maintenance and Reengineering- Reengineering process model-Reverse and Forward Engineering

**UNIT V PROJECT MANAGEMENT AND QUALITY ASSURANCE MODELS 9**

Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm And comparing two classification algorithms – *t* test, McNemar’s test, K-fold CV paired *t* test

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Explain the Software Process and Agile Development. **(K2)**
- Identify the software requirements for classical analysis. **(K3)**
- Develop the software design and UML models. **(K3)**
- Compare various software testing and maintenance techniques. **(K2)**
- Calculate the software project effort and cost. **(K3)**
- Describe the software quality assurance models. **(K2)**

**TEXT BOOKS:**

1. Roger S. Pressman, — Software Engineering – A Practitioner’s Approach, Eighth Edition, McGraw-Hill International Edition, 2015
2. Ian Sommerville, — Software Engineering, 10th Edition, Pearson Education Asia, 2016.
3. Craig Larman, — Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, Third Edition, Pearson Education, 2005

**REFERENCES**

1. Rajib Mall, — Fundamentals of Software Engineering, Third Edition, PHI Learning Private Limited, 2009.
2. Ali Bahrami - Object Oriented Systems Development - McGraw Hill International Edition - 1999.
3. Pankaj Jalote, “Software Engineering, A Precise Approach”, Wiley India, 2010.

<b>20MC501</b>	<b>CONSTITUTION OF INDIA</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- To enable the student to understand the importance of the constitution.
- To understand the structure of executive, legislature and judiciary.
- To understand the philosophy of fundamental rights, duties and Emergency Provisions.
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court.
- To understand the central and state relation financial and administrative.

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION 3**

History of Making of the Indian Constitution- Drafting Committee -(Composition Working)- Philosophy of the Indian Constitution – Preamble - Salient Features

**UNIT II CONTOUR\SOFCONSTITUTIONALRIGHTS&DUTIES 3**

Fundamental Rights-Right to Equality-Right to Freedom- Right against Exploitation Right to Freedom of Religion -Cultural and Educational Rights -Right to Constitutional Remedies Directive Principles of State Policy - Fundamental Duties

**UNIT III ORGANS OF GOVERNANCE 3**

Parliament–Composition-Qualifications and Disqualifications-Powers and Functions-Executive President – Governor - Council of Ministers - Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions

**UNIT IV EMERGENCY PROVISIONS 3**

Emergency Provisions – National Emergency, President Rule, Financial Emergency

**UNIT V LOCAL ADMINISTRATION 3**

District's Administration head- Role and Importance - Municipalities – Introduction - Mayor and role of Elected Representative - CEO of Municipal Corporation - Pachayat raj – Introduction – PRI –Zila Pachayat Elected officials and their roles - CEO Zila Pachayat - Position and role- Block level - Organizational Hierarchy(Different departments)-Village level- Role of Elected and Appointed officials -Importance of grass root democracy

**TOTAL: 15 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Explain history and philosophy of Indian Constitution. **(K2)**
- Explain the premises informing the twin themes of liberty and Freedom from a civil rights perspective. **(K2)**
- Explain the powers and functions of Indian government. **(K2)**
- Explain the emergency rules of Indian Constitution. **(K2)**
- Explain the structure and functions of local administration. **(K2)**

**TEXT BOOKS:**

1. RajeshKumar, 'Universal's Guide to the Constitution of India', Universal Law Publications, 2016.
2. D.C.Gupta, 'Indian Government and Politics', VikasPub, 2018.

**REFERENCES**

1. H.M.Sreevai, 'Constitutional Law of India', 4th edition in 3 volumes, Universal Law Publication.
2. J.C.Johari, 'Indian Government and Politics', Shoban Lal&Co, 2012.
3. Noorani A.G., (South Asia Human Rights Documentation Centre), 'Challenges to Civil Rights Guarantees in India', Oxford University Press, 2012.

20AD5L1	<b>MACHINE LEARNING TECHNIQUES LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	4	2

**OBJECTIVES:**

- To understand the data sets and apply suitable algorithms for selecting the appropriate features for analysis.
- To learn to implement supervised machine learning algorithms on standard datasets and evaluate the performance.
- To experiment the unsupervised machine learning algorithms on standard datasets and evaluate the performance.
- To build the graph based learning models for standard data sets.
- To compare the performance of different ML algorithms and select the suitable one based on the application

**PRE-REQUISITE:**

Course Code: 20GE101

Course Name: Problem Solving using Python Programming

**LIST OF PROGRAMS**

1. Write a program to demonstrate the working of the decision tree. Use an appropriate dataset
2. Write a program to construct a CORONA infection using standard WHO Data Set.
3. Develop Logistic Regression Model for a given dataset.
4. Implement Random forest algorithm for given dataset.
5. Build K-NEAREST NEIGHBOUR model for a given dataset.
6. Apply Medical Diagnosis using various ML Algorithm. Compare the results of those algorithms
7. Implement K-Means Clustering algorithm for given dataset
8. Implement Unsupervised Learning using Singular Value Decomposition
9. Implement Reinforced Learning algorithm for a given dataset.
10. Develop a Simple Application using reinforced learning algorithm

**TOTAL: 60PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Apply suitable algorithms for selecting the appropriate features for analysis. **(K3)**
- Implement supervised machine learning algorithms on standard datasets and evaluate the performance. **(K3)**
- Apply unsupervised machine learning algorithms on standard datasets and evaluate the performance. **(K3)**
- Build the Reinforced Learning models for standard data sets. **(K3)**
- Assess and compare the performance of different ML algorithms. **(K4)**
- Build an application based on any one of ML algorithm. **(K3)**

<b>20CS5L2</b>	<b>SOFTWARE ENGINEERING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	4	2

**OBJECTIVES:**

- To capture the requirements specification for an intended software system
- To draw the DFD and UML diagrams for the given specification
- To map the design properly to code
- To test the software system thoroughly for all scenarios

**PRE-REQUISITE:NIL**

**LISTOF PROGRAMS**

1. Write down the problem statement for a suggested system of relevance.
2. Do requirement analysis and develop Software Requirement Specification Sheet (SRS) for suggested system.
3. Develop Data flow diagram(DFD) model (level-0,level-1) of the project
4. Identify use cases and develop the Use Case model.
5. Identify the conceptual classes and develop a Class Diagram.
6. Using the identified scenarios, find the interaction between objects and represent them  
using UML Sequence and Collaboration Diagrams
7. Draw relevant State Chart and Activity Diagrams for the same system.
8. Implement the system as per the detailed design
9. Test the software system for all the scenarios identified as per the usecase diagram.

**Sample Projects:**

1. Passport automation system.
2. Book bank
3. Exam registration
4. Stock maintenance system.
5. Online course reservation system
6. Airline/Railway reservation system
7. Software personnel management system
8. Library management system
9. e-book management system
10. Student information system

**TOTAL: 60 PERIODS**

**LIST OF SOFTWARE FOR A BATCH OF 30 STUDENTS:**

- 1.Windows 7 or higher
2. Rational Rose Enterprise Edition/ open source tools: Star UML, UML Graph

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Build the SRS for a suggested system using Software requirements. **(K3)**
- Construct the Data Flow Diagram (DFD) using software requirements. **(K3)**
- Examine the identified classes and functionality of the system using USECASE model. **(K4)**
- Demonstrate the objects interaction and implementation models for the system. **(K3)**
- Demonstrate the code from system design. **(K3)**
- Analyze the developed code using testing strategies. **(K4)**

<b>20AD601</b>	<b>NATURAL LANGUAGE PROCESSING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**OBJECTIVES:**

- To learn the fundamental mathematical models and algorithms of NLP.
- To learn the sentiment analysis and its evaluation
- logistic regression for classification
- To learn semantic parsing for measuring word semantics and evaluation.
- Study the principles of language resource annotation to annotate the data.
- To learn about the NLP application and its uses

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION 9**

Introduction -Regular Expressions- Words - Text Normalization, Minimum Edit Distance - N-gram Language Models - Evaluating Language Models - Sampling sentences from a language model – Smoothing.

**UNIT II SENTIMENT CLASSIFICATION AND LOGISTIC REGRESSION 9**

Naive Bayes Classifiers - Optimizing for Sentiment Analysis - Evaluation: Precision, Recall, F measure - Logistic Regression: Classification with Logistic Regression - Multinomial logistic regression - Learning in Logistic Regression - The cross-entropy loss: Gradient Descent - Regularization.

**UNIT III SEMANTIC PARSING 9**

Lexical Semantics - Vector Semantics - Words and Vectors - Cosine for measuring similarity - TF-IDF: Weighing terms in the vector - Point wise Mutual Information - Word2vec - Visualizing Embedding's - Bias and Embedding's - Evaluating Vector Models

**UNIT IV ANNOTATING LINGUISTIC STRUCTURE 9**

Context-Free Grammars and Constituency Parsing: Context-Free Grammars – Treebanks - Grammar Equivalence and Normal Form – Ambiguity - Span-Based Neural Constituency Parsing - Evaluating Parsers - Dependency Parsing: Dependency Relations - Transition-Based Dependency Parsing - Graph Based Dependency Parsing – Evaluation.

**UNIT V NLP APPLICATIONS 9**

Machine Translation: Language Divergences and Typology - Machine Translation using Encoder Decoder - Translating in low-resource situations - MT Evaluation - Question Answering and Information Retrieval: Information Retrieval - IR-based Factoid Question Answering - Entity Linking - Knowledge-based Question Answering - Using Language Models to do QA.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Interpret the fundamental mathematical models and algorithms in the field of NLP. **(K2)**
- Discuss about the sentiment analysis and its evaluation. **(K2)**
- Illustrate the logistic regression for classification. **(K3)**
- Implement semantic parsing for measuring word semantics and evaluation. **(K2)**
- Apply the principles of language resource annotation to annotate the data. **(K3)**
- Discuss about the NLP application and its uses. **(K2)**

**TEXT BOOKS:**

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2023.
2. Foundations of Statistical Natural Language Processing by Christopher D. Manning and Hinrich Schuetze, MIT Press, 2018
3. Steven Bird, Ewan Klein and Edward Loper Natural Language Processing with Python, O'ReillyMedia; 1 edition, 2009
4. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval",Oxford University Press, 2008.

<b>20AD602</b>	<b>IMAGE AND VIDEO ANALYTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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

**PRE-REQUISITE: NIL**

**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.

**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-spectral images - Local pre-processing in the frequency domain - Line detection by local pre-processing operators - Image restoration

**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-FasterR-CNN-You Only Look Once(YOLO)-Salient features-Loss Functions-YOLO architectures

**UNIT IV FACE RECOGNITION AND GESTURE RECOGNITION 9**

Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition Deep Face solution by Facebook- Face Net for Face Recognition- Implementation using Face Net Gesture Recognition

**UNIT V VIDEO ANALYTICS 9**

Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem- Rest Net architecture-Rest Net and skip connections-Inception Network-Google Net architecture-Improvement in Inception v2-Video analytics-Rest Net and Inception v3

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Understand the basics of image processing techniques for computer vision. **(K2)**
- Explain the techniques used for image pre-processing. **(K2)**
- Apply various object detection techniques. **(K3)**
- Understand deep learning and YOLO architectures. **(K2)**
- Apply various face recognition mechanisms. **(K3)**
- Demonstrate on deep learning-based video analytics. **(K3)**

**TEXT BOOKS:**

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4th edition, Thomson Learning, 2013.
2. Vaibhav Verdhhan,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras, A press 2021(UNIT-III,IV and V)

**REFERENCES**

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited, 2011.
2. Caifeng Shan, Fatih Porikli, 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.
4. E. R. Davies, (2012), "Computer & Machine Vision", Fourth Edition, Academic Press.

<b>20AD6L1 IMAGE AND VIDEO ANALYTICS LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	0	0	4	2

**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

**PRE-REQUISITE:NIL**

**LISTOF PROGRAMS**

1. Write a program that computes the pyramid of an image.
2. Write a program that derives the quad tree representation of an image using the homogeneity criterion of equal intensity
3. Develop programs for the following geometric transforms: (a) Rotation (b) Change of scale (c) Skewing (d) Affine transform calculated from three pairs of corresponding points (e) Bilinear transform calculated from four pairs of corresponding points.
4. Develop a program to implement Object Detection and Recognition
5. Develop a program for motion analysis using moving edges, and apply it to your image sequences.
6. Develop a program for Facial Detection and Recognition
7. Write a program for Hand Gesture Recognition

**TOTAL: 60 PERIODS**

**LIST OF SOFTWARE FOR A BATCH OF 30 STUDENTS:**

- Python/ Python Libraries

**Tools**

- Anaconda Navigator / google colab / Pycharm

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Apply image processing techniques for computer vision and video analysis. **(K3)**
- Demonstrate various techniques used for image pre-processing. **(K3)**
- Construct various object detection techniques. **(K3)**
- Apply face recognition mechanisms. **(K3)**
- Apply motion analysis using moving edges in image sequences. **(K3)**
- Discover deep learning-based video analytics. **(K3)**

<b>20CS6L1</b>	<b>MOBILE APPLICATION DEVELOPMENT LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	4	2

**OBJECTIVES:**

- To understand the components and structure of mobile application development frame works for Android and windows OS based mobiles.
- To understand how to work with various mobile application development frameworks.
- To learn the basic and important design concepts and issues of development of mobile applications.
- To understand the capabilities and limitations of mobile devices

**PRE-REQUISITE:**NIL

**LISTOF PROGRAMS**

1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Develop an application that draws basic graphical primitives on the screen.
4. Develop an application that makes use of databases.
5. Develop an application that makes use of Notification Manager
6. Implement an application that uses Multi-threading
7. Develop a native application that uses GPS location information
8. Implement an application that writes data to the SD card.
9. Write a mobile application that creates alarm clock
10. Write a mobile application that makes use of RSS feed
11. Develop a mobile application to send an email.
12. Develop a Mobile application for simple needs (Mini Project)

**TOTAL: 60PERIODS**

**LIST OF SOFTWARE FOR A BATCH OF 30 STUDENTS:**

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

**HARDWARE:**

Standalone desktops - 30 Nos. (or) Server supporting 30 terminals ormore.

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Develop mobile applications using UI and Layouts. **(K3)**
- Develop mobile applications using Event Listener. **(K3)**
- Develop mobile applications using Databases. **(K3)**
- Develop mobile applications using Notification Manager. **(K3)**
- Develop mobile applications using RSS Feed, Internal / External Storage, SMS, Multi-threading and GPS. **(K3)**
- Create own mobile app for simple needs. **(K6)**

<b>20CS701</b>	<b>DATA ANALYTICS</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- To understand the basic concepts of Data Analytic.
- To Handle missing data in the real world datasets by choosing appropriate methods
- To Learn data analysis methods
- To learn stream computing
- To Understand and apply Data Analysis Techniques
- To gain knowledge on Hadoop related tool

**PRE-REQUISITE:**

Course Code: 20AD502

Course Name: Machine Learning Techniques

**UNIT I INTRODUCTION 9**

Knowledge domains of Data Analysis, Understanding structured and unstructured data, data analytic tools, applications of data analytics, various phases of data analytics lifecycle—discovery, data preparation, model planning, model building, communicating results, operationalization.

**UNIT II DATA PREPROCESSING 9**

Data Preprocessing: Data Cleaning–Data Integration-Data Reduction– Data Transformation Handling Missing Data: Introduction to Missing data, Traditional methods for dealing with missing data, Maximum Likelihood Estimation – Basics, Missing data handling, improving the accuracy of analysis

**UNIT III CLASSIFICATION AND CLUSTERING 9**

Statistical Methods: Regression modelling, 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.

**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. CaseStudy: Text,Web and Social Media Analytics, Real Time Sentiment Analysis, Stock Market Predictions

**UNIT V HADOOP FRAMEWORKS 9**

HADOOP – HDFS concepts, Algorithms using Map Reduce, Introduction to NoSQL, Cassandra, Pig, Hive.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Explain the basic concepts of Data Analytics. **(K2)**
- Describe the Data Analysis preprocessing Techniques. **(K2)**
- Explain about how missing data will be handled during preprocessing. **(K2)**
- Apply the Classification and Clustering algorithms for real time applications. **(K2)**
- Apply intelligent analytics techniques like neural networks, fuzzy and genetic algorithms for real time analytics applications. **(K3)**
- Explain the Hadoop related tools such as Pig and Hive for big data analytics. **(K2)**

**TEXT BOOKS:**

1. John Wiley & Sons, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services (Editor),2015
2. Craig K. Enders, “Applied Missing Data Analysis”, The Guilford Press, 2010.
3. Michael Berthold, David J. Hand, —Intelligent Data Analysis, Springer, Second Edition, 2007.

**REFERENCES**

1. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Wiley, 2012
2. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.



**TEXT BOOKS:**

1. R. Siegwart, I. R. Nourbaksh, and D. Scaramuzza, "Introduction to Autonomous Mobile Robots", Second Edition, MIT Press, 2011.

**REFERENCES**

1. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition, Pearson Education, 2020.
2. Bhaumik and Arkapravo "From AI to Robotics: Mobile, Social, and Sentient Robots" by CRC Press Taylor & Francis 2017.

<b>20AD702</b>	<b>CLOUD COMPUTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the concept of cloud computing.
- To appreciate the evolution of cloud from the existing technologies.
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.

**PRE-REQUISITE:** NIL

**UNIT I INTRODUCTION 9**

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

**UNIT II CLOUD ENABLING TECHNOLOGIES 9**

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

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

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

**UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD 9**

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

**UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS 9**

Virtual Box -- Google App Engine – Programming Environment for Google App Engine — Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Describe the main concepts, key technologies, and strengths and limitations of cloud computing. **(K2)**
- Explain the key and enabling technologies that help in the development of cloud. **(K2)**
- Discuss the usage of architecture of compute and storage cloud, service and delivery models. **(K2)**
- Explain the core issues of cloud computing such as resource management and security. **(K2)**
- Illustrate the security features to be adopted in cloud. **(K2)**
- Infer the appropriate technologies, algorithms and approaches for implementation and use of cloud. **(K3)**

**TEXT BOOKS:**

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

**REFERENCES**

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

<b>20AD7L1</b>	<b>DATA EXPLORATION LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	4	2

**OBJECTIVES:**

- Understand various methods of Data Preparation and Manipulation
- Learn the data analysis basics with Python
- To understand various types of Tools for Analytics
- To perform DAX calculation for data model
- To design report and dashboard for Visualization

**PRE-REQUISITE:**NIL

**LISTOF PROGRAMS**

1. Perform data pre-processing operations using python
2. Perform Z-test
3. Perform T-test
4. Perform ANOVA
5. Install the data Analysis and Visualization tool:Python/TableauPublic/ PowerBI Desktop.
6. Prepare & Load data
7. Develop the data model
8. Perform DAX calculations
9. Design a report
10. Create a dashboard and perform data analysis

**TOTAL: 60PERIODS**

**LIST OF SOFTWARE FOR A BATCH OF 30 STUDENTS:**

Tool:Python/TableauPublic/ PowerBI Desktop

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Apply the various analysis methods in python.**(K3)**
- Install and use data Analysis and Visualization tool. **(K3)**
- Prepare & load data to develop the data model. **(K3)**
- Apply DAX calculation for analytics. **(K3)**
- Construct the report for given dataset using Visualization tool. **(K3)**
- Design a dashboard and perform data analysis. **(K3)**

<b>20AD7L2</b>	<b>CLOUD COMPUTING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		0	0	4	2

**OBJECTIVES:**

- To learn and develop applications using gcc and make
- To learn and use version control systems
- To develop web applications in cloud
- To learn the design and development process involved in creating a cloud based application
- To learn to implement and use parallel programming using Hadoop

**PRE-REQUISITE:NIL****LISTOF PROGRAMS**

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on topof windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute SimplePrograms
3. Install Google App Engine. Create hello world app and other simple web applications usingpython/java.
4. Use GAE launcher to launch the web applications.
4. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is notpresent in CloudSim.
5. Find a procedure to transfer the files from one virtual machine to another virtual machine.
6. Install Hadoop single node cluster and run simple applications like wordcount..

**TOTAL: 60 PERIODS****OUTCOMES:****On Completion of the course, the students should be able to:**

- Configure various virtualization tools such as Virtual Box, VMware workstation. **(K3)**
- Design and deploy a web application in a PaaS environment. **(K3)**
- Learn how to simulate a cloud environment to implement new schedulers. **(K3)**
- Install and use a generic cloud environment that can be used as a private cloud. **(K3)**
- Install Hadoop single node cluster and run simple applications. **(K3)**

<b>20AD8L1</b>	<b>PROJECT WORK</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>20</b>	<b>10</b>

**OBJECTIVES:**

To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The student in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Identify a domain and problem by applying required domain knowledge. **(K3)**
- Analyze and categorize executable project modules including real time project constraints based on environmental and societal impact. **(K4)**
- Examine efficient tools and methods for designing and implementing project modules. **(K4)**
- Develop effective solution for the problem identified with the help of proposed methodology and tools. **(K6)**
- Assess all the modules through effective integration, optimization and testing. **(K5)**
- Elaborate the completed task and compile the project report. **(K4)**

**TOTAL: 300 PERIODS**

<b>20ADV11</b>	<b>VIRTUALIZATION</b>	L	T	P	C
		2	0	2	3

**OBJECTIVES:**

- To Learn the basics and types of Virtualization
- To understand the Hypervisors and its types
- To Explore the Virtualization Solutions
- To discover various virtualization platforms

**PRE-REQUISITE:** NIL

**UNIT I INTRODUCTION TO VIRTUALIZATION 6**

Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations- Types of hardware virtualization: Full virtualization - partial virtualization - Paravirtualization-Types of Hypervisors

**UNIT II SERVER AND DESKTOP VIRTUALIZATION 6**

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 6**

introduction to Network Virtualization-Advantages- Functions-Tools for Network Virtualization VLAN-WAN Architecture-WAN

**UNIT IV STORAGE VIRTUALIZATION 6**

Memory Virtualization-Types of Storage Virtualization-Block, File-Address space Remapping-Risks of Storage Virtualization-SAN-NAS-RAID

**UNIT V VIRTUALIZATION TOOLS 6**

VMWare-AWS-Microsoft HyperV- Oracle VM Virtual Box - IBM PowerVM- Google Virtualization- Case study.

**TOTAL: 30+30 PERIODS**

## PRACTICAL EXERCISES:

1. Create type 2 virtualization in VMWARE or any equivalent Open Source Tool. Allocate memory and storage space as per requirement. Install Guest OS on that VMWARE.
- 2.a. Shrink and extend virtual disk
  - b. Create, Manage, Configure and schedule snapshots
  - c. Create Spanned, Mirrored and Striped volume
  - d. Create RAID 5 volume
- 3.a. Desktop Virtualization using VNC
  - b. Desktop Virtualization using Chrome Remote Desktop
4. Create type 2 virtualization on ESXI 6.5 server
5. Create a VLAN in CISCO packet tracer
6. Install KVM in Linux
7. Create Nested Virtual Machine (VM under another VM)

## OUTCOMES:

On Completion of the course, the students should be able to:

- Understand the virtualization concepts and Hypervisor. **(K2)**
- Install & Configure the different VM platforms for an application. **(K3)**
- Construct server and desktop virtualization. **(K2)**
- Demonstrate network virtualization and Architecture. **(K2)**
- Demonstrate memory and storage virtualization. **(K2)**
- Apply various virtualization tools. **(K3)**

## 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, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach

## REFERENCES

1. Chris Wolf, Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", APress, 2005.
2. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
3. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006

<b>20CSV21</b>	<b>DATA WAREHOUSING AND DATA MINING</b>	L	T	P	C
		3	0	0	3

**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.

**PRE-REQUISITE:**

Course Code : 20CS402

Course Name : Database Management Systems

**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– Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns. Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

**UNIT III FREQUENT PATTERN ANALYSIS 9**

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

**UNIT IV CLASSIFICATION AND CLUSTERING 9**

Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines —Clustering Techniques – Cluster Analysis-Partitioning Methods - Hierarchical Methods – Density Based Methods - Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis

**UNIT V DATA MINING TOOLS 9**

Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database – Data mining tools: WEKA, Hadoop, Spark, R tool – Learning algorithms, Clustering algorithms, Association–rule learners.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Discuss data warehouse system and business analysis with OLAP tools. **(K2)**
- Describe various pre-processing and visualization techniques for data analysis. **(K2)**
- Apply frequent pattern and association rule mining techniques. **(K3)**
- Select and apply an appropriate classification algorithm for labeled data. **(K3)**
- Apply various clustering techniques for unlabeled data. **(K3)**
- Apply learning and clustering algorithms using data mining tools. **(K3)**

**TEXT BOOKS:**

1. Jiawei Han and MichelineKamber, Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.
2. Alex Berson and Stephen J.Smith, Data Warehousing, Data Mining & OLAP, Tata McGraw – Hill Edition, 5th Reprint 2016.

**REFERENCES**

1. K.P. Soman, ShyamDiwakar and V. Ajay, Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.
2. Ian H.Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition.
3. Daniel T.Larose, “Data Mining Methods and Models”, Wiley-Interscience, 2006.

<b>20CSV31</b>	<b>CLOUD SERVICE MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		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 cloud services
- Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

**PRE-REQUISITE: NIL**

**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, Cloud Service 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 Life Cycle, 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 Operations Management.

**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, CapexvsOpex 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:**

- Discuss the fundamentals of cloud service management. **(K2)**
- Describe the cloud service strategies like cloud policy, risk management and change management etc. **(K2)**

- Explain the life cycle and benchmarks of cloud services. **(K2)**
- Illustrate deployment and migration of cloud services. **(K2)**
- Discuss the economic based cloud services. **(K2)**
- Explain the strong theoretical foundation leading to cloud service governance & measuring the value of cloud-based services. **(K2)**

**TEXT BOOKS:**

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by Enamul Haque, Enel Publications
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

**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.

<b>20CSV41</b>	<b>SOFTWARE DEFINED NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**OBJECTIVES:**

- To learn the fundamentals of software defined networks.
- To understand the separation of the data plane and the control plane.
- To study about the SDN Programming.
- To study about the various applications of SDN

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION TO SOFTWARE DEFINED NETWORK 9**

SDN Origins and Evolution – Introduction – Why SDN? - Centralized and Distributed Control and Data Planes - The Genesis of SDN

**UNIT II OPEN FLOW AND SDN CONTROLLERS 9**

Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via HypervisorBased Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts.

**UNIT III DATA CENTERS 9**

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE

**UNIT IV SDN PROGRAMMING 9**

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications

**UNIT V SDN FRAMEWORK 9**

Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Explain the key benefits of SDN by separation of Data and Control Planes. **(K2)**
- Discuss the open flow specification and different controllers of SDN. **(K2)**
- Describe various Data centers and SDN solutions for the Data Center networks. **(K2)**
- Develop various applications of SDN using current languages and tools. **(K3)**
- Explain the various concepts of Network function virtualization in SDN programming. **(K2)**
- Explain different framework and controller used in SDN. **(K2)**

**TEXT BOOKS:**

1. Paul Goransson and Chuck Black, Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, SDN: Software Defined Networks, O'Reilly Media, 2013

**REFERENCES**

1. SiamakAzodolmolky, Software Defined Networking with Open Flow, Packet Publishing, 2013.
2. VivekTiwari, SDN and Open Flow for BeginnersII, Amazon Digital Services, Inc., 2013.
3. Fei Hu, Editor, Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

<b>20ADV51</b>	<b>STORAGE TECHNOLOGIES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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

**PRE-REQUISITE: NIL**

**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 virtualization and 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**

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications

**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 infrastructure management functions, Storage infrastructure management processes.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment. **(K2)**
- Illustrate the usage of advanced intelligent storage systems and RAID. **(K3)**
- Identify various storage networking architectures – SAN. **(K3)**
- Apply storage subsystems and Virtualization. **(K3)**
- Examine the different role in providing disaster recovery and remote replication technologies. **(K3)**
- Infer the security needs and security measures to be employed in information storage Management. **(K2)**

**TEXT BOOKS:**

1. EMC Corporation, Information Storage and Management, Wiley, India
2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017

**REFERENCES**

1. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein, Storage Networks Explained, Second Edition, Wiley, 2009

<b>20CSV61</b>	<b>INFORMATION RETRIEVAL TECHNIQUES</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- To understand the basics of Information Retrieval.
- To understand machine learning techniques for text classification and clustering.
- To understand various search engine system operations.
- To learn different techniques of recommender system.

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION 9**

Information Retrieval – Early Developments – The IR Problem – The User’s Task – Information versus Data Retrieval - The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes - The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

**UNIT II MODELING AND RETRIEVAL EVALUATION 9**

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

**UNIT III TEXT CLASSIFICATION AND CLUSTERING 9**

A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing.

**UNIT IV WEB RETRIEVAL AND WEB CRAWLING 9**

The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations -- Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

**UNIT V RECOMMENDER SYSTEM 9**

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

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Explain the IR components and Web Search Engine Framework. **(K2)**
- Discuss various information retrieval models. **(K2)**
- Apply appropriate method of classification or clustering. **(K3)**
- Explain the Web Search Engine architecture and ranking functions. **(K2)**
- Discuss Web Link Analysis algorithms and advanced search. **(K2)**
- Illustrate recommendation techniques and develop content-based Recommender Systems. **(K3)**

**TEXT BOOKS:**

1. Ricardo BaezaYates and BerthierRibeiroNeto, Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.
2. Ricci, F, Rokach, L. Shapira, B.Kantor, Recommender Systems Handbook, First Edition, 2011.

**REFERENCES**

1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008.
2. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

<b>20SCV71</b>	<b>SECURITY AND PRIVACY IN CLOUD</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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

**PRE-REQUISITE: NIL**

**UNIT I                      FUNDAMENTALS OF CLOUD SECURITY CONCEPTS                      9**

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Nonrepudiation, 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 Protection strategies: 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.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Discuss the fundamental concepts of cloud security. **(K2)**
- Illustrate the various cloud security design for cloud. **(K2)**
- Apply data protection strategies for cloud. **(K3)**
- Identify the cloud requirements, storage and network access control options. **(K2)**
- Explain the different types of architectural and design considerations for security in the cloud. **(K2)**
- Explain the various risks, audit and monitoring mechanisms in the cloud. **(K2)**

**TEXT BOOKS:**

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

<b>20ITV81</b>	<b>REINFORCEMENT LEARNING TECHNIQUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**OBJECTIVES:**

- To introduce the fundamentals of Reinforcement Learning
- To illustrate model-based prediction and control using dynamic programming
- To illustrate model-free prediction and control
- To introduce planning and learning with tabular methods
- To explain approximation of a value function

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION 9**

Introduction to Reinforcement learning, examples - Elements of reinforcement learning - Limitations and Scope- An extended example - multi-armed bandits - k-armed bandit problem - action-value methods - the 10-armed testbed - incremental implementation - tracking a nonstationary problem - optimistic initial values - upper-confidence-bound action selection - associative search

**UNIT II MARKOV DECISION PROCESS AND MODEL-BASED PREDICTION AND CONTROL 9**

Finite Markov Decision Process - The Agent–Environment Interface - Goals and Rewards - Returns and Episodes - Unified Notation for Episodic and Continuing Tasks - Policies and Value Functions - Optimal Policies and Optimal Value Functions - Optimality and Approximation - Dynamic Programming - Policy Evaluation (Prediction) - Policy Improvement - Policy Iteration - Value Iteration - Generalized Policy Iteration - Efficiency of Dynamic Programming - Asynchronous Dynamic Programming.

**UNIT III MODEL-FREE PREDICTION AND CONTROL 9**

Model-free learning - Model-free prediction - Monte Carlo methods - Monte Carlo Prediction - Monte Carlo Estimation of Action Values - Temporal-Difference Learning - TD Prediction - Advantages of TD Prediction Methods - Optimality of TD(0) - n-step Bootstrapping - n-step TD Prediction - n-step Sarsa - Model-free control - Monte Carlo Control - Monte Carlo Control without Exploring Starts - Off policy learning - Importance sampling - Off-policy Monte Carlo Control - Sarsa: On-policy TD Control - Q-learning: Off-policy TD control

**UNIT IV PLANNING AND LEARNING WITH TABULAR METHODS 9**

Models and planning - Dyna: Integrated Planning, Acting and Learning - When the model is wrong - Prioritized Sweeping - Real-time Dynamic Programming - Monte Carlo Tree Search.

**UNIT V VALUE FUNCTION APPROXIMATION 9**

On-policy Prediction with Approximation - Value Function Approximation - The Prediction Objective (VE) - Stochastic-gradient and Semi-gradient Methods - Linear Methods - Least-Squares TD.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Explain basic concepts of reinforcement learning. **(K2)**
- Perform model-based prediction and control using dynamic programming. **(K2)**
- Apply model-free prediction and control. **(K2)**
- Comprehend the use of tabular methods. **(K2)**
- Explain how a value function can be approximated. **(K2)**
- Apply Stochastic-gradient and Semi-gradient Methods for value function approximation. **(K3)**

**TEXT BOOKS:**

1. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An introduction, 2nd edition, The MIT Press, 2015.
2. Martijn van Otterlo, Marco Wiering, Reinforcement Learning: State-of-the-Art, Springer Verlag Berlin Heidelberg, 2012.
3. Artificial Intelligence: A Modern Approach, Stuart J. Russell and Peter Norvig, 3rd edition Pearson, 2015.

**REFERENCES**

1. Good fellow, Y. Bengio, A. Courville, Deep Learning, MIT Press Ltd., 2016.
2. Reinforcement Learning with MATLAB, Math Works Inc., 2020.

<b>20CSV12</b>	<b>SOCIAL NETWORK ANALYSIS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**OBJECTIVES:**

- To understand the concept of semantic web and related applications.
- To learn knowledge representation using ontology.
- To understand human behaviour in social web and related communities.
- To learn visualization of social networks.

**PRE-REQUISITE:**

Course Code :20CS501

Course Name :Computer Networks

**UNIT I INTRODUCTION 9**

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

**UNIT II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION 9**

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations

**UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 9**

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 - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.

**UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES 9**

Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

**UNIT V**                      **VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS**                      **9**

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Explain the semantic web concepts and applications of social network analysis. **(K2)**
- Discuss about modeling and knowledge representation using ontology of social network. **(K2)**
- Illustrate the extraction and mining communities in web social networks. **(K2)**
- Illustrate the various methods for predicting human behaviour in social communities. **(K2)**
- Describe the privacy issues in trust network analysis. **(K2)**
- Make use of visualization techniques for social network applications. **(K3)**

**TEXT BOOKS:**

1. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
2. Borko Furht, Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.

**REFERENCES**

1. Guandong Xu, Yanchun Zhang and Lin Li, Web Mining and Social Networking – Techniques and applications, First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo, Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling, IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, The Social Semantic Web, Springer, 2009.

<b>20ITV22</b>	<b>CYBER PHYSICAL SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the nature of continuous and discrete systems
- To develop synchronous and asynchronous model of processes
- To specify both safety and liveness requirements in temporal logic
- To debug the correctness of the protocol using model checking
- To develop and analyze model of timed and hybrid systems
- To understand zero behaviors and its hybrid automata

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION 9**

Introduction-key features of cyber physical systems- Continuous dynamics: Newtonian mechanics- actor models-properties of systems-feedback control-Discrete dynamics: Discrete systems- Finite state machines

**UNIT II SYNCHRONOUS AND ASYNCHRONOUS MODEL 9**

Synchronous model: Reactive components-properties of components-composing components- synchronous design, Asynchronous model- asynchronous processes-asynchronous design primitives- coordination protocols.

**UNIT III SAFETY AND LIVENESS REQUIREMENT 9**

Safety specifications- verifying invariants- Enumerative search- Temporal logic- Model checking- reachability analysis- proving liveness

**UNIT IV TIMED MODEL AND REAL-TIME SCHEDULING 9**

Timed processes- Timing based protocols: Timing-Based Distributed Coordination-Audio Control Protocol- Timed automata: Model of Timed Automata-Region Equivalence-Matrix-Based Representation for Symbolic Analysis, Real-time scheduling.

**UNIT V HYBRID SYSTEMS 9**

Classes of Hybrid Systems-Hybrid dynamic models: Hybrid Processes-Process Composition-Zeno Behaviors-Stability- designing hybrid systems- linear hybrid automata

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Ability to understand knowledge, opportunities, challenges and Logical Foundations of Cyber Physical Systems. **(K2)**
- Ability to develop model for synchronous, asynchronous, continuous and discrete systems. **(K2)**

- Ability to identify safety specifications and critical properties of Cyber Physical Systems. **(K2)**
- Ability to design and analyze the stability of hybrid systems. **(K2)**
- Ability to apply automata for timed systems. **(K2)**
- Ability to understand Zeno Behaviors. **(K2)**

**TEXT BOOKS:**

1. Rajeev Alur, Principles of cyber-physical systems, The MIT press, 2015
2. E. A. Lee and S. A. Seshia, Introduction to Embedded Systems - A Cyber-Physical Systems Approach, Lulu.com, Second Edition, 2015.

**REFERENCES**

1. Sang C.Suh , U.JohnTanik and John N.Carbone , Applied Cyber-Physical systems, Springer,2014

<b>20SCV32</b>	<b>DIGITAL AND MOBILE FORENSICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand basic digital forensics and techniques.
- To understand digital crime and investigation.
- To understand how to be prepared for digital forensic readiness.
- To understand and use forensics tools for iOS devices.
- To understand and use forensics tools for Android devices.

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION TO DIGITAL FORENSICS 6**

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.

**Practical 6**

1. Installation of Sleuth Kit on Linux. List all data blocks. Analyze allocated as well as unallocated blocks of a disk image.

**UNIT II DIGITAL CRIME AND INVESTIGATION 6**

Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence.

**Practical 6**

1. Data extraction from call logs using Sleuth Kit.

**UNIT III DIGITAL FORENSIC READINESS 6**

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.

**Practical 6**

1. Data extraction from SMS and contacts using Sleuth Kit.

**UNIT IV iOS FORENSICS 6**

Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud.

**Practical 6**

1. Install Mobile Verification Toolkit or MVT and decrypt encrypted iOS backups.
2. Process and parse records from the iOS system.

**UNIT V                    HYBRID SYSTEMS**

6

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.

**Practical**

6

1. Extract installed applications from Android devices.
2. Extract diagnostic information from Android devices through the adb protocol.
3. Generate a unified chronological timeline of extracted records.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Explain various digital forensics process. **(K2)**
- Discuss various digital crime and investigation methods. **(K2)**
- Illustrate the digital forensic readiness and challenges in digital forensic. **(K2)**
- Identify and extract digital evidence from iOS devices. **(K2)**
- Discuss the basics of Android forensics. **(K2)**
- Apply needed tools in Android devices. **(K3)**

**TEXT BOOKS:**

1. Andre Arnes, "Digital Forensics", Wiley, 2018.
2. Chuck Easttom, "An In-depth Guide to Mobile Device Forensics", First Edition, CRC Press, 2022.

**REFERENCES**

1. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

<b>20ITV42</b>	<b>CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES</b>	L	T	P	C
		3	0	0	3

**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

**PRE-REQUISITE: NIL**

**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 precursor for 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)- HashcashPoW ,BitcoinPoW, Attacks on PoW,monopoly problem- 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**

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Explain emerging abstract models for Block chain Technology. **(K2)**
- Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain. **(K2)**
- Explain the function of Block chain as a method of securing distributed ledgers, how consensus on their contents is achieved. **(K2)**
- Apply hyper ledger Fabric and Ethereum platform to implement the Block chain Application. **(K3)**
- Describe emerging abstract models for Block chain Technology. **(K2)**
- Apply block chain concepts in supply chain management. **(K3)**

**TEXT BOOKS:**

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
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 University Press, 2016
3. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015
4. RiteshModi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain", Packet Publishing
5. Handbook of Research on BlockchainTechnology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

<b>20SCV52</b>	<b>WEB APPLICATION SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		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

**PRE-REQUISITE: NIL**

**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 VULNER ABILITY ASSESSMENT AND PENETRATION TESTING 9**

Vulner ability Assessment Lifecycle, Vulner ability Assessment Tools : Cloud-based vulner ability scanners, 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, etc.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Explain the fundamental concept of Web application security. **(K2)**
- Discuss Microsoft security development lifecycle, security process and software assurance maturity model. **(K2)**
- Illustrate API security using session cookies, token based authentication and encryption. **(K3)**

- Describe various vulnerability assessments tools in web application. **(K2)**
- Illustrate different type of penetration tests to identify security weaknesses in web application. **(K3)**
- Explain various hacking techniques and tools in web application. **(K2)**

**TEXT BOOKS:**

1. Andrew Hoffman, Web Application Security: Exploitation and Counter measures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The Mc Graw- 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.

<b>20CSV62</b>	<b>ENGINEERING SECURE SOFTWARE SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		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.

**PRE-REQUISITE: NIL**

<b>UNIT I</b>	<b>NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS</b>				<b>9</b>
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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.

<b>UNIT II</b>	<b>SECURE SOFTWARE DESIGN</b>				<b>9</b>
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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.

<b>UNIT III</b>	<b>SECURITY RISK MANAGEMENT</b>				<b>9</b>
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Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management.

<b>UNIT IV</b>	<b>SECURITY TESTING</b>				<b>9</b>
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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.

<b>UNIT V</b>	<b>SECURE PROJECT MANAGEMENT</b>				<b>9</b>
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Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Identify various vulnerabilities related to memory attacks and low level attacks. **(K2)**
- Apply security principles in software development and secure design. **(K3)**
- Discuss the risk factors in software systems and risk assessment techniques. **(K2)**
- Apply various testing techniques related to software security in the testing phase of software development. **(K3)**
- Discuss the web application security, bypassing Firewalls and tools for penetration testing. **(K2)**
- Illustrate secure project management and its framework. **(K3)**

**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 Security Testing: 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, "Developing Secure Software"

<b>20CSV82</b>	<b>MALWARE ANALYSIS</b>	L	T	P	C
		2	0	2	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.

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION AND BASIC ANALYSIS 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.

**Practical 6**

1. Experimentation on Initial Infection Vectors and Malware Discovery
2. Implementation on Sandboxing Malware and Gathering Information From Runtime Analysis

**UNIT II ADVANCED STATIC ANALYSIS 9**

The Stack, Conditionals, Branching, Rep Instructions, Disassembly, Global and local variables, Arithmetic operations, Loops, Function Call Conventions, C Main Method and Offsets. Portable Executable File Format, The PE File Headers and Sections, IDA Pro, Function analysis, Graphing, The Structure of a Virtual Machine, Analyzing Windows programs, Anti-static analysis techniques, obfuscation, packing, metamorphism, polymorphism.

**Practical 6**

1. Implementation on Portable Executable (PE32) File Format
2. Implementation on Executable Metadata and Executable Packers

**UNIT III ADVANCED DYNAMIC ANALYSIS 9**

Live malware analysis, dead malware analysis, analyzing traces of malware, system calls, api calls, registries, network activities. Anti-dynamic analysis techniques, VM detection techniques, Evasion techniques, , Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark, Kernel vs. User-Mode Debugging, OllyDbg, Breakpoints, Tracing, Exception Handling, Patching .

**Practical 6**

1. Experimentation on Malware Self - Defense, Compression, and Obfuscation Techniques
2. Experimentation on Malware behaviour analysis

**UNIT IV MALWARE FUNCTIONALITY 9**

Down loaders and Launchers, Backdoors, Credential Stealers, Persistence Mechanisms, Handles, Mutexes, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection.

**Practical 6**



<b>20ITV13</b>	<b>PRINCIPLES OF PROGRAMMING LANGUAGES</b>	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 and ling in programming languages
- To develop programs in non-procedural programming paradigms.

**PRE-REQUISITE: NIL**

**UNIT I SYNTAXANDSEMANTICS 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,DATATYPES, ANDBASICSTATEMENTS 9**

Names–variables–binding–type checking –scope–scope rules–life time 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 UBPROGRAMSANDIMPLEMENTATIONS 9**

Subprograms – design issues – local referencing – parameter passing – overloaded methods – generic methods – design issues for functions – semantics of call and return – implementing simplesubprograms–stackanddynamiclocalvariables–nestedsubprograms–blocks–dynamicscoping.

**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:**

**On Completion of the course, the students should be able to:**

- Describe syntax and semantics of programming languages. **(K2)**
- Illustrate different data types and statements for the programming language. **(K3)**

- Develop simple and nested sub-programs. **(K3)**
- Make use of semaphores and monitors concept to implement basic concepts of object-oriented programming. **(K3)**
- Illustrate the mechanism of threads and exception handling. **(K3)**
- Compare features, applications of functional and logic programming language. **(K2)**

**TEXT BOOKS:**

1. Robert W. Sebesta, "Concepts of Programming Languages", Twelfth Edition (Global Edition), Pearson, 2022.
2. Scott, "Programming Language Pragmatics", Fourth Edition, Elsevier, 2018.

**REFERENCES**

1. R. Kent Dybvig, "The Scheme programming language", Fourth Edition, Prentice Hall, 2011.
2. Jeffrey D. Ullman, "Elements of ML programming", Second Edition, Pearson, 1997
3. W.F. Clocksin and C.S. Mellish, "Programming in Prolog: Using the ISO Standard" Fifth Edition, Springer, 2003.



**UNIT V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE 6**

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods – Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams – Flow Mapping - Information Architecture.

**Practical6**

1. Conduct end-to-end user research - User research, creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping
2. Sketch, design with popular tool and build a prototype and perform usability testing and identify improvements

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Differentiate divergent and convergent thinking and explain brainstorming and game storming. **(K2)**
- Discuss the fundamental needs of UI design. **(K2)**
- Illustrate methods and tools to the process of UX design for research. **(K2)**
- Explain the sketching principles, responsive design and wire framing. **(K2)**
- Discuss the design of UI and UX prototyping and testing with suitable tools. **(K2)**
- Identifying and writing problem statements, appropriate research methods and creating scenarios. **(K2)**

**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” 3rd Edition, O’Reilly 2020
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.](https://www.interaction-design.org/literature)



- Identify the test objectives and apply different method of test strategies. **(K3)**
- Apply advanced testing concepts like Fail-Over testing, usability testing, security testing etc. **(K3)**
- Describe the Testing methods for web and mobile applications. **(K2)**
- Use automatic software testing tools like Selenium web driver for automating web-based application testing. **(K3)**

**TEXT BOOKS:**

1. Yogesh Singh, "Software Testing", Cambridge University Press, 2012
2. Unmesh Gundecha, SatyaAvasarala, "Selenium WebDriver 3 Practical Guide" - Second Edition 2018

**REFERENCES**

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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
4. Elfriede Dustin, Thom Garrett, Bernie Gaurf, Implementing Automated Software Testing, 2009, Pearson Education, Inc.
6. SatyaAvasarala, Selenium WebDriver Practical Guide, 2014, Packt Publishing.
7. VarunMenon, TestNg Beginner's Guide, 2013, Packt Publishing.

<b>20ITV63</b>	<b>COMPUTER VISION</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- To understand the fundamental concepts related to Image formation and processing.
- To learn feature detection, matching and detection
- To become familiar with feature based alignment and motion estimation
- To develop skills on 3D reconstruction
- To understand image based rendering and recognition

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION TO IMAGE FORMATION AND PROCESSING 9**

Computer Vision - Geometric primitives and transformations - Photometric image formation – The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization

**UNIT II FEATURE DETECTION, MATCHING AND SEGMENTATION 9**

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

**UNIT III FEATURE-BASED ALIGNMENT & MOTION ESTIMATION 9**

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.

**UNIT IV 3D RECONSTRUCTION 9**

Shape from X - Active range finding - Surface representations - Point-based representations Volumetric representations - Model-based reconstruction - Recovering texture maps and albedos

**UNIT V IMAGE-BASED RENDERING AND RECOGNITION 9**

View interpolation Layered depth images - Light fields and Lumi graphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Explain basic knowledge, theories and methods in image processing and computer vision. **(K2)**
- Implement basic and some advanced image processing techniques in Open CV. **(K2)**
- Apply 2D feature-based based image alignment, segmentation and motion estimations. **(K2)**
- Apply 3D image reconstruction techniques. **(K2)**
- Explain the innovative image processing concepts. **(K2)**
- Develop innovative image processing and computer vision applications. **(K3)**

**TEXT BOOKS:**

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.

**REFERENCES**

"

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006

<b>20ITV73</b>	<b>DEVOPS</b>	L	T	P	C
		2	0	2	4

**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 real world problems

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION TO DEVOPS 6**

Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.

**Practical 6**

1. Install Jenkins in Cloud
2. Install Ansible and configure ansible roles and to write playbook

**UNIT II COMPILE AND BUILD USING MAVEN & GRADLE 6**

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.

**Practical 6**

1. Build a simple application using Gradle

**UNIT III CONTINUOUS INTEGRATION USING JENKINS 6**

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

**Practical 6**

1. Create CI pipeline using Jenkins
2. Create a CD pipeline in Jenkins and deploy in Cloud

**UNIT IV CONFIGURATION MANAGEMENT USING ANSIBLE 6**

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

**Practical** 6

1. Create an Ansible playbook for a simple web application infrastructure

**UNIT V BUILDING DEVOPS PIPELINES USING AZURE** 6

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file.

**Practical** 6

1. Create Maven Build pipeline in Azure
2. Run regression tests using Maven Build pipeline in Azure

**TOTAL: 60 PERIODS**

#### **OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Understand different actions performed through Version control tools like Git. **(K2)**
- Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle. **(K2)**
- Perform Automated Continuous Deployment. **(K2)**
- Do configuration management using Ansible. **(K2)**
- Understand to leverage Cloud-based DevOps tools using Azure DevOps. **(K2)**
- Implement the Devop pipeline using Azure. **(K3)**

#### **TEXT BOOKS:**

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to 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: Cidc Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: Cidc Implementation for... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni
2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.
3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.
4. Mariot Tsitoara, "Ansible Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019

<b>20ITV81</b>	<b>REINFORCEMENT LEARNING TECHNIQUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To introduce the fundamentals of Reinforcement Learning
- To illustrate model-based prediction and control using dynamic programming
- To illustrate model-free prediction and control
- To introduce planning and learning with tabular methods
- To explain approximation of a value function

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION 9**

Introduction to Reinforcement learning, examples - Elements of reinforcement learning - Limitations and Scope- An extended example - multi-armed bandits - k-armed bandit problem - action-value methods - the 10-armed test bed - incremental implementation - tracking a nonstationary problem - optimistic initial values - upper-confidence-bound action selection - associative search

**UNIT II MARKOV DECISION PROCESS AND MODEL-BASED PREDICTION AND CONTROL 9**

Finite Markov Decision Process - The Agent–Environment Interface - Goals and Rewards - Returns and Episodes - Unified Notation for Episodic and Continuing Tasks - Policies and Value Functions - Optimal Policies and Optimal Value Functions - Optimality and Approximation - Dynamic Programming - Policy Evaluation (Prediction) - Policy Improvement - Policy Iteration - Value Iteration - Generalized Policy Iteration - Efficiency of Dynamic Programming - Asynchronous Dynamic Programming

**UNIT III MODEL-FREE PREDICTION AND CONTROL 9**

Model-free learning - Model-free prediction - Monte Carlo methods - Monte Carlo Prediction - Monte Carlo Estimation of Action Values - Temporal-Difference Learning - TD Prediction - Advantages of TD Prediction Methods - Optimality of TD(0) - n-step Bootstrapping - n-step TD Prediction - n-step Sarsa - Model-free control - Monte Carlo Control - Monte Carlo Control without Exploring Starts - Off policy learning - Importance sampling - Off-policy Monte Carlo Control - Sarsa: On-policy TD Control - Q-learning: Off-policy TD control

**UNIT IV PLANNING AND LEARNING WITH TABULAR METHODS 9**

Models and planning - Dyna: Integrated Planning, Acting and Learning - When the model is wrong - Prioritized Sweeping - Real-time Dynamic Programming - Monte Carlo Tree Search

**UNIT V VALUE FUNCTION APPROXIMATION 9**

On-policy Prediction with Approximation - Value Function Approximation - The Prediction Objective (VE) - Stochastic-gradient and Semi-gradient Methods - Linear Methods - Least-Squares TD.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Explain basic concepts of reinforcement learning. **(K2)**
- Perform model-based prediction and control using dynamic programming. **(K2)**
- Apply model-free prediction and control. **(K2)**
- Comprehend the use of tabular methods. **(K2)**
- Explain how a value function can be approximated. **(K2)**
- Apply Stochastic-gradient and Semi-gradient Methods for value function approximation. **(K3)**

**TEXT BOOKS:**

1. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An introduction, 2nd edition, The MIT Press, 2015.
2. Martijn van Otterlo, Marco Wiering, Reinforcement Learning: State-of-the-Art, Springer Verlag Berlin Heidelberg, 2012.
3. Artificial Intelligence: A Modern Approach, Stuart J. Russell and Peter Norvig, 3rd edition Pearson, 2015.

**REFERENCES**

1. Good fellow, Y. Bengio, A. Courville, Deep Learning, MIT Press Ltd., 2016.
2. Reinforcement Learning with MATLAB, Math Works Inc., 2020.

<b>20ADV14</b>	<b>DATA AND INFORMATION SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**OBJECTIVES:**

- To understand the basics of Information Security
- To know the legal, ethical and professional issues in Information Security
- To equip the students' knowledge on digital signature, email security and web security.

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION 9**

History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

**UNIT II SECURITY INVESTIGATION 9**

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies

**UNIT III DIGITAL SIGNATURE AND AUTHENTICATION 9**

Digital Signature and Authentication Schemes: Digital signature-Digital Signature Schemes and their Variants- Digital Signature Standards-Authentication: Overview- Requirements Protocols - Applications - Kerberos -X.509 Directory Services

**UNIT IV E-MAIL AND IP SECURITY 9**

E-mail and IP Security: Electronic mail security: Email Architecture -PGP – Operational Descriptions- Key management- Trust Model- S/MIME.IP Security: Overview- Architecture - ESP, AH Protocols IPsec Modes – Security association - Key management.

**UNIT V WEB SECURITY 9**

Web Security: Requirements- Secure Sockets Layer- Objectives-Layers -SSL secure communication-Protocols - Transport Level Security. Secure Electronic Transaction- Entities DS Verification-SET processing.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Understand the basics of data and information security. **(K2)**
- Understand the legal, ethical and professional issues in information security. **(K2)**
- Understand the various authentication schemes to simulate different applications.
- Understand the various protocols and application. **(K2)**
- Understand various security practices and system security standards. **(K2)**
- Understand the Web security protocols for E-Commerce applications. **(K2)**

**TEXT BOOKS:**

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security, Course Technology, 6th Edition, 2017.
2. Stallings William. Cryptography and Network Security: Principles and Practice, Seventh Edition, Pearson Education, 2017.

**REFERENCES**

- "
1. Harold F. Tipton, Micki Krause Nozaki,, "Information Security Management Handbook, Volume 6, 6th Edition, 2016.
  2. Stuart McClure, Joel Scrambray, George Kurtz, "Hacking Exposed", McGraw- Hill, Seventh Edition, 2012.
  3. Matt Bishop, "Computer Security Art and Science, Addison Wesley Reprint Edition, 2015.
  4. Behrouz A Forouzan, Debdeep Mukhopadhyay, Cryptography And network security, 3rd Edition, . McGraw-Hill Education, 2015.



## REFERENCES

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

<b>20ADV34</b>	<b>NEURAL NETWORKS AND DEEP LEARNING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		2	0	2	4

**OBJECTIVES:**

- To understand the basics in deep neural networks
- To understand the basics of associative memory and unsupervised learning networks
- To apply CNN architectures of deep neural networks
- To analyze the key computations underlying deep learning, then use them to build and train deep neural networks for various tasks.
- To apply generative models for suitable applications.

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION TO DEVOPS 6**

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction-Evolution of Neural Networks-Basic Models of Artificial Neural Network-Important Terminologies of ANNs-Supervised Learning Network

**Practical 6**

1. Implement simple vector addition in TensorFlow.
2. Implement a regression model in Keras.

**UNIT II ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS 6**

Training Algorithms for Pattern Association-Auto associative Memory Network-Hetero associative Memory Network-Bidirectional Associative Memory (BAM)-Iterative Auto associative Memory Networks-Fixed Weight Competitive Nets(MAXNET, Hamming Network)-Kohonen Self-Organizing Feature Maps.

**Practical 6**

1. Implement a perceptron in TensorFlow/Keras Environment.
2. Implement a Feed-Forward Network in Tensor Flow/Keras.

**UNIT III THIRD-GENERATION NEURAL NETWORKS 6**

Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Efficient Convolution Algorithms

**Practical 6**

1. Implement an Image Classifier using CNN in TensorFlow/Keras

**UNIT IV DEEP FEED FORWARD NETWORKS 6**

A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Back propagation Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout.

**Practical 6**

1. Implement character and Digit Recognition using ANN

**UNIT V RECURRENT NEURAL NETWORKS**

6

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing.

**Practical**

6

1. Perform Sentiment Analysis using RNN
2. Recommendation system from sales data using Deep Learning

**TOTAL: 60 PERIODS****OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Describe the scope of the neural network and explain the basic models of Artificial Neural Network. **(K2)**
- Illustrate the different types of associative memory networks. **(K3)**
- Apply conventional neural network model and its algorithms. **(K3)**
- Use deep learning components to build and train deep neural networks for various tasks. **(K3)**
- Apply Recurrent Neural Network and its variants for text analysis. **(K3)**
- Utilize the applications of neural networks and deep learning for image compression and Natural Language Processing. **(K3)**

**TEXT BOOKS:**

1. Ian Good fellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016.
2. Francois Chollet, “Deep Learning with Python”, Second Edition, Manning Publications, 2021.

**REFERENCES**

1. Introduction to Neural Networks Using Matlab 6.0 - S. N. Sivanandam, S. N Deepa
2. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn and TensorFlow”, O'Reilly, 2018.
3. Josh Patterson, Adam Gibson, “Deep Learning: A Practitioner’s Approach”, O’Reilly Media, 2017.
4. Charu C. Aggarwal, “Neural Networks and Deep Learning: A Textbook”, Springer International Publishing, 1st Edition, 2018.
5. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress, 2018
6. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
7. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND, 2017. S Rajasekaran, G A Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications”, PHI Learning, 2017.
8. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress, 2017
9. James A Freeman, David M S Kapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Addison Wesley, 2003

<b>20SCV54</b>	<b>CYBER SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand various types of cyber-attacks and cyber-crimes
- To learn threats and risks with in context of the cyber security
- To have an overview of the cyber laws & concepts of cyber forensics
- To study the defensive techniques against the seat tacks

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION 9**

Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats-CyberWarfare, Cyber Crime, Cyberterrorism, Cyber Espionage, etc.

**UNIT II CYBER FORENSICS 9**

Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics

**UNIT III CYBERCRIME:MOBILE AND WIRELESS DEVICES 9**

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attack on Mobile/Cell Phones

**UNIT IV PRIVACY ISSUES 9**

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains-medical, financial, etc

**UNIT V CYBERCRIME 9**

Cybercrime: Examples and Mini – Cases Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mails spoofing instances. Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

**TOTAL: 45 PERIODS**

## **OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Identify the fundamental concepts of cyber security and the layers of cyber security based on real time scenarios**(K3)**
- Illustrate the process of digital forensics, analysis and challenges in computer forensics. **(K4)**
- Analyze the security challenges and prevention measures for the security attacks on mobile and wireless devices. **(K4)**
- Discuss the concepts of privacy Attacks, Data linking and profiling. **(K2)**
- Explain the privacy policies and their specifications in various domains. **(K2)**
- Infer the category of the cyber security attacks and analyze its security Measures. **(K4)**

## **TEXT BOOKS:**

1. Nina Godbole and SunitBelpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives,Wiley,2013
2. B.B.Gupta, D.P.Agrawal, HaoxiangWang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRCPress, 2018.

## **REFERENCES**

”

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRCPress,2016
2. Chwan-Hwa (John) Wu,J.DavidIrwin, Introduction to Computer Networks and Cyber security,CRC Press T&F Group,2013.

<b>20ITV64</b>	<b>3D PRINTING AND DESIGN</b>	L	T	P	C
		3	0	0	3

**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.

**PRE-REQUISITE: NIL**

**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; Material Formulation for jetting; Liquid based fabrication – Continuous jet, Multijet; 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;

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Outline and examine the basic concepts of 3D printing technology. **(K2)**
- Outline 3D printing workflow. **(K2)**
- Explain and categorise the concepts and working principles of 3D printing using inkjet

technique. **(K2)**

- Explain and categorise the working principles of 3D printing using laser technique. **(K2)**
- Explain various method for designing and modeling for industrial applications. **(K2)**
- Explain the future trends in 3D design. **(K2)**

**TEXT BOOKS:**

1. Christopher Barnatt, 3D Printing: The Next Industrial Revolution, Create Space Independent Publishing 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, second edition, World Scientific Publishers, 2010
2. Ibrahim Zeid, Mastering CAD CAM Tata McGraw-Hill Publishing Co., 2007
3. Joan Horvath, Mastering 3D Printing, APress, 2014

<b>20CSV84</b>	<b>VIRTUAL REALITY AND AUGMENTED REALITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**OBJECTIVES:**

- To learn rapidly evolving and commercially viable field of computer science.
- To become familiar with geometric modeling and computer graphics.
- To learn various types of Hardware and Software in virtual Reality systems

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION TO VIRTUAL REALITY 9**

Virtual Reality and Virtual Environment: Introduction-Computer graphics-Real time computer graphics-Flight Simulation-Virtual environment requirement-benefits of virtual reality-Historical development of VR-Scientific Landmark.

**UNIT II AUGMENTED REALITY 9**

Taxonomy-technology and features of augmented reality-difference between AR and VR-Challenges with AR-AR systems and functionality-Augmented reality method-visualization techniques for augmented reality-enhancing interactivity in AR environments-evaluating AR systems.

**UNIT III COMPUTER GRAPHICS AND GEOMETRIC MODELING 9**

Introduction-The Virtual world space-positioning the virtual observer-The perspective projection-Human vision-Stereo perspective projection- Colour theory-Geometrical Transformations-Introduction-frames of reference-Modeling transformations-scaling the VE-Collision detection.

**UNIT IV DEVELOPMENT TOOLS AND FRAMEWORK 9**

Human factors-Hardware-Software-The somatic senses-Sensor hardware-Head coupled displays-Acoustic hardware-Integrated VR systems-Modeling virtual world-Physical simulation.

**UNIT V AUGMENTED AND VIRTUAL REALITY APPLICATION 9**

Virtual Reality Applications: Introduction – Engineering – Entertainment-Education- The Future: Introduction – Virtual environments – modes of interaction. Case study on Oculus Rift -Head mounted display.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Explain the Virtual Reality and Environment, Virtual Reality Requirements and benefits. **(K2)**
- Illustrate the visualization techniques for augmented reality. **(K2)**
- Discuss the concept of Computer Graphics And Geometric Modeling. **(K2)**
- Use various types of Hardware and software in virtual Reality systems. **(K3)**
- Apply Development Tools And Framework for Virtual Reality. **(K3)**
- Analyze and Design a system or process to meet given specifications with Realistic Engineering Constraints. **(K4)**

**TEXT BOOKS:**

1. JernejBarbic-Mirabelle D'Cruz Marc Erich Latoschik, Melslater Patrick Bourdot Edition 2017.
2. Timothy Jung M.claudia tom Diek Philip A.Rauschnabel 2019

**REFERENCES**

1. Grigore C. Burdea, Philippe Coiffet , Virtual Reality Technology, Wiley 2016
2. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan A. Kaufmann, 2013
3. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications,
4. Foundations of Effective Design, Morgan Kaufmann, 2009.
5. John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2007.

<b>20ADV15</b>	<b>BUSINESS INTELLIGENCE SYETEM</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		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

**PRE-REQUISITE: NIL**

**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 – Validation and Evaluation – Interpretation –Deployment and Iteration

**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

**UNIT III BUSINESS FORECASTING 9**

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modeling–Machine Learning for Predictive analytics.

**UNIT IV HR & SUPPLY CHAIN ANALYTICS 9**

HumanResources–PlanningandRecruitment–TrainingandDevelopment-Supplychainnetwork - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR &Supply Chain

**UNIT V MARKETING& SALES ANALYTICS 9**

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

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Explain the real world business problems and model with analytical solutions. **(K2)**
- Identify the business processes for extracting Business Intelligence. **(K2)**
- Apply predictive analytics for business fore-casting. **(K3)**
- Apply analytics for supply chain and logistics management. **(K3)**
- Use analytics for marketing and sales. **(K2)**
- Discuss the applications in Marketing and Sales. **(K2)**

## REFERENCES

1. R. EvansJames, Business Analytics, 2017
2. RNPrasad, SeemaAcharya, Fundamentals of Business Analytics, 2016
3. PhilipKotler and KevinKeller, Marketing Management, 15thedition,PHI,2016
4. VSPRAO, Human Resource Management, 3rdEdition, Excel Books, 2010.
5. Mahadevan B,“ Operations Management -Theory and Practice”, 3<sup>rd</sup> Edition, Pearson Education, 2018.

<b>20ADV25</b>	<b>DATA COMMUNICATION AND COMPUTER NETWORKS</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- To introduce the fundamental various types of computer networks.
- To demonstrate the TCP/IP and OSI models with merits and demerits
- To explore the various layers of OSI Model
- To introduce UDP and TCP Models.

**PRE-REQUISITE: NIL**

**UNIT I DATA COMMUNICATIONS 9**

Components–Direction of Dataflow– Networks– Components and Categories–Types of Connections– Topologies –Protocols and Standards – ISO / OSI model, Example Networks such as ATM, Frame Relay, ISDN Physical layer: Transmission modes, Multiplexing, Transmission Media, Switching, Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks.

**UNIT II DATA LINK LAYER 9**

Introduction, Framing, and Error– Detection and Correction– Parity– LRC – CRC Hamming code, Flow and Error Control, Noiseless Channels, Noisy Channels, HDLC, Point to Point Protocols. 111Medium Access sub layer: ALOHA, CSMA/CD, LAN –Ethernet IEEE802.3, IEEE802.5–IEEE802.11,Randomaccess,Controlledaccess,Channelization

**UNIT III NETWORK LAYER 9**

Logical Addressing, Inter networking, Tunneling, Address mapping, ICMP, IGMP, Forwarding, Uni-Cast Routing Protocols, Multi cast Routing Protocols.

**UNIT IV TRANSPORT LAYER 9**

Process to Process Delivery, UDP and TCP protocols, Data Traffic, Congestion, Congestion Control, QoS, Integrated Services, Differentiated Services, QoS in Switched Networks.

**UNIT V APPLICATION LAYER 9**

Domain namespace, DNS in internet, electronic mail, SMTP, FTP, WWW, HTTP, SNMP.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Demonstrate the basic layers and its functions in computer networks. **(K3)**
- Evaluate the performance of a network. **(K3)**
- Concepts of the basics of how data flows from one node to another. **(K2)**
- Analyze and design routing algorithms. **(K3)**
- Design protocols for various functions in the network. **(K3)**
- Know about the working of various application layer protocols. **(K2)**

**TEXT BOOKS:**

1. Data Communications and Networking, BehrouzA. Forouzan, Fourth EditionTMH,2006.
2. ComputerNetworks,AndrewSTanenbaum,4th Edition.Pearson Education, PHI

## REFERENCES

1. Data communications and Computer Networks, P.C .Gupta, PHI.
2. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education.
3. Understanding communications and Networks, 3rd Edition, W.A. Shay, Cengage Learning.
4. Computer Networking: A Top-Down Approach Featuring the Internet. James F. Kurose& Keith W. Ross, 3 rd Edition, Pearson Education.
5. Data and Computer Communication, William Stallings, Sixth Edition, Pearson Education, 2000.

<b>20ADV45</b>	<b>ROBOTIC PROCESS AUTOMATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**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.

**PRE-REQUISITE: NIL**

**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, Ui Explorer, 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 work flows, Reusability, Templates, Commenting techniques, State Machine

**UNIT V DEPLOYMENT AND MAINTENANCE 9**

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors -Open Source RPA, Future of RPA

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Understand the robotic process automation and its applications. **(K2)**
- Illustrate control flows and work flows for the target process. **(K2)**
- Demonstrate recording, web scraping and process mining by automation. **(K3)**
- Determine exception handling in automation processes. **(K3)**
- Understand Code management and maintenance in automation. **(K2)**
- Understand the Orchestrator for controlling of automated bots. **(K2)**

**TEXT BOOKS:**

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, PacktPublishing, 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 ProcessAutomation, 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 GerardusBlokdyk, “Robotic Process Automation RpaA Complete Guide “, 2020



**TEXT BOOKS:**

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. DipanjanSarkar, "Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data", APress,2018.
2. TanveerSiddiqui, Tiwary U S, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
3. LawrenceRabiner, 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.

20ADV65	<b>SENSORS AND DEVICES</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- To understand different types of sensors and actuators for different environments.
- To find the different measurements methods using sensors
- To design suitable sensors and actuators for engineering applications

**PRE-REQUISITE: NIL**

**UNIT I CLASSIFICATION AND CHARACTERISTICS OF SENSORS 9**

Classification of Sensors and Transducers - Units and Measures–Transfer function–Impedance matching - Range, Span, Resolution, Accuracy, Errors, Repeatability, Sensitivity and Sensitivity analysis - Hysteresis , Nonlinearity and saturation - Frequency response, response time and bandwidth -Calibration-Excitation– Dead band-Reliability.

**UNIT II SENSORS AND ACTUATORS 9**

Temperature Sensors: Thermistors, Thermocouple, RTD. Motion sensor - Accelerometers – Gyroscopes - proximity sensors. Optical and Acoustical Sensors Bio sensors-EEG-ECG-EMG, image sensor –CCD – CMOS. Actuators - Piezoelectric and Piezo resistive actuators, micro pumps and micro actuators.

**UNIT III INTRODUCTION TO ARDUINO 9**

Arduino Uno Architecture – Setup the IDE, Writing Arduino Software - Arduino Libraries-Basics of Embedded C programming for Arduino - Interfacing LED - push button and buzzer with Arduino.

**UNIT IV INTERFACING OF SENSORS 9**

Sensors- Definition, Types. Interfacing arduino to different sensors- light sensor, temperature sensor, humidity sensor, pressure sensor sound sensor, distance ranging sensor, water/detector sensor, smoke, gas,alcoholsensor, ultrasonic rangefinder

**UNIT V PROGRAMMING ESP8266 MODULE 9**

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploybots, License management, Publishing and managing updates. RPA Vendors -Open Source RPA, Future of RPA

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Explain the classification of sensors and transducers and discuss the characteristics of Sensors. **(K2)**
- Explain the construction and operation of various types of sensors and Actuators. **(K2)**
- Discuss the general requirements for interfacing of sensors and algorithm for various types of sensors. **(K2)**
- Develop a signal conditioning circuits for thermistor and RTD. **(K3)**
- Develop V/I and I/V converters for various sensors and discuss DAC and ADC. **(K3)**
- Discuss the appropriate sensor for realtime applications. **(K2)**

**TEXT BOOKS:**

1. NathanIida, "Sensors, Actuators and their Interfaces", Institution of Engineering and Technology,2020.
2. PatranabisD, "Sensor and Actuators", Prentice Hall of India (Pvt) Ltd.2003.
3. Renganathan.S, " Transducer Engineering", Allied Publishers(P)Ltd.,2003.
4. Beginning Arduino" ,Michal McRoberts, Second Edition
5. 2.Michal McRoberts "Beginning Arduino" Second Edition, Technology in Action

**REFERENCES**

1. Clarence W. de Silva, " Sensors and Actuators: Engineering System Instrumentation", 2<sup>nd</sup> Edition, CRC Press,2015
2. ErnestO.Doeblin,"Measurement system, Application and design ",Tata McGrawHill Publishing Company Ltd.,Fifth Edition,2004
3. Bradley D.A., Dawson D, Burd N C, Loader A J," Mechatronics: Electronics in products and processes", CRC Press, 2018
4. MassimoBanzi, "GettingstartedwithArduino"2ndEdition,Orelly2011

<b>20ADV75</b>	<b>ETHICS AND AI</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- Study the morality and ethics in AI
- Learn about the Ethical initiatives in the field of artificial intelligence
- Study about AI standards and Regulations
- Study about social and ethical issues of Robot Ethics
- Study about AI and Ethics- challenges and opportunities

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION 9**

Definition of morality and ethics in AI-Impact on society – Impact on human psychology-Impact on the legal system –Impact on the environment and the planet-Impact on trust

**UNIT II ETHICAL INITIATIVES IN AI 9**

International ethical initiatives-Ethical harms and concerns-Case study: health care robots, Autonomous Vehicles, Warfare and weaponization

**UNIT III AI STANDARDS AND REGULATION 9**

Model Process for Addressing Ethical Concerns During System Design-Transparency of Autonomous Systems - Data Privacy Process- Algorithmic Bias Considerations -Ontological Standard for Ethically Driven Robotics and AutomationSystems

**UNIT IV ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS 9**

Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility- Roboethics Taxonomy.

**UNIT V AI AND ETHICS- CHALLENGES AND OPPORTUNITIES 9**

Challenges - Opportunities- ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in industries-National and International Strategies on AI.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Describe about morality and ethics in AI. **(K2)**
- Express the knowledge of real time application ethics, issues and its challenges. **(K2)**
- Understand the ethical harms and ethical initiatives in AI. **(K2)**
- Discuss about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems. **(K2)**
- Understand the concepts of Robo ethics and Morality with professional responsibilities. **(K2)**
- Explain the societal issues in AI with National and International Strategies on AI. **(K2)**

**TEXT BOOKS:**

1. Y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield ,”The ethics of artificial intelligence: Issues and initiatives”, EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020
2. Patrick Lin, Keith Abney, George A Bekey,” Robot Ethics: The Ethical and Social Implications of Robotics”, The MIT Press- January 2014.

**REFERENCES**

”

1. Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017
2. Mark Coeckelbergh,” AI Ethics”, The MIT Press Essential Knowledge series, April 2020

<b>20ADV85</b>	<b>HEALTH CARE ANALYTICS</b>	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

**PRE-REQUISITE: NIL**

**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 Bayes Theorem, 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

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Use machine learning and deep learning algorithms for health data analysis. **(K2)**
- Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications. **(K3)**
- Apply the data management techniques for healthcare data. **(K2)**
- Demonstrate health data analytics for real time applications. **(K2)**
- Understand emergency care system using health data analysis. **(K2)**
- Apply health care analytics in Healthcare and Emerging Technologies. **(K3)**

## REFERENCES

1. ChandanK.Reddy, Charu C. Aggarwal, "Health Care data Analysis", First edition, CRC, 2015.
2. Vikas Kumar, "Health Care Analysis Made Simple", Packt Publishing, 2018.
3. NilanjanDey, AmiraAshour , Simon James Fong, ChintanBhatl, "Health Care Data Analysis and Management, First Edition, Academic Press, 2018.
4. Hui Jang, Eva K.Lee, "HealthCare Analysis : From Data to Knowledge to Healthcare Improvement", First Edition, Wiley, 2016.
5. Kulkarni ,Siarry, Singh ,Abraham, Zhang, Zomaya , Baki, "Big Data Analytics in HealthCare", Springer, 2020.

**MANAGEMENT ELECTIVE COURSES**

<b>20HS5A1</b>	<b>MANAGEMENT CONCEPTS AND ORGANIZATIONAL BEHAVIOR</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization with a perspective to diagnose and effectively handle human behavior.

**PRE-REQUISITE:** NIL

**UNIT I INTRODUCTION TO MANAGEMENT 9**

Origin - Definition of management -Nature & Characteristics of management - Scope of management - Importance of Management - Difference between administration & management-Levels of management -Functions of Management - Principles of management - Management by objectives - Management by exception .

**UNIT II PLANNING AND ORGANIZING 9**

Definitions of planning -Nature of planning - Importance of planning - Limitations of planning - Process / steps of planning -Elements of planning - Decision making - Characteristics of decision making - Process / steps of decision making-Nature of Organisation-Principles of Organisation - Advantages of Organisation - Process / steps of Organisation - Formal & Informal Organisation - Organisational Structure (Types) - Organisation chart - delegation - Process / steps of delegation - Centralisation - De-Centralisation

**UNIT III CO-ORDINATION AND CONTROLLING 9**

Definition of Co-ordination - characteristics of Co-ordination - Benefits of Co-ordination - Problems in Coordination -Techniques of Co-ordination - Defintion of controlling -characteristics of control function – Control process –Communication - Characteristics of Communication - Process of Communication - Formal & Informal Communication - Upward & Downward Communication - Sideward Communication – Written Communication -Barriers in Communication - Measures to overcome communication barriers

**UNIT IV INDIVIDUAL BEHAVIOUR 9**

Meaning of Organizational behavior, contributing disciplines, importance of organizational behavior, Perception and Learning - Personality and Individual Differences - Motivation theories and Job Performance - Values, Attitudes and Beliefs - Communication Types-Process - Barriers - Making Communication

**UNIT V GROUP BEHAVIOUR 9**

Groups and Teams: Definition, Difference between groups and teams, Stages of Group Development, Group Cohesiveness, Types of teams, Group Dynamics - Leadership - Styles - Approaches - Power and Politics

**TOTAL: 45 PERIODS**

## **OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Explain Management principles into management practices and Managers manage business in global context with different strategies and to determine the effective ways of controlling, and decision making. **(K2)**
- Understand and explain all the managerial functions. **(K2)**
- Demonstrate the applicability of the concept of organizational behavior to understand the behavior of people in the organization and management of individual behavior in the organization. **(K2)**
- Analyze the complexities associated with management of the group behavior in the organization. **(K2)**
- Demonstrate how the organizational behavior can integrate in understanding the motivation (why) behind behavior of people in the organization. **(K2)**
- Managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management and the degree to which one can make an individual to think beyond self. **(K2)**

## **REFERENCES**

1. Stephen P. Robins, Organizational Behavior, Pearson Education, Edition 16, 2022.
2. Steven L. Mc Shane, Mary Ann Von Glinow, et al. Organizational Behavior, Edition 9, 2022
3. PC Tripathi, PN Reddy, AshishBajpai, Principles of Management, Tata McGraw Hill,



## **OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Compare industrial vs consumer marketing and the classifications of industrial customers. **(K2)**
- Develop Negotiation and buying techniques for industrial products . **(K2)**
- Formulate strategic plan and implementation methods. **(K2)**
- Develop techniques of Logistics, Marketing Control and Channel Optimization. **(K2)**
- Identify Pricing tactics and Sales Force Planning techniques. **(K2)**
- Manage the entire industrial marketing process. **(K2)**

## **REFERENCES**

1. Industrial Marketing: A Process of Creating and Maintaining Exchange by krishnamacharyuluCsg,Lalitha R, Publisher: Jaico Book House,
2. Industrial Marketing by Ghosh, Publisher: Oxford University Press,2019
3. Industrial Marketing 2e by K. K. Havaldar, Publisher: Tata McGraw-Hill Publishing Company limited,2016
4. Industrial Marketing Management by Govindarajan, Vikas Publishing House.2018
5. Industrial Marketing by Phadtare -M. T, Prentice Hall of India Private Limited ,2020

<b>20HS6A1</b>	<b>INTELLECTUAL PROPERTY RIGHTS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**OBJECTIVES:**

- To get an adequate knowledge on patent and copyright for their innovative research works.
- To use in their career, information in patent documents provide useful insight on novelty of their idea from state-of-the art search. This provide further way for developing their idea or innovations.
- To pave the way to catch up Intellectual Property (IP) as an career option.
  - R & D IP Counsel
  - Government Jobs – Patent Examiner
  - Private Jobs
  - Patent agent and Trademark agent
  - Entrepreneur

**PRE-REQUISITE:** NIL

**UNIT I OVERVIEW OF INTELLECTUAL PROPERTY 9**

Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design - Genetic Resources and Traditional Knowledge - Trade Secret - IPR in India: Genesis and development - IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention - 1883, the Berne Convention - 1886, the Universal Copyright Convention - 1952, the WIPO Convention - 1967, the Patent Co-operation Treaty - 1970, the TRIPS Agreement - 1994.

**UNIT II PATENTS 9**

Patents - Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application - Non-Patentable Subject Matter - Registration Procedure - Rights and Duties of Patentee - Assignment and license - Restoration of lapsed Patents - Surrender and Revocation of Patents - Infringement - Remedies & Penalties - Patent office and Appellate Board.

**UNIT III COPYRIGHTS 9**

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works - cinematograph films and sound recordings - Registration Procedure - Term of protection - Ownership of copyright - Assignment and license of copyright - Infringement - Remedies & Penalties - Related Rights - Distinction between related rights and copyrights.

**UNIT IV TRADEMARKS 9**

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board.

**UNIT V OTHER FORMS OF IP & REGISTRATION PROCESS 9**

Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection. Geographical Indication (GI): meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection. IPR registration process through government website-modalities and publications. Plant Variety Protection: meaning and benefit sharing and farmers' rights – Procedure for registration, effect of registration and term of protection. Layout Design Protection: meaning – Procedure for registration, effect of registration and term of protection.

**TOTAL: 45 PERIODS**

## OUTCOMES:

On Completion of the course, the students should be able to:

- Explain the fundamental aspects of Intellectual property Rights which plays a major role in development and management of innovative projects in industries. **(K2)**
- Describe the patents, patent regime in India and abroad and registration aspects. **(K2)**
- Describe the copyrights and its related rights and registration aspects. **(K2)**
- Explain the trademarks and registration aspects. **(K2)**
- Explain the Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects. **(K2)**
- Analyze the current trends in IPR and Government steps in fostering IPR. **(K2)**

## TEXT BOOKS

1. K.V.Nithyananda, "Intellectual Property Rights: Protection and Management", Cengage Learning India Pvt. Ltd., 2019.
2. P.Neeraj and D.Khusdeep, "Intellectual Property Rights", PHI Learning Pvt. Ltd., 2014.

## REFERENCES

1. V.K.Ahuja, "Law Relating to Intellectual Property Rights", Lexis Nexis, Third Edition, 2017.
2. Journal of Intellectual Property Rights (JIPR): NISCAIR
3. Cell for IPR Promotion and Management (<http://cipam.gov.in/>)
4. World Intellectual Property Organization (<https://www.wipo.int/about-ip/en/>)
5. Office of the Controller General of Patents, Designs & Trademarks (<http://www.ipindia.nic.in/>)

<b>20HS6B1</b>	<b>PROJECT MANAGEMENT AND ENTREPRENEURSHIP</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- To make them understand the concepts of project management for planning to execution of projects.
- To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

**PRE-REQUISITE: NIL**

**UNIT I PROJECT MANAGEMENT 9**

Project management: meaning, scope & importance, role of project manager - Project life-cycle and Project appraisal - project feasibility report- Technical appraisal, Environmental appraisal, Market appraisal and Managerial appraisal.

**UNIT II PROJECT FINANCING 9**

Project cost estimation & working capital requirements - sources of funds - capital budgeting - Risk & uncertainty in project evaluation - preparation of projected financial statements viz. Projected balance sheet - projected income statement - projected funds & cash flow statements - Preparation of detailed project report - Project finance.

**UNIT III ENTREPRENEURSHIP 9**

Entrepreneurship need and scope - Entrepreneurial competencies and traits - Factors affecting entrepreneurial development - Entrepreneurial motivation (Mc Clelland's Achievement motivation theory) - conceptual model of entrepreneurship - entrepreneur vs. entrepreneur - Classification of entrepreneurs - Entrepreneurial Development Programmes.

**UNIT IV ENTREPRENEURIAL IDEA AND INNOVATION 9**

Introduction to Innovation - Entrepreneurial Idea Generation and Identifying Business Opportunities - Management skills for Entrepreneurs and managing for Value Creation - Creating and Sustaining Enterprising Model - Organizational Effectiveness

**UNIT V SOCIAL ENTREPRENEURSHIP 9**

Social Sector Perspectives and Social Entrepreneurship - Social Entrepreneurship Opportunities and Successful Models - Social Innovations and Sustainability - Marketing Management for Social Ventures - Risk Management in Social Enterprises - Legal Framework for Social Ventures.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Conclude the project characteristics and various stages of a project. **(K6)**
- Compile the conceptual clarity about project organization and feasibility. **(K5)**
- Apply the risk management plan and analyze the role of stakeholders. **(K3)**
- Analyze the social responsibility for an entrepreneurship. **(K4)**
- Interpret the gain knowledge to overcome the factors affecting small-scale business. **(K3)**
- Formulate a new small-scale business. **(K6)**

## **TEXT BOOKS**

1. Robert D. Hisrich, Michael P. Peters and Dean A. Shepherd, "Entrepreneurship", McGraw Hill Education, Tenth Edition, 2018.
2. Peter F. Drucker, "Innovation and Entrepreneurship", Harper Business, 2006.

## **REFERENCES**

1. Anil K. Gupta, "Grassroots Innovation: Minds on the Margin Are Not Marginal Minds", Random House, 2016.
2. V.S.P.Rao, "Business, Entrepreneurship and Management", Vikas Publishing, 2014.
3. Rajeev Roy, "Entrepreneurship", Oxford University Press, 2011.
4. Roman Pichler, "Agile Product Management with Scrum Creating Products That Customers Love", Pearson India, 2013.
5. John M. Nicholas and Herman Steyn, "Project Management for Engineering, Business and Technology", A Butterworth-Heinemann Title, Fourth Edition, 2011

<b>20HS7A2</b>	<b>TOTAL QUALITY MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**OBJECTIVES:**

- To understand TQM concepts.
- To know about TQM principles.
- To understand Six Sigma, Traditional tools, New tools, Benchmarking and FMEA.
- To understand Taguchi's Quality Loss Function, Performance Measures and apply QFD, TPM, COQ and BPR.
- To apply QMS and EMS in any organization.

**PRE-REQUISITE: NIL****UNIT I INTRODUCTION 9**

Quality – Need, Evolution, Definitions, Dimensions of product and service quality. TQM - Basic concepts, Framework, Contributions of Deming, Juran and Crosby, Barriers. Quality statements, Customer satisfaction, Customer complaints, Customer retention, Costs of quality.

**UNIT II TQM PRINCIPLES 9**

Strategic quality planning, Quality Councils, Employee involvement, Motivation, Empowerment, Teamwork, Quality circles, Recognition and Reward, Performance appraisal, Continuous process improvement - PDCA cycle, 5S, Kaizen, Supplier partnership, Supplier selection, Supplier Rating.

**UNIT III TQM TOOLS AND TECHNIQUES I 9**

Traditional tools of quality, New management tools. Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT, Bench marking, Reason to bench mark, Bench marking process, FMEA - Stages, Types.

**UNIT IV TQM TOOLS AND TECHNIQUES II 9**

Control Charts, Process Capability, Quality Function Development (QFD), Taguchi quality loss function, TPM - Concepts, improvement needs, Performance measures.

**UNIT V QUALITY SYSTEMS 9**

Need for ISO 9000, ISO 9001-2008 Quality System, Elements, Documentation, Quality Auditing, QS 9000 - ISO 14000, Concepts, Requirements and Benefits, TQM Implementation in manufacturing and service sectors.

**TOTAL: 45 PERIODS****OUTCOMES:****On Completion of the course, the students should be able to:**

- Explain basic concepts, TQM framework, Barriers Benefits of TQM and importance of customers**(K2)**
- Explain the TQM Principles, understand the importance of employee involvement and supplier partnership**(K2)**
- Explain the basics of Six Sigma, Traditional tools, New tools , **(K2)**
- Explain the process of Benchmarking and FMEA.**(K2)**
- Explain process capability, QFD, TPM, Taguchi quality loss function and performance measures**(K2)**
- Explain the Quality system ISO 9000, ISO 14000, Audit, Certification process and implementation of TQM in manufacturing and service sectors**(K2)**

## TEXT BOOKS

1. Dale H. Besterfield, et al., "Total quality Management", Pearson Education Asia, 5th Edition, 2018.
2. James R. Evans and William M. Lindsay, "The Management and Control of Quality", Cengage Learning, 8th Edition, 2012.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2nd Edition, 2006.

## REFERENCES

1. Joel.E. Ross, "Total Quality Management – Text and Cases", CRC Press, 5th Edition, 2017.
2. Kiran.D.R, "Total Quality Management: Key concepts and case studies, Butterworth – Heinemann Ltd, 1st Edition, 2016.
3. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2012.
4. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 1st Edition, 2006.
5. Brue G, "Six Sigma for Managers", Tata-McGraw Hill, 2nd Edition, 2002.

<b>20HS8A1</b>	<b>HUMAN RELATIONS AT WORK</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To create awareness of human relations at work its relationship with self.
- To create awareness about the processes involved in interaction with people at work.
- To understand the importance of psychological and physical health in maintaining human relations at work and progressing in career.

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION TO HUMAN RELATIONS 9**

Understanding and Managing Yourself – Human Relations and You – Self-Esteem and Self – Confidence – Self-Motivation and Goal Setting – Emotional Intelligence – Attitudes and Happiness – Values and Ethics – Problem Solving and Creativity.

**UNIT II HUMAN RELATIONS AT WORK 9**

Dealing Effectively with People – Communication in the Workplace – Specialized Tactics for Getting Along with Others in the Workplace – Managing Conflict – Becoming an Effective Leader – Motivating Others and Developing Teamwork – Diversity and Cross-Cultural Competence.

**UNIT III STAYING PHYSICALLY HEALTHY 9**

Yoga: Ashtanga, Yam and Niyam, Asan – Pranayam – Exercise: Aerobic and anaerobic.

**UNIT IV STAYING PSYCHOLOGICALLY HEALTHY 9**

Managing Stress and Personal Problems – Meditation – Cognitive, behavioural and emotional well-being.

**UNIT V DEVELOPING CAREER THRUST 9**

Getting Ahead in Your Career – Learning Strategies – Perception – Life Span Changes – Developing Good Work Habits.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Implement the elements of Emotional Intelligence and create a plan for continual improvement. **(K3)**
- Demonstrate the elements of teamwork such as team development stages, leadership skills, team dynamics, problems solving and decision making approaches, and team building. **(K3)**
- Employ active listening skills including paraphrasing, questioning, empathetic listening, analytic listening, responding and communicating non-verbally while respecting individual differences. **(K3)**

- Identify various Yoga Postures. **(K3)**
- Develop an action plan to increase personal motivation in a personal and or workplace situation. **(K3)**
- Identify different elements of organizational behavior and change including organizational climate, culture, power, ethics, and organizational development techniques to develop a change model for an aspect of their personal and or professional life. **(K3)**

### TEXT BOOKS

1. Andrew DuBrin, "Human Relations for Career and Personal Success: Concepts, Applications, and Skills", Pearson Education, Eleventh Edition, 2016.
2. Swami Vivekananda, "Raja-Yoga or Conquering the Internal Nature", Vedanta Press, 1998.

### REFERENCES

1. Jerrold S. Greenberg, "Comprehensive Stress Management", McGraw-Hill Humanities Social, Thirteenth Edition, 2012.
2. Y.Udai, "Yogasan aur pranayama", N.S. Publications, New Delhi, 2015.
3. Janardan Swami Yogabhyasi Mandal, "Yogic Asanas for Group Training - Part-I", Nagpur.

20HS8B2

ECONOMICS FOR ENGINEERS

L	T	P	C
3	0	0	3

**OBJECTIVES:**

- To understand the fundamental economic concepts
- To understand cost estimation concepts
- To understand value engineering
- To understand project appraisal and methods of analysis
- To understand the methods of depreciation

**PRE-REQUISITE:** NIL

**UNIT I INTRODUCTION TO ECONOMICS 9**

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis - V ratio, Elementary economic Analysis – Material selection for product Design selection of a product, Process planning.

**UNIT II COST ESTIMATION AND MACRO ECONOMICS 9**

Cost and revenue concepts- Determination of equilibrium price under perfect competition - Banking – Inflation - National Income

**UNIT III VALUE ENGINEERING 9**

Make or buy decision, Value engineering – Function, aims, Value engineering procedure: Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor - Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

**UNIT IV PROJECT APPRAISAL AND ANALYSIS 9**

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods

**UNIT V DEPRECIATION 9**

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions –procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Describe the concept of engineering economics. **(K2)**
- Comprehend macroeconomic principles. **(K2)**

- Decision making in diverse business set up. **(K2)**
- Explain the Inflation & Price Change. **(K2)**
- Explain Present Worth Analysis. **(K2)**
- Apply the principles of economics through various case studies. **(K3)**

### **TEXT BOOKS**

1. Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.

### **REFERENCES**

1. Chan S. Park, "Contemporary Engineering Economics", Prentice Hall of India, 2011.
2. Donald G. Newman, Jerome P. Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2010.
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, "Engineering Economy", Macmillan, New York, 2011.
4. Zahid Akhan: Engineering Economy, "Engineering Economy", Dorling Kindersley, 2012

<b>20OE901</b>	<b>DATA SCIENCE USING PYTHON</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- To understand the basic concepts of python programming.
- To Handle the file and exception
- To Learn Numpy
- To learn data manipulation with pandas
- To Understand Data cleaning Techniques
- To gain knowledge on data preparation

**PRE-REQUISITE: NIL**

<b>UNIT I</b>	<b>INTRODUCTION TO DATA SCIENCE AND PYTHON PROGRAMMING</b>	9
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Introduction to Data Science - Why Python? - Essential Python libraries - Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set - Type Conversion- Operators. Decision Making- Looping- Loop Control statement- Math and Random number functions. User defined functions - function arguments & its types

<b>UNIT II</b>	<b>FILE, EXCEPTION HANDLING AND OOP</b>	9
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User defined Modules and Packages in Python- Files: File manipulations, File and Directory related methods - Python Exception Handling OOPs Concepts -Class and Objects, Constructors – Data hiding- Data Abstraction- Inheritance.

<b>UNIT III</b>	<b>INTRODUCTION TO NUMPY</b>	9
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NumPy Basics: Arrays and Vectorized Computation- The NumPy ND array- Creating ND arrays- Data Types for ND arrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing-Transposing Arrays and Swapping Axes. Universal Functions: Fast Element-Wise Array Functions- Mathematical and Statistical Methods-Sorting Unique and Other Set Logic..

<b>UNIT IV</b>	<b>DATA MANIPULATION WITH PANDAS</b>	9
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Introduction to pandas Data Structures: Series, DataFrame, Essential Functionality: Dropping Entries Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format.

<b>UNIT V</b>	<b>DATA CLEANING, PREPARATION AND VISUALIZATION</b>	9
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Data Cleaning and Preparation: Handling Missing Data - Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers- String Manipulation: Vectorized String Functions in pandas. Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

**TOTAL: 45 PERIODS**

## **OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Explain the basic problems using Python built-in data types and their methods. **(K2)**
- Describe the user-defined modules and packages using OOP concept. **(K2)**
- Explain about data operations using NumPy arrays. **(K2)**
- Apply the concepts of Pandas data Series and Data Frame to display datas. **(K3)**
- Explain the data preprocessing modules using Pandas. **(K2)**
- Describe the data visualization methods using Pandas. **(K2)**

## **TEXT BOOKS**

1. Y. Daniel Liang, "Introduction to Programming using Python", Pearson,2012.
2. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly, 2nd Edition,2018.
3. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly, 2017.

## **REFERENCES**

1. Wesley J. Chun, "Core Python Programming", Prentice Hall,2006.
2. Mark Lutz, "Learning Python", O'Reilly, 4th Edition, 2009.

<b>20OE902</b>	<b>INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND DATA SCIENCE</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- To explore the need of Artificial Intelligence.
- To provide knowledge of AI systems and its variants.
- To investigate the role of data science.
- To Work with data pre-processing methods
- To Work with data analytics methods

**PRE-REQUISITE: OPERATING SYSTEMS**

**UNIT I INTRODUCTION TO AI 9**

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems

**UNIT II KNOWLEDGE REPRESENTATION 9**

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations – Constraint Satisfaction Problems

**UNIT III INTRODUCTION TO DATA SCIENCE 9**

Introduction– Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues

**UNIT IV DATA COLLECTION AND DATA PRE-PROCESSING 9**

Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

**UNIT V EXPLORATORY DATA ANALYTICS 9**

Descriptive Statistics – Mean Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map Correlation Statistics – ANOVA.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Understand the characteristics of intelligent agents. **(K2)**
- Classify searching algorithm in AI. **(K3)**
- Describe various knowledge representation methods. **(K2)**
- Examine the basics of data science. **(K3)**
- Apply the concepts of Data Collection and Data Pre-Processing. **(K3)**
- Demonstrate exploratory data analytics. **(K3)**

## TEXT BOOKS

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Fourth Edition, 2021.
2. Bratko, —Prolog: Programming for Artificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.
3. JojoMoolayil, "Smarter Decisions : The Intersection of IoT and Data Science", PACKT, 2016
4. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015

## REFERENCES

1. Husain, Amir. The sentient machine: The coming age of artificial intelligence. Simon and Schuster, 2017
2. Kaplan, Jerry. Artificial intelligence: What everyone needs to know. Oxford University Press, 2016
3. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013
4. Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global

<b>200E903</b>	<b>MOBILEAPP DEVELOPMENT AND ITS APPLICATION</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- Understand system requirements for mobile applications
- Generate suitable design using specific mobile development frameworks
- Generate mobile application design
- Implement the design using specific mobile development frameworks
- Deploy the mobile applications in market place for distribution

**PRE-REQUISITE:** NIL

**UNIT I INTRODUCTION TO MOBILE APPLICATIONS 9**

Web Vs mobile App–Cost of Development – Myths – Mobile Applications – Marketing-Mobile User Interface Design-EffectiveUseofScreen–MobileUsers-MobileInformationDesign-MobilePlatforms - Tools of Mobile Interface Design

**UNIT II ANDROID USER INTERFACE DESIGN 9**

Android Architecture–Android SDK Tools – Application Components-Intents –Content providers-Broadcast receivers–Services- User Interface Design -Views –View Groups–Layouts-Event Handling– Listeners – Adapters – Menus - Action Bars–Notifications-Android Localization

**UNIT III ANDROID DATA STORAGE 9**

I Content Providers –Uri – CRUD access– Browser– Call Log– Contacts– Media Store – Data Access and Storage - Shared Preferences – Storage External - Network Connection - SQ Lite Databases

**UNIT IV ANDROID NATIVE CAPABILITIES 9**

Camera – Audio - Sensors and Bluetooth - Playing audio/video - Media recording -Sensors-Listening to sensor readings – Bluetooth - Android Communications – GPS - Working with Location Manager, Working with Google Maps extensions - Maps via intent - Map Activity - Location based Services – Location Updates- Location Providers - Selecting a Location Provider- Finding Location

**UNIT V IOS DESIGN 9**

iPhone Craze – iOS Features – iOS Tools – iOS Project – Objective C Basics – Building iOS App– Actions and Outlets – Delegates – User Interface Elements– Accelerometer–Location Handling - SQ Lite Database

**TOTAL: 45 PERIODS**

## **OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Understand the requirements for mobile applications. **(K2)**
- Describe user interface for mobile applications. **(K3)**
- Store mobile data of android applications. **(K2)**
- Native capabilities of android applications. **(K2)**
- Describe iOS applications with tools. **(K3)**
- Classify Mobile App using android and ios platforms. **(K3)**

## **TEXT BOOKS**

1. Jeff Mc Wherter and Scott Gowell, "Professional Mobile Application Development", Wrox , 2012.

## **REFERENCES**

1. RetoMeier, "Professional Android for Development", John Wiley and Sons, 2012.
2. DavidMark, JackNutting, Jeff La Marche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.



- Apply various concepts like configurations, End effectors and grippers. **(K3)**
- Classify different sensors in robots. **(K3)**
- Demonstrate the image processing and image analysis techniques. **(K3)**
- Acquire knowledge of programming languages and applications of Robot. **(K3)**

### TEXT BOOKS

1. Ganesh.S.Hedge, "A textbook of Industrial Robotics", Lakshmi Publications, 2006.
2. Mikell.P.Groover , "Industrial Robotics – Technology, Programming and applications" McGraw Hill 2ND edition 2012.

### REFERENCES

1. Fu K.S. Gonalz R.C. and ice C.S.G."Robotics Control, Sensing, Vision and Intelligence", McGraw Hill book co. 2007.
2. YoramKoren, "Robotics for Engineers", McGraw Hill Book, Co., 2002.
3. Janakiraman P.A., "Robotics and Image Processing", Tata McGraw Hill 2005.
4. John. J.Craig, "Introduction to Robotics: Mechanics and Control" 2nd Edition, 2002.
5. Jazar, "Theory of Applied Robotics: Kinematics, Dynamics and Control", Springer India reprint, 2010.

<b>200E905</b>	<b>ARTIFICIAL NEURAL NETWORK AND ITS APPLICATIONS</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- Study the concepts of Artificial Intelligence.
- Learn the methods of solving problems using Artificial Intelligence.
- Introduce the concepts of ANN.

**PRE-REQUISITE:** NIL

**UNIT I INTRODUCTION TO ANN 9**

Features , structure and working of Biological Neural Network , Trends in Computing Comparison of BNN and ANN

**UNIT II BASICS OF ARTIFICIAL NEURAL NETWORKS 9**

History of neural network research, characteristics of neural network terminology, models of neuron McCulloch – Pitts model, Perceptron, Adaline model, Basic learning laws, Topology of neural network architecture

**UNIT III BACK PROPAGATION NETWORKS : (BPN) 9**

Architecture of feed forward network, single layer ANN, multi-layer perceptron, back propagation learning, input - hidden and output layer computation, back propagation algorithm, applications, selection of tuning parameters in BPN, Numbers of hidden nodes, learning.

**UNIT IV BASIC FUNCTIONAL UNITS OF ANN FOR PATTERN RECOGNITION TASKS 9**

Basic feedforward, Basic feedback and basic competitive learning neural network. Pattern association, pattern classification and pattern mapping tasks

**UNIT V APPLICATIONS OF ANN 9**

Pattern classification – Recognition of Olympic games symbols, Recognition of printed Characters. Neocognitron – Recognition of handwritten characters. NET Talk: to convert English text to speech. Recognition of consonant vowel(CV) segments, texture classification and segmentation

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Organize synaptic connectivity as the basis of neural computation and learning. **(K3)**
- Understand the ideological basics of artificial neural networks. **(K2)**
- Apply the back propagation algorithm in ANN. **(K3)**
- Identify the different structures of artificial neural networks. **(K3)**
- Explain functional units of ANN for pattern recognition. **(K3)**
- Describe various application of artificial neural networks. **(K3)**

### **TEXT BOOKS**

1. B. Yegnanarayana - Artificial neural network PHI Publication.
2. S. Raj sekaran, VijayalakshmiPari - Neural networks, Fuzzy logic and Genetic Algorithms
3. Kevin L. Priddy, Paul E. Keller – Artificial neural networks: An Introduction - SPIE Press, 2005.

### **REFERENCES**

1. Mohammad H. Hassoun – Fundamentals of artificial neural networks - MIT Press ,3 1995
2. Nelson Morgan – Artificial neural network: Electronic Implementations – IEEE Press,1990
3. Journal of Artificial neural networks, Volume 1 – Ablex Publishing corporation , 1994



### **TEXT BOOKS**

1. E. Rich and K. Knight, "Artificial intelligence", MH, 2nd ed., 1992.
2. N.J. Nilsson, "Principles of AI", Narosa Publ. House, 2000.
3. Robin R Murphy, Introduction to AI Robotics PHI Publication, 2000

### **REFERENCES**

1. D. W. Patterson, "Introduction to AI and Expert Systems", PHI, 1992.
2. R. J. Schalkoff, "Artificial Intelligence - an Engineering Approach", McGraw Hill Int. Ed., Singapore, 1992.
3. George Lugar, .AI-Structures and Strategies for and Strategies for Complex Problem solving, 4/e, 2002, Pearson Educations.

<b>200E907</b>	<b>FUNDAMENTALS OF BLOCKCHAIN TECHNOLOGY</b>	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- To understand the history, types and applications of Blockchain
- To acquire knowledge about cryptography and consensus algorithms.
- Deploy projects using Web3j and design blockchain based applications

**PRE-REQUISITE:** NIL

**UNIT I INTRODUCTION TO BLOCKCHAIN 9**

Distributed DBMS – Limitations of Distributed DBMS, Introduction to Block chain – History, Definition, Distributed Ledger, Blockchain Categories – Public, Private, Consortium, Blockchain Network and Nodes, Peer-to-Peer Network, Mining Mechanism, Generic elements of Blockchain, Features of Blockchain, and Types of Blockchain

**UNIT II BLOCKCHAIN ARCHITECTURE 9**

Operation of Bitcoin Blockchain, Blockchain Architecture – Block, Hash, Distributer P2P, Structure of Blockchain - Consensus mechanism: Proof of Work (PoW), Proof of Stake (PoS), Byzantine Fault Tolerance(BFT), Proof of Authority (PoA) and Proof of Elapsed Time (PoET)

**UNIT III BLOCKCHAIN-BASED FUTURES SYSTEM 9**

Project presentation- Futures smart contract: Blockchain oracles- Web3j: Setting up the Web3J- Installingweb3j- Wallet creation, Java client: The wrapper generator- Initializing web3j- Setting up Ethereumaccounts- Deploying the contract

**UNIT IV BLOCKCHAINS IN BUSINESS AND CREATING ICO 9**

Public versus private and permissioned versus permission less blockchains- Privacy and anonymity in Ethereum- Why are privacy and anonymity important? - The Ethereum Enterprise Alliance- Blockchain-as-a-Service- Initial Coin Offering (ICO): Project setup for ICO implementation- Token contracts- Token sale contracts-Contract security and testing the code.

**UNIT V DISTRIBUTED STORAGE IPFS AND SWARM 9**

Ethereum Virtual Machine- Swarm and IPFS: Installing IPFS, Hosting our frontend: Serving your frontend using IFPS, Serving your frontend using Swarm, IPFS file uploader project: Project setup the web page

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Understand the Mining Mechanism and Blockchain Network. **(K2)**
- Understand the cryptography and Consensus mechanism. **(K2)**
- Classify Project presentation using Web3j. **(K3)**
- Implement an ICO on Ethereum. **(K3)**
- Explain blockchain based application with Swarm and IPFS. **(K3)**
- Demonstrate Initial Coin Offering and Contract security. **(K3)**

## TEXT BOOKS

1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained", 2ndEdition, Packt Publishing Ltd, March 2018.
2. BellajBadr, Richard Horrocks, Xun (Brian) Wu, "BlockchainBy Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger", Packt Publishing Limited, 2018.

## REFERENCES

1. Andreas M. Antonopoulos , "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media Inc, 2015
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and CryptocurrencyTechnologies: A Comprehensive Introduction", Princeton University Press, 2016

<b>200E908</b>	<b>INTRODUCTION WEB APPLICATION SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**OBJECTIVES:**

- To reveal the underlying in web application.
- To identify and aid in fixing any security vulnerabilities during the web development tprocess.
- To understand the security principles in developing a reliable web application

**PRE-REQUISITE:** NIL

**UNIT I OVERVIEW OF WEB APPLICATIONS 9**

Introduction history of web applications interface ad structure benefits and drawbacks of web applications Web application Vs Cloud application

**UNIT II WEB APPLICATION SECURITY FUNDAMENTALS 9**

Security Fundamentals: Input Validation - Attack Surface Reduction Rules of Thumb- Classi - fying and Prioritizing Threads

**UNIT III BROWSER SECURITY PRINCIPLES 9**

Origin Policy - Exceptions to the Same-Origin Policy - Cross-Site Scripting and Cross-Site Request Forgery - Reflected XSS - HTML Injection

**UNIT IV WEB APPLICATION VULNERABILITIES 9**

Understanding vulnerabilities in traditional client server application and web applications, client state manipulation, cookie based attacks, SQL injection, cross domain attack (XSS/XSRF/XSSI) http header injection. SSL vulnerabilities and testing - Proper encryption use in web application- Session vulnerabilities and testing - Cross-site request forgery

**UNIT V WEB APPLICATION SECURITY 9**

Http request , http response, rendering and events , html image tags, image tag security, issue, java script on error , Java script timing , port scanning , remote scripting , running remote code, frame and iframe , browsers and box, policy goals, same origin policy, library import, domain relaxation Clickjacking - DNS rebinding - Flash security - Java applet security - Single-sign-on solution and security -IPv6 impact on web security

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Identify the vulnerabilities in the web applications. **(K2)**
- Explain various types of threats and mitigation measures of web applications. **(K3)**
- Understand the Browser Security Principles. **(K2)**
- Apply the security principles in developing a reliable web application. **(K3)**
- Use industry standard tools for web application security. **(K2)**
- Describe penetration testing to improve the security of web applications. **(K3)**

## TEXT BOOKS

1. Sullivan, Bryan, and Vincent Liu. *Web Application Security, A Beginner's Guide*. McGraw Hill Professional, 2011.
2. Stuttard, Dafydd, and Marcus Pinto. *The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws*. John Wiley Sons, 2011.

## REFERENCES

1. *Hacking Exposed Web Applications*, 3rd edition, Joel Scambray, Vincent Liu, Caleb Sima
2. *The Web Application Hacker's Handbook Discovering and Exploiting Security Flaws*, Dafydd Stuttard, Marcus Pinto
3. Rich Bowen, Ken Coar, "Apache Cookbook", O'Reilly
4. Open Web Application Security Project. *A Guide to Building Secure Web Applications and Web Services*.  
[http://www.owasp.org/index.php/Category:OWASP\\_Guide\\_Project](http://www.owasp.org/index.php/Category:OWASP_Guide_Project)