SETHU INSTITUTE OF TECHNOLOGY

Pulloor, Kariapatti – 626 115

B.E. Degree Programme

CBCS CURRICULUM

Regulations R2021

Bachelor of Engineering in Computer Science & Engineering

OVERALL COURSE STRUCTURE

Code	Category	Total No. of Courses	Credits	Percentage
BS	Basic Sciences	9	25	15.34
ES	Engineering Sciences	4	9	5.52
HSS	Humanities and Social Sciences	5	8.5	5.21
PC	Professional Core (Including Lab Courses)	31	71.5	43.87
PE	Professional Elective	6	18	11.04
OE	Open Elective	4	12	7.36
PW	Project Work, Seminar	3	13	7.98
MC	Mandatory Courses	12	6	3.68
	TOTAL	**74**	**163**	**100**

COURSE CREDITS – SEMESTERWISE

Branch	I	II	III	IV	V	VI	VII	VIII	TOTAL
CSE	**20**	**18**	**22**	**22**	**24**	**26**	**17**	**14**	**163**

Semester I

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UEN101	English for Technical Communication (Common to ALL Branches except CSBS)	2	0	0	2	HSS
R21UMA102	Matrix and Calculus (Common to ALL Branchesexcept CSBS)	3	1	0	4	BS
R21UPH103	Physics for Information Science (Common to CSE, IT,CSBS, AIDS,CSD,AIML,IoT and Cyb.Sec.,)	3	0	0	3	BS
R21UCS107	Problem Solving and C programming (Common to CSE, ECE, IT, CSBS,AIDS,CSD,AIML,IoT and Cyb.Sec.,)	3	0	0	3	PC
R21UME109	Engineering Graphics (Common to All BranchesExcept CSBS,AIDS, CSD andAIML)	1	3	0	4	ES
PRACTICAL						
R21UCS111	Problem Solving and C programming Laboratory (Common to CSE , ECE ,IT , CSBS,AIDS,CSD,AIML,IoT and Cyb.Sec.,)	0	0	2	1	PC
R21UEC112	Engineering Fundamentals Laboratory (Common to CSE,ECE,IT and BME)	0	0	2	1	ES
R21UPH113	Physics Laboratoroy (Common to CSE, IT,CSBS ,AIDS,CSD,AIML,IoT and Cyb.Sec.,)	0	0	2	1	BS
MANDATORY						
R21UGM131	Induction Programme (Common to All Branches)	0	3	0	P/F	MC
R21UGT140	Heritage of Tamils (Common to allBranches)	1	0	0	1	MC
	TOTAL	**13**	**7**	**6**	**20**	
Total No of Credits - 20						

Semester II

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UEN201	Communication Skills for Professionals (Integrated Course) (Common to All Branches except CSBS)	1	0	1	1.5	HSS
R21UMA203	Differential Equations and Complex Analysis (Common to CSE,IT,IoT and Cyb.Sec.,)	3	1	0	4	BS
R21UIT206	Programming Fundamentals using Python (Common to CSE, IT,CSD,AIML,IOT, Cyb.Sec.,)	3	0	0	3	PC
R21UCS205	Digital Electronics (Common to CSE, Cyb.Sec.,)	3	0	0	3	PC
R21UCY206	Principles of Chemistry in Engineering (Common to CSE,IT, AIDS,CSD,AIML,IoT and Cyb.Sec.,)	3	0	0	3	BS
PRACTICAL						
R21UCY213	Applied Chemistry Laboratory (Common to CSE,IT, AIDS,CSD,AIML, IoT and Cyb.Sec.,)	0	0	2	1	BS
R21UIT207	Programming Fundamentals using Python Laboratory (Common to CSE, IT,CSD, AIML,IoT and Cyb.Sec.,)	0	0	3	1.5	PC
MANDATORY						
R21UGT241	Tamils and Technology (Common to All Branches)	1	0	0	1	MC
R21UAC231	Biology for Engineers (Common to All except BME and BT)	2	0	0	P/F	MC
	TOTAL	**16**	**1**	**6**	**18**	
Total No of Credits - 18						

Semester III

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UMA322	Probability, Queueing Theory and Numerical Methods (Common to CSE,IT,IoT and Cyb.sec)	3	1	0	4	BS
R21UIT302	Data Structures (Common to CSE,IT,AIDS,CSD,AIML,IOT and Cyb.sec)	3	0	0	3	PC
R21UCS303	Object Oriented Programming using C++ (Common to CSE,IT,CSBS,CSD,AIML, IOT and Cyb.sec)	3	0	0	3	PC
R21UIT304	Principles of Operating Systems (Common to CSE,IT,AIDS,CSD,AIML)	3	0	0	3	PC
R21UCS305	Computer Organization (Common to CSE,IT,CSBS,AIDS,AIML and Cyb.sec)	3	0	0	3	PC
R21UCD306	Database System Design (Common to CSE,IT,AI&DS,CSD,AIML,IOT)	3	0	0	3	PC
PRACTICAL						
R21UIT307	Data Structures Laboratory (Common to CSE,IT,AI&DS,CSD,AIML,IOT and Cyb.sec)	0	0	2	1	PC
R21UCD308	Database System Design Laboratory (Common to CSE,IT,AI&DS,CSD,AIML,IOT)	0	0	2	1	PC
R21UCS309	Object Oriented Programming using C++ Laboratory(Common to CSE,IT,CSBS,CSD,AIML,IOT and Cyb.sec)	0	0	2	1	PC
MANDATORY						
R21UGM331	Environmental Science (Common to All Branches)	2	0	0	P/F	MC
	TOTAL	**20**	**1**	**6**	**22**	
Total No of Credits - 22						

Semester IV

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UMA421	Transforms and Discrete Mathematics (Common to CSE,IT ,AIML, IoT &Cyb.sec))	3	1	0	4	BS
R21UCS402	Computer Networks (Common to CSE ,IT,CSD, Cyb.sec)	3	0	0	3	PC
R21UCS403	Algorithm Analysis (Common to CSE ,IT,CSD,AIDS,AIML, IoT &Cyb.sec)	3	0	0	3	PC
R21UIT404	Java Programming (Common to CSE ,IT,CSD,AIML, IoT & Cyb.sec)	3	0	0	3	PC
R21UIT405	Software Engineering Methodology (Common to CSE ,IT , IoT)	3	0	0	3	
R21UEC425	Microprocessors and Microcontrollers	3	0	0	3	ES
PRACTICAL						
R21UEC426	Microprocessors and Microcontrollers Laboratory	0	0	2	1	ES
R21UCS407	Computer Networks Laboratory (Common to CSE ,IT,CSD, Cyb.sec)	0	0	2	1	PC
R21UIT408	Java Programming Laboratory (Common to CSE ,IT,CSD,AIML, IoT & Cyb.sec)	0	0	2	1	PC
MANDATORY						
R21UGM431	Gender Equality (Common to allBranches)	1	0	0	P/F	MC
	TOTAL	**19**	**1**	**6**	**22**	
Total No of Credits -22						

Semester V

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UGS531	Reasoning and Aptitude (Common to CSE, IT, CSBS, AIDS, CSD,AIML,IoT and Cyb.Sec.,)	1	0	0	1	BS
R21UCS501	Graphics and Multimedia	3	0	0	3	PC
R21UCS502	Mobile Applications Design and Development (Common to CSE &IT)	3	0	0	3	PC
R21UCS503	Theory of Computation (Common to CSE & AIML)	3	1	0	4	PC
PE1	ProfessionalElective–I	3	0	0	3	PE
OE1	Open Elective–I	3	0	0	3	OE
PRACTICAL						
R21UGS532	Soft Skills Laboratory (Common to CSE, EEE, IT,CSBS,AIDS,CSD,AGRI and AIML)	0	0	2	1	HSS
R21UCS507	Creative Thinking and Innovation	0	0	2	1	PW
R21UCS508	Graphics and Multimedia Laboratory	0	0	2	1	PC
R21UCS509	Mobile Applications Design and Development Laboratory	0	0	2	1	PC
MANDATORY						
R21UGM535	Universal Human Values II	2	1	0	3	MC
	TOTAL	**18**	**2**	**8**	**24**	
Total No of Credits –24						

NOTE: Any One of the Six Professional Elective Courses should be replaced by the equivalent NPTEL Course.

Semester VI

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UCS601	Principles of Compiler Design	3	1	0	4	PC
R21UCD602	IoT Design **(Common to CSE & CSD)**	3	0	0	3	PC
R21UCS603	Artificial Intelligence and Machine Learning **(Common to CSE & IT)**	3	0	0	3	PC
PE-II	ProfessionalElective–II	3	0	0	3	PE
PE-III	ProfessionalElective–III	3	0	0	3	PE
OE-II	OpenElective–II	3	0	0	3	OE
PRACTICAL						
R21UCS607	Product Development Project	0	0	8	4	PW
R21UGS633	Interpersonal Skills Development Lab (Common to CSE,EEE, IT, CSBS,AIDS,CSD,AGRI and AIML)	0	0	2	1	HSS
R21UCS608	Artificial Intelligence and Machine Learning Laboratory **(Common to CSE & IT)**	0	0	2	1	PC
R21UCD609	IoT Design Laboratory **(Common to CSE & CSD)**	0	0	2	1	PC
MANDATORY						
R21UGM631	Indian Constitution (Common to all Branches)	1	0	0	P/F	MC
	TOTAL	**19**	**1**	**14**	**26**	
Total No of Credits - 26						

NOTE: Any One of the Six Professional Elective Courses should be replaced by the equivalent NPTEL Course.

Semester VII

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UME701	Project Management and Finance (Common to All Branches Except CSBS)	3	0	0	3	HSS
R21UCS702	Cryptography and Cyber Security	3	0	0	3	PC
PE-IV	Professional Elective–IV	3	0	0	3	PE
PE-V	Professional Elective –V	3	0	0	3	PE
OE-III	Open Elective–III	3	0	0	3	OE
PRACTICAL						
R21UCS707	Cryptography and Cyber Security Laboratory	0	0	2	1	PC
R21UGE710	MDP-Phase I *	0	0	6	3	PW
MANDATORY						
R21UGM731	Sports and Social Development (Common to allBranches)	-	-	-	P/F	MC
R21UGM732	Skill Development (Common to allBranches)	-	-	-	P/F	MC
R21UCS735	Internship	-	-	-	1	MC
	TOTAL	**15**	**0**	**2**	**17**	
Total No of Credits - 17						

NOTE: Any One of the Six Professional Elective Courses should be replaced by the equivalent NPTEL Course.

Students those who opt for MDP-Phase1 are excempted from taking Open Elective III

Semester VIII

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
PE-VI	Professional Elective–VI	3	0	0	3	PE
OE-IV	Open Elective–IV	3	0	0	3	OE
PRACTICAL						
R21UCS801	Project work	0	0	16	8	PW
R21UGE810	MDP-Phase II*	0	0	16	8	PW
MANDATORY						
R21UGM831	Professional Ethics and Human values (Common to all branches)	2	0	0	P/F	MC
	TOTAL	**8**	**0**	**16**	**14**	
Total No of Credits -14						

***Students those who opt for MDP-Phase1 are allowed to take MDP PhaseII**

TOTAL CREDITS – 163

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Data Science	**Vertical II Full Stack Development**	**Vertical III Cloud Computing and Data Center Technologies**	**Vertical IV Cyber Security and Data Privacy**	**Vertical V Creative Media**	**Vertical VI Emerging Technologies**	**Vertical VII Artificial Intelligence and MachineLearning**
Exploratory Data Analysis	Full Stack Web Development	Cloud Computing	Ethical Hacking	Metaverse	Augmented Reality/Virtual Reality	Knowledge Engineering
Recommender Systems	App Development	Virtualization	Digital and Mobile Forensics	Multimedia and Animation	Robotic Process Automation	Soft Computing
Neural Networks and Deep Learning	Cloud Essentials	Cloud Essentials	Social Network Security	Video Creation and Editing	Human Computer Interfaces	Neural Networks and Deep Learning
Text and Speech Analysis	UI and UX Design	Data Warehousing	Modern Cryptography	Digital Audio & Video Production Workflow	Cyber security	Text and Speech Analysis
Business Analytics	Software Testing And Automation	Storage Technologies	Engineering Secure Software Systems	Digital marketing	Quantum Computing	Optimization Techniques
Image and Video Analytics	Web Application Security	Software Defined Networks	Cryptocurrency and Blockchain Technologies	Visual Effects	Cryptocurrency and Blockchain Technologies	Game Theory
Computer Vision	DevOps	Stream Processing	Network Security	Digital Audio and Video Design	Game Development	Cognitive Science
BigData Analytics	Principles of Programming Languages	Security and Privacy in Cloud	Security and Privacy in Cloud	Short Film Development	3D Printing and Design	Ethics And AI

	Cloud Computing					

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 1: DATA SCIENCE

Course Code	Course Title	L	T	P	C
R21CSV 101	Exploratory Data Analysis	3	0	0	3
R21CSV 102	Recommender Systems	3	0	0	3
R21ITV 103	Neural Networks and Deep Learning	3	0	0	3
R21CSV 104	Text and Speech Analysis	3	0	0	3
R21ITV 105	Business Analytics	3	0	0	3
R21ITV 106	Image and Video Analytics	3	0	0	3
R21CSV 107	Computer Vision	3	0	0	3
R21ITV 108	BigData Analytics	3	0	0	3

VERTICAL 2: FULL STACK DEVELOPMENT

Course Code	Course Title	L	T	P	C
R21ITV 201	FullStack Web Development	3	0	0	3
R21ITV 202	App Development	3	0	0	3
R21CSV 303	Cloud Essentials	3	0	0	3
R21CSV 204	UI and UX Design	3	0	0	3
R21ITV 205	Software Testing And Automation	3	0	0	3
R21CSV 206	Web Application Security	3	0	0	3
R21ITV207	DevOps	3	0	0	3
R21CSV 208	Principles of Programming Languages	3	0	0	3
R21CSV 301	Cloud Computing	3	0	0	3

VERTICAL 3: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES

Course Code	Course Title	L	T	P	C
R21CSV 301	Cloud Computing	3	0	0	3
R21CSV 302	Virtualization	3	0	0	3
R21CSV 303	Cloud Essentials	3	0	0	3
R21ITV 304	Data Warehousing	3	0	0	3
R21ITV 305	Storage Technologies	3	0	0	3
R21CSV 306	Software Defined Networks	3	0	0	3
R21ITV 307	Stream Processing	3	0	0	3
R21ITV 308	Security and Privacy in Cloud	3	0	0	3

VERTICAL 4: CYBER SECURITY AND DATA PRIVACY

Course Code	Course Title	L	T	P	C
R21ITV 401	Ethical Hacking	3	0	0	3
R21ITV 402	Digital and Mobile Forensics	3	0	0	3
R21CSV 403	Social Network Security	3	0	0	3
R21CSV 404	Modern Cryptography	3	0	0	3
R21ITV 405	Engineering Secure Software Systems	3	0	0	3
R21ITV 406	Cryptocurrency and Blockchain Technologies	3	0	0	3
R21CSV 407	Network Security	3	0	0	3
R21ITV 308	Security and Privacy in Cloud	3	0	0	3

VERTICAL 5: CREATIVE MEDIA AND DESIGN

Course Code	Course Title	L	T	P	C
R21ITV 501	Metaverse	3	0	0	3
R21ITV 502	Multimedia and Animation	3	0	0	3
R21ITV 503	Video Creation and Editing	3	0	0	3
R21ITV 504	Digital Audio & Video Production Workflow	3	0	0	3
R21CSV 505	Digital marketing	3	0	0	3
R21CSV 506	Visual Effects	3	0	0	3
R21ITV 507	Digital Audio and Video Design	3	0	0	3
R21ITV 508	Short Film Development	3	0	0	3

VERTICAL 6: EMERGING TECHNOLOGIES

Course Code	Course Title	L	T	P	C
R21ITV 501	Metaverse	3	0	0	3
R21CSV602	Robotic Process Automation	3	0	0	3
R21ITV603	Human Computer Interfaces	3	0	0	3
R21CSV 604	Cybersecurity	3	0	0	3
R21CSV 605	Quantum Computing	3	0	0	3
R21ITV 406	Cryptocurrency and Blockchain Technologies	3	0	0	3
R21ITV207	DevOps	3	0	0	3
R21ITV 608	3DPrinting and Design	3	0	0	3

VERTICAL 7:ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Course Code	Course Title	L	T	P	C
R21ITV 701	Knowledge Engineering	3	0	0	3
R21CSV 702	Soft Computing	3	0	0	3
R21ITV 103	Neural Networks and DeepLearning	3	0	0	3
R21CSV 104	Text and Speech Analysis	3	0	0	3
R21CSV 705	Optimization Techniques	3	0	0	3
R21ITV 706	Game Theory	3	0	0	3
R21ITV 707	Cognitive Science	3	0	0	3
R21CSV 708	Ethics And AI	3	0	0	3

ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree. For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes, Moreover, for minor degree the student can register for courses from any one of the following verticals also.

VERTICALS FOR MINOR DEGREE

(In addition to all the verticals of other programmes)

Vertical I Fintech and Block Chain	**Vertical II Entrepreneurship**	**Vertical III Public Administration**	**Vertical IV Business Data Analytics**	**Vertical V Environment and Sustainability**	**Vertical VI Computer Technology**	**Vertical VII Artificial Intelligence and Data Science**
Financial Management	Foundations of Entrepreneurship	Principles of Public Administration	Statistics for Management	Sustainable Infrastructure Development	Object oriented programming using C++	Fundamentals of Data Science
Fundamentals of Investment	Team Building & Leadership Management for Business	Constitution of India	Data mining for Business Intelligence	Sustainable Agriculture and Environmental Management	Algorithms and data structures	Foundation of Artificial Intelligence
Banking, Financial Services and Insurance	Creativity & Innovation in Entrepreneurship	Public Personnel Administration	Human Resource Analytics	Sustainable Bio Materials	Java fundamentals	Data Analytics
Introduction to Block chain and its Applications	Principles of Marketing Management for Business	Administrative Theories	Marketing and Social Media Web Analytics	Materials for Energy Sustainability	Agile Software development	Data and Information Security

Fintech Personal Finance and Payments	Human Resource Management for Entrepreneurs	Indian Administrative System	Operation and Supply Chain Analytics	Green Technology	Database and data analytics	Information Storage and Management
Introduction to Fintech	Financing New Business Ventures	Public Policy Administration	Financial Analytics	Environmental Quality Monitoring and Analysis	Networking and data Communication	Statistical Machine Learning
-	-	-	-	Integrated Energy Planning for Sustainable Development	Applications development (Full Stack)	Human Computer Interaction
-	-	-	-	Energy Efficiency for Sustainable Development	Machine learning	AI in Speech Processing
-	-	-	-	-	Cyber Security	-

(choice of courses for Minor degree is to be made from any one vertical of other programmes or from anyone of the following verticals)

VERTICAL I: FINTECH AND BLOCK CHAIN

Course Code	Course Title	L	T	P	C
R21CBVG11	Financial Management	3	0	0	3
R21CBVG12	Fundamentals of Investment	3	0	0	3
R21CBVG13	Banking, Financial Services and Insurance	3	0	0	3
R21CBVG14	Introduction to Blockchain and its Applications	3	0	0	3
R21CBVG15	Fintech Personal Finance and Payments	3	0	0	3
R21CBVG16	Introduction to Fintech	3	0	0	3

VERTICAL II: ENTREPRENEURSHIP

Course Code	Course Title	L	T	P	C
R21MEVGR21	Foundations of Entrepreneurship	3	0	0	3
R21MEVG22	Team Building & Leadership Management for Business	3	0	0	3
R21MEVG23	Creativity & Innovation in Entrepreneurship	3	0	0	3
R21MEVG24	Principles of Marketing Management for Business	3	0	0	3
R21MEVG25	Human Resource Management for Entrepreneurs	3	0	0	3
R21MEVG26	Financing New Business Ventures	3	0	0	3

VERTICAL III :PUBLIC ADMINISTRATION

CourseCode	Course Title	L	T	P	C
R21EEVG31	Principles of Public Administration	3	0	0	3
R21EEVG32	Constitution of India	3	0	0	3
R21EEVG33	Public Personnel Administration	3	0	0	3
R21EEVG34	Administrative Theories	3	0	0	3
R21EEVG35	Indian Administrative System	3	0	0	3
R21EEVG36	Public Policy Administration	3	0	0	3

VERTICAL IV: BUSINESS DATA ANALYTICS

CourseCode	Course Title	L	T	P	C
R21CSVG41	Statistics for Management	3	0	0	3
R21CSVG42	Datamining for Business Intelligence	3	0	0	3
R21CSVG43	Human Resource Analytics	3	0	0	3
R21CSVG44	Marketing and Social Media Web Analytics	3	0	0	3
R21CSVG45	Operation and Supply Chain Analytics	3	0	0	3
R21CSVG46	Financial Analytics	3	0	0	3

VERTICAL V: ENVIRONMENT AND SUSTAINABILITY

CourseCode	Course Title	L	T	P	C
R21CEVG51	Sustainable Infrastructure Development	3	0	0	3
R21CEVG52	Sustainable Agriculture and Environmental Managemen	3	0	0	3
R21CEVG53	Sustainable Bio Materials	3	0	0	3
R21CEVG54	Materials for Energy Sustainability	3	0	0	3
R21CEVG55	Green Technology	3	0	0	3
R21CEVG56	Environmental Quality Monitoring and Analysis	3	0	0	3
R21CEVG57	Integrated Energy Planning for Sustainable Development	3	0	0	3
R21CEVG58	Energy Efficiency for Sustainable Development	3	0	0	3

VERTICAL VI: COMPUTER TECHNOLOGY

Course Code	Course Title	L	T	P	C
R21ITVG61	Object oriented programming using C++	2	0	2	3
R21ITVG62	Algorithms and data structures	3	0	0	3
R21ITVG63	Java fundamentals	2	0	2	3
R21ITVG64	Agile Software development	3	0	0	3
R21ITVG65	Database and data analytics	3	0	0	3
R21ITVG6	Networking and data Communication	3	0	0	3
R21ITVG67	Applications development (Full Stack)	2	0	2	3
R21ITVG68	Machine learning	3	0	0	3
R21ITVG69	Cyber Security	3	0	0	3

VERTICAL VII ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Course Code	Course Title	L	T	P	C
R21ADVG71	Fundamentals of Data Science	3	0	0	3
R21ADVG72	Foundation of Artificial Intelligence	3	0	0	3
R21ADVG73	Data Analytics	3	0	0	3
R21ADVG74	Data and Information Security	3	0	0	3
R21ADVG75	Information Storage and Management	3	0	0	3
R21ADVG76	Statistical Machine Learning	3	0	0	3
R21ADVG77	Human Computer Interaction	3	0	0	3
R21ADVG78	AI in Speech Processing	3	0	0	3

LIST OF OPEN ELECTIVES OFFERED TO OTHER PROGRAMMES

Course Code	Course Title	L	T	P	C
R21UCS971	Artificial Intelligence and Machine Learning Fundamentals	3	0	0	3
R21UCS972	Web Technologies and Applications	3	0	0	3
R21UCS973	Data Analysis using Open Source Tool	3	0	0	3
R21UCS974	Free and Open Source Softwares	3	0	0	3
R21UCS975	Fundamentals of Deep Learning Techniques	3	0	0	3
R21UCS976	Introduction to MATLAB for Artificial Intelligence	3	0	0	3
R21UCS977	Mobile Application Development	3	0	0	3
R21UCS978	Network security essentials	3	0	0	3
R21UCS979	Usability Engineering	3	0	0	3

INDUSTRY DESIGNED ONE CREDIT COURSES

Course Code	Course Title	L	T	P	C
R21UCS861	R Programming	0	0	2	1
R21UCS862	Server Side Scripting	1	0	0	1
R21UCS863	Client side Scripting	1	0	0	1
R21UCS864	Ruby on Rails	1	0	0	1
R21UCS865	Wordpress	1	0	0	1
R21UCS866	Multimedia	1	0	0	1
R21UCS867	Mongo DB	0	0	2	1
R21UCS868	Software Testing Tools	1	0	0	1
R21UCS869	Graphics & Animation	0	0	2	1
R21UCS870	UML Modeling	0	0	2	1
R21UCS871	Game Design	0	0	2	1
R21UCS872	Web Designing	0	0	2	1

COURSES OFFERED TO OTHER PROGRAMMES

Course Code	Course Title	L	T	P	C
R21UCS426	Fundamentals of C Programming	3	0	0	3
R21UCS428	Fundamentals of C Programming Laboratory	0	0	2	1

Semester I

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UEN101	English for Technical Communication (Common to ALL Branches except CSBS)	2	0	0	2	HSS
R21UMA102	Matrix and Calculus (Common to ALL Branchesexcept CSBS)	3	1	0	4	BS
R21UPH103	Physics for Information Science (Common to CSE, IT,CSBS, AIDS,CSD,AIML,IoT and Cyb.Sec.,)	3	0	0	3	BS
R21UCS107	Problem Solving and C programming (Common to CSE, ECE, IT, CSBS,AIDS,CSD,AIML,IoT and Cyb.Sec.,)	3	0	0	3	PC
R21UME109	Engineering Graphics (Common to All BranchesExcept CSBS,AIDS, CSD andAIML)	1	3	0	4	ES
PRACTICAL						
R21UCS111	Problem Solving and C programming Laboratory (Common to CSE , ECE ,IT , CSBS,AIDS,CSD,AIML,IoT and Cyb.Sec.,)	0	0	2	1	PC
R21UEC112	Engineering Fundamentals Laboratory (Common to CSE,ECE,IT and BME)	0	0	2	1	ES
R21UPH113	Physics Laboratoroy (Common to CSE, IT,CSBS ,AIDS,CSD,AIML,IoT and Cyb.Sec.,)	0	0	2	1	BS
MANDATORY						
R21UGM131	Induction Programme (Common to All Branches)	0	3	0	P/F	MC
R21UGT140	Heritage of Tamils (Common to allBranches)	1	0	0	1	MC
	TOTAL	**13**	**7**	**6**	**20**	
Total No of Credits - 20						

R21UEN101	ENGLISH FOR TECHNICAL COMMUNICATION (Common to ALL Branches except CSBS)	L	T	P	C
		2	0	0	2

PRE-REQUISITE:

COURSE OBJECTIVES :

- To enhance the vocabulary of students
- To strengthen the application of functional grammar and basic skills
- To improve the language proficiency of students

UNIT I	PRESENTING ESSENTIALS OF CORRESPONDENCE	6

Listening –Formal and informal conversations and comprehension. **Speaking-** introducing oneself – exchanging personal and social information. **Reading** – Skimming and Scanning. **Writing –** Sentence Formation, Formal Letters (Permission/Requisition).**Grammar**- Parts of Speech. **Vocabulary Development** – Technical Word Formation- Prefix- suffix - Synonyms and Antonyms-Phrases and Clauses.

UNIT II	COMMUNICATION SKILLS	6

Listening– Telephonic Conversations**. Speaking** – Pronunciation rules with Stress pattern. **Reading** – comprehension-pre-reading, post-reading- comprehension questions **Writing** – Punctuation rules, paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions, - **Grammar** – Tense. **Vocabulary Development**- Words from other languages in English.

UNIT III	CORRESPONDENCE AND VOCATION IMPROVEMENT	6

Listening – Motivational speech by Great Speakers **Speaking** –Narrating daily events.**Reading** – Newspaper reading. **Writing** – Job application letter - Transformation of Information (Transcoding) –**Grammar –** Voice. – **Vocabulary Development –**Same word in different parts of speech

UNIT IV	PORTRAYAL AND SUMMATION	6

Listening – Understating the instruction. **Speaking** -Intonation and preparing dialogue on various formal and informal situation**Reading** –Note Making from given text - **Writing** –Creating coherence, Essay writing with proper introduction and conclusion, Giving Instruction (Guidance/Procedure) -**Grammar** – Subject-Verb Agreement (Concord), **VocabularyDevelopment** – One word substitution.

UNIT V	CRITICAL THINKING	6

Listening –Listening important messages based on news report. Speaking- retelling short stories.Reading- Organization Profile, news report. Writing – Precise writing, Developing Hints - Report Writing (Industrial, Accident). Grammar – Spot the Errors in English

TOTAL : 30 Periods

COURSE OUTCOMES:

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

S.No	21UEN101 – TECHNICAL ENGLISH	Bloom's Level
CO-1	Apply grammar effectively in writing meaningful sentences and paragraphs.	Responding A2
CO-2	Exhibit reading skills and comprehension to express the ideas in the given text.	Responding A2
CO-3	Develop writing skills to present the ideas in various formal situations.	Responding A2
CO-4	Develop oral fluency to express the ideas in various formal situations.	Responding A2
CO-5	Prepare Reports for various purpose	Responding A2

TEXT BOOK:

1.KN Shoba, Lourdes JoavaniRayen, Communicative English, New Delhi, Cambridge University Press, 2017

REFERENCE BOOKS:

1. Raman, Meenakshi, Sangeetha Sharma, **Business Communication**, New Delhi, Oxford University Press, 2014.

2. Lakshminarayanan. K.R, **English for Technical Communication**, Chennai, Scitech Publications (India) Pvt. Ltd, 2004.

3. Rizvi. Asraf M, **Effective Technical Communication**, New Delhi, Tata McGraw-Hill Publishing Company Limited, 2007.

R21UMA102	MATRIX AND CALCULUS (Common to ALL Branches – Except CSBS)	L	T	P	C
		3	1	0	4

PRE-REQUISITE:

COURSE OBJECTIVES :

- To make the students capable of identifying linear equations based problems (Eigen Value) from practical areas and obtain the Eigen value oriented solutions in certain cases.
- To widen the students' knowledge base on linear algebra, growth rate computation and application of integrals.
- Able to integrating various types of functions using various integration methods.
- To familiarize the students with the basic rules of differentiation and use them to find derivatives of products and quotients of functions
- To apply these mathematical concepts (matrix theory, differentiation and integration) in engineering field.

UNIT I	MATRICES	8 + 3

Eigen value and eigenvector of a real matrix – Characteristic equation – Properties – Cayley-Hamilton theorem (excluding Proof) – Orthogonal reduction –(transformation of a symmetric matrix to diagonal form) – Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation

UNIT II	DIFFERENTIAL CALCULUS	9 + 3

Introduction – Definition of derivatives – Limits and Continuity – Differentiation techniques (Product rule, Quotient rule, Chain rule) – Successive differentiation (n^{th} derivatives) – Leibnitz theorem (without proof) – Maclaurin's series – Physical Applications (Newton's law of cooling – Heat flow problems, Rate of decay of radioactive materials - Chemical reactions and solutions, Ohm's law, Kirchoff's law – Simple electric circuit problems)

UNIT III	FUNCTIONS OF SEVERAL VARIABLES	9 + 3

Partial derivatives – Euler's theorem for homogenous functions – Total derivatives – Differentiation of implicit functions – Jacobian – Taylor's expansion – Maxima and Minima – Method of Lagrangian Multipliers.

UNIT IV	INTEGRAL CALCULUS	8 + 3

Definitions and concepts of integrals – Methods of integration (Decomposition method, Substitution method, Integration by parts) – Definite integrals – Properties and problems – Reduction formulae – Beta and Gamma functions.

UNIT V	MULTIPLE INTEGRALS	8 + 3

Double integration – Cartesian and Polar coordinates – Change of order of integration – Area as a double

integral - Change of variables between Cartesian and Polar coordinates – Triple integration in Cartesian coordinates – Volume as triple integral.

SUPPLEMENT TOPIC (for internal evaluation only-) 3

Evocation /Application of Mathematics, Quick Mathematics – Speed Multiplication and Division Applications of Matrices.

TOTAL : 45 (L) + 15 (T) = 60 Periods

COURSE OUTCOMES:

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

- Apply the knowledge of Matrices to solve Engineering problems(CO1) AP – K3
- Analyze Engineering problems using limits, continuity and derivatives (CO 2) A – K4
- Applythe knowledge of differentiation techniques to predict the extreme values of the Engineering problems with constraints (CO3) AP – K3
- Apply the knowledge of Beta and Gammafunction and their relation to evaluate the Engineering problems involving definite integrals. (CO4) AP – K3
- Apply the concept of Multiple integralsto compute the graphical representation in Engineering problems(CO5) AP – K3
- Explain the basic concepts of Matrix, Differentiation and Integration (CO6) U – K2

TEXT BOOKS:

1. BALI N. P and MANISH GOYAL, “A Text book of Engineering Mathematics”, Laxmi Publications (P) Ltd, New Delhi, 8th Edition, (2011).
2. VEERARAJAN.T “Engineering Mathematics” Tata McGraw Hill Publishing Company, New Delhi, vol 15.
3. GREWAL. B.S, “Higher Engineering Mathematics”, Khanna Publications, New Delhi, 42nd Edition, (2012).

REFERENCE BOOKS:

1. RAMANA B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, 11th Reprint, (2010).
2. GLYN JAMES, “Advanced Engineering Mathematics”, Pearson Education, New Delhi, 7th Edition, (2007).
3. JAIN R.K and IYENGAR S.R.K,” Advanced Engineering Mathematics”, Narosa Publishing House, New Delhi, 3rd Edition, (2007).
4. BHARATI KRISHNA TIRTHAJI, “Vedic Mathematics - Mental Calculation”, MotilalBanarsi Dass Publications, New Delhi, 1st Edition, (1965).
5. KREYSZIG. E, “Advanced Engineering Mathematics”, John Wiley & Sons, New York, 10th Edition, (2011).
6. P.SIVARAMAKRISHNA DAS, E.RUKMANGADACHARI “Engineering mathematics”, volume1, Pearson Edison New Delhi, 2nd Edition, (2013).

R21UPH103	PHYSICS FOR INFORMATION SCIENCE (FOR CSE, IT, CSBS, CSD, AIDS, AIML, IOT AND CYBER SECURITY BRANCHES)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To learn the basic concepts of physics needed for computing engineering
- To apply the physics concepts in solving real time engineering problem
- To implement and visualize theoretical aspects in the laboratory
- To familiarize the students to handle various instruments and equipment

UNIT I	CRYSTAL PHYSICS	9

Introduction –Classification of solids–Space lattice–Basis-Lattice parameter–Unit cell –Crystal system –Miller indices –d-spacing in cubic lattice - Calculation of number of atoms per unit cell – Atomic radius-Coordination number – Packing factor for SC, BCC, FCC and HCP structures –crystal imperfection –Burger vector - X-ray diffraction – Determination of crystallite size.

UNIT II	LIGHTAND LASERS	9

Light –optical medium-Reflection and Refraction-Total internal reflection-wave front-mathematical representation of a plane wave-wave characteristics of light superposition interference of light young's double slit experiment – bandwidth coherence thin film interference air wedge- colors in thin films - Newton's rings - application of interference, Principles of Laser- Characteristics of laser – Population inversion– Einstein's A and B coefficients - Types of lasers (Example: CO2 laser).

UNIT III	INTRODUCTION TO QUANTUM PHYSICS	9

Introduction - Blackbody radiation – Planck's law of radiation-Wien's displacement law-Rayleigh Jeans law- –Compton Effect – Theory and experimental verification – Matter waves – Electron Diffraction and its Application (SEM) – Schrodinger's wave equation – Time dependent – Time independent equation – Application of Schrodinger's wave equation (1-D dimensional box).

UNIT IV	ELECTRON THEORY OF SOLIDS	9

Introduction – Conduction in metals – mobility and conductivity – classical free electron theory of metals–merits and demerits – Electrical and thermal conductivity (derivation) – Wiedemann–Franz law – Lorentz number – Quantum free electron theory – Band theory of solids – Fermi distribution function-Effect of temperature on Fermi function – Density of energy states – Carrier concentration in metals.

UNIT V	SEMICONDUCTOR PHYSICS	9

Introduction–Properties and types of semiconductor – Electron and hole concentration intrinsic semiconductor – Intrinsic Carrier Concentration – Electrical conductivity of an intrinsic semiconductor – Determination of band gap of an intrinsic semiconductor – Extrinsic (N- and P-type) semiconductors – Hall effect and its applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- Describe the different types of crystal systems, semiconductors and wave motions.(Understand)
- Apply the principle of light and laser in optical communication systems. .(Apply)
- Apply the characteristics of crystal structures, metals, semiconductors and dual nature of matter in industries.(Apply)
- Apply the knowledge of quantum physics to solve the problem of one dimensional box using Schrödinger's wave equations.(Apply)
- Interpret the theoretical knowledge of light to determine the wavelength of light using interference and grating.(Apply)
- Analyze the structural behavior of metallic and semiconducting crystal and light to select suitable material for industrial application.(Analyze)

TEXTBOOKS:

1. Dr. M.N. Avadhanulu& Dr. P.G. Kshirsagar, "A Textbook of Engineering Physics", Revised Edition 2014, S. Chand Company and Private limited, New Delhi.

2. Rajendran V, "Engineering, Physics", Tata Mc-Graw Hill Publishing Company limited, New Delhi, RevisedEdition2018.

3. Palanisami P.K., "Physics For Engineers", Scitech Publications (India), Pvt Ltd., Chennai, 2018.

REFERENCES:

1. Basics of laser physics: for students of science and engineering. http://www.springer.com/978-3-319-50650-0

2. AjoyGhatak, Optics, 5thEd., Tata McGraw Hill, 2012

3. Arthur Beiser, ShobhitMahajan and S. RaiChoudhury, Concepts of Modern Physics, 6th Edition,Tata McGraw Hill Education Pvt.Ltd., New Delhi, 2014

4. B.K. Pandey and S. Chaturvedi, Engineering Physics, 1st edition, Cengage Learning India Pvt Ltd., New Delhi, 2017.

5. Halliday and Resnick, Fundamentals of Physics, 11thedition, John Wiley and Sons, Inc,2018

R21UCS107	PROBLEM SOLVING AND C PROGRAMMING (Common to CSE,ECE IT,CSBS,AI&DS,CSD,AIML,IOT,CYBER SECURITY)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To impart the concepts in basic organization of computers and problem solving techniques.
- To familiarize the programming constructs of C.
- To explain the concepts of arrays, strings, functions, pointers, structures and unions in C.

UNIT I	INTRODUCTION TO C PROGRAMMING	11

Basic Organization of a Computer – Problem formulation – Problem Solving - Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart- Introduction to ' C' programming – fundamentals – structure of a 'C' program – Compilation and Linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations.

UNIT II	DECISION MAKING AND LOOPING STATEMENTS	9

if - if-else - nested if-else – else-if ladder statement – switch – goto – for- while – do-while – break – continue statements .

UNIT III	ARRAYS AND STRINGS	9

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays - String - String operations – string arrays.

UNIT IV	FUNCTIONS	8

Function – Definition of function – Declaration of function – Parameter passing methods – Recursion.

UNIT V	POINTERS, STRUCTURES AND UNIONS	8

Pointers - Dynamic Memory allocation – Structure – Union.

TOTAL: 45 Periods

COURSE OUTCOMES:

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

- Explain the basic problem-solving techniques and concepts of the C programming language. (Understand)
- Apply problem-solving techniques and basic concepts of the C programming language to find solutions to real-world problems. (Apply)
- Apply the concepts of looping, branching, and decision-making statements for a given problem.(Apply)
- Apply the advanced concepts of C language like, pointers, structures, unions and arrays to solve real-world problems. (Apply)
- Analyze the appropriateness of C language constructs to provide solutions to computer applied complex engineering problems. (Analyze)
- Work individually or in teams and demonstrate the solutions to the given exercises

through presentation. (Affective Domain)

TEXT BOOKS :

1. Balagurusamy, E, “Programming in ANSIC”, Eighth Edition, Tats McGraw-Hill Publishing Company Limited, New Delhi, 2019.
2. Deitel and Deitel, “C How to Program”, Pearson Education, New Delhi, 2011

REFERENCE BOOKS :

1. Yashavant P. Kanetkar. “ Let Us C”, BPB Publications, 2011.
2. Kernighan.B.W ,Ritchie.D.M, “The C Programming language”, Pearson Education,Second Edition, 2006.
3. Stephen G.Kochan, “Programming in C”, Pearson Education India,Third Edition, 2005.
4. Anita Goel ,Ajay Mittal, ” Computer Fundamentals and Programming in C””, Dorling Kindersley (India) Pvt. Ltd, Pearson Education in South Asia, 2011.
5. Byron S Gottfried, ” Programming with C ”, Schaum’s Outlines, Tata McGraw-Hill,Second Edition, 2006.
6. PradipDey, ManasGhosh, “Fundamentals of Computing and Programming in C”, Oxford University Press, First Edition, 2009.

R21UME109	ENGINEERING GRAPHICS (Common to ALL Branches except CSBS, AI&DS,CSD,AIML)	L	T	P	C
		1	3	0	4

PRE-REQUISITE:

COURSE OBJECTIVES :

- To develop student's graphic skill for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technicaldrawings.
- To impart knowledge in development of surfaces, isometric and perspective projections.

	CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)	4

Importance of Graphics in Engineering Applications – Use of Drafting Instruments – BIS Conventions and Specifications – Size, Layout and Folding of Drawing Sheets – Lettering and Dimensioning - Introduction to Plane Curves, Projection of Points, Lines and Plane Surfaces.

UNIT I	PROJECTION OF SOLIDS	12

Projection of simple solids like prisms, pyramids, cylinder and cone with axis is parallel, perpendicular and inclined to one of the plane.

UNIT II	SECTION OF SOLIDS	10

Section of solids - simple position with cutting plane parallel, perpendicular and inclined to one of the plane.

UNIT III	DEVELOPMENT OF SURFACES	10

Development of lateral surfaces of simple and truncated solids - Prisms, pyramids and cylinders and cones - Development of lateral surfaces of sectioned solids.

UNIT IV	ISOMETRIC PROJECTIONS	12

Principles of isometric projection – isometric scale – isometric view - isometric projections of simple solids and cut solids.

UNIT V	ORTHOGRAPHIC PROJECTION	12

Representation of Three Dimensional objects – General principles of orthographic projection- Need for importance of multiple views and their placement – First angle projection – layout views – layout views – Developing visualization skills of multiple views (Front, top and side views) from pictorial views of objects.

TOTAL 15 (L) + 45 (T) = 60 Periods

COURSE OUTCOMES:

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

- Draw orthographic projections of basic geometrical entities in various positions and translate the Geometric information of engineering objects into engineering drawings. (Understand)
- Apply the principles of orthographic projections to draw projections of solids and sections of solids. (Apply)
- Develop lateral surfaces of regular and sectioned solids. . (Apply)
- Prepare isometric drawings of simple solids from orthographic views. (Apply)
- Construct orthographic projection from the given pictorial view. (Apply)
- Analyze the projections of various solid models using different resting conditions. (Analyze)

TEXT BOOKS:

1. Natarajan K.V., “A Text book of Engineering Graphics”, Dhanalakshmi Publishers, (2006).
2. Bhatt N.D., “Engineering Drawing”, 46th Edition, Charotar Publishing House,(2003).

REFERENCE BOOKS:

1. Venugopal K., and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited,(2008).
2. Gopalakrishnan K.R., “Engineering Drawing” (Vol.I&II), SubhasPublications.(1998).
3. DhananjayA.Jolhe, “Engineering Drawing with an introduction to Auto CAD”,Tata McGraw Hill Publishing Company Limited,(2008).

4.Saravanan M,Bensan Raj J,Ganesh Kumar S,,”EngineeringGraphics”,JBRTrisea Publishers,Nagercoil.2020.

R21UCS111	PROBLEM SOLVING AND C PROGRAMMING LABORATORY (Common to CSE , ECE ,IT , CSBS,AIDS,CSD,AIML,IoT and Cyb.Sec.,)	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES :

- Familiarize with programming environment
- Familiarize the implementation of programs in C

LIST OF EXPERIMENTS

- **Familiarization with Integrated Development Environment (IDE)**(Compile, Debug)

oblems involve arithmetic computations and sequential logic

1. Write a C program to display the Bio data using printf statement.
2. Write a c program to find simple interest.
3. Writing a C program for a landscaping company. The company needs a tool to calculate the amount of material required to create circular garden beds and the length of edging required for each bed.

Problems involve decision making

1 Write a C program for an event management company that organizes seating arrangements for events such as concerts, conferences, or sports matches. The company needs a tool to efficiently assign seats to attendees based on whether their ticket numbers are even or odd.

2 Write a C program for developing software for a payroll management system used by a company with employees working on projects spanning multiple years. The system needs to calculate salaries and benefits, taking into account leap years for accurate time calculations. Your task is to write a program that determines whether a given year is a leap year or not.

3 Write a C program to read the age of a candidate and determine whether he is eligible to cast his/her own vote.

4 Write a C program to find Largest from Three Numbers given by user using Else-if Statement

5 Design a calculator to perform the arithmetic operations.

Problems involve iterations

1 You are developing a program for a financial institution that offers investment plans based on the Fibonacci sequence. The institution wants to provide a tool that visualizes the growth of investments over time using the Fibonacci series.

2 Developing a program for an online security system that requires checking whether a user's chosen PIN is a prime number. The security system wants to ensure that users have unique and secure PINs.

3 A supermarket manager wishes to keep some toys and puzzle games to enable the customers to

manage their kids during the purchase time. He kept a machine called “Fortune Teller machine”, it replies the kid with some fortune message if he enters the palindrome number. It replies with “try again later” if the kid failed to input a valid palindrome number.

4 Write a C program to print Triangle Pattern Using Nested for Loop.

Problems involve arrays

1 You are developing a program for a gradebook application used by teachers to manage student scores. The application needs a tool that allows teachers to input the scores of five different assignments for each student and then display the scores entered. Your task is to write a C program that takes 5 values from the user representing the scores of five different assignments and stores them in an array. After storing the values, the program should print the elements stored in the array.

2 You are developing a program for a scientific research project where data from multiple experiments need to be analyzed. The research team wants a tool that can calculate the average of a set of data points collected from various experiments. Your task is to write a C program that finds the average of n numbers using arrays.

3 You are developing a program for a financial analysis tool used by an investment firm. The tool requires performing matrix addition to analyze the performance of various investment portfolios over multiple periods. Your task is to write a C program that prints the elements of two 2D arrays representing the returns of two investment portfolios over a specific time period and then performs matrix addition to calculate the combined returns.

4 Write a C program to print the elements of 2D-array Matrix addition using 2D-Array.

Problem involve strings

1. Developing a program for a language learning platform that helps students practice reading and understanding words and sentences in a foreign language. As part of the exercises, the platform needs a tool to display the reverse of the words or sentences entered by the students.

Problems involve in functions, recursion

1. Write a C program to swap two values using call by value and call by reference.
2. You are developing a program for a manufacturing company that produces various components. One of the critical processes involves calculating the number of possible combinations of components that can be assembled. Your task is to write a C program that calculates the factorial of a given number representing the number of components available, using recursion.

Problems involve structures, Unions

1. Create a C programming using Union called Employee which stores the name, id, basic pay, HRA and DA as members. Find the total pay of the employee.
2. Create a C programming using an Structure called Student with name, class, rollnum, total marks as members. Find and display the grade of each student.
    - >80 – Grade A
    - >60 – Grade B
    - > 50 – Grade C

- <50 - Fail

TOTAL: 30 Periods

COURSE OUTCOMES:

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

- Write programs to solve problems involving computations. (Apply)
- Develop computer applications using suitable control structures. (Apply)
- Apply different programming constructs to solve a variety of computational problems efficiently. (Apply)
- Design solutions for computer applied complex Engineering Problems that meet specified needs. (Create)
- Communicate effectively to justify the solutions to the given problems based on legal and ethical principles. (Affective domain - Value)

  Work effectively as an individual or in teams to develop solution for the given problem. (Affective domain - Value)

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

HARDWARE

PERSONAL COMPUTERS WITH 4GB RAM ,500 GB HDD,MOINTOR ,KEYBOARD AND MOUSE-30 NUMBERS

SOFTWARE

TURBO C

R21UEC112	ENGINEERING FUNDAMENTALS LABORATORY (Common to CSE, ECE, IT)	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To familiarize with word, excel and power point using AI concepts.
- To familiarize with the function of electronic components, logic gates and electronic devices.
- To study various electronic measurements using Arduino Processor

LIST OF EXPERIMENTS:

1. Assembling hardware components of a computer
2. Installation of windows and Linux operating systems and Software installation in both OS
3. Configuring the computer to connect with internet
4. Study of electronic components and equipments-
    a. Resistor colorcoding
    b. Measurement of AC signal parameter (peak to peak, rms, period, frequency) using CRO
5. Study of logicgates
6. Soldering practice – components devices and circuits - using general purpose PCB
7. Characteristics ofLED
8. Interfacing of PIR sensor with arduino
9. Switch control with arduino

Temperature measurement with arduino

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

- Implement the process of Microsoft windows, PowerPoint and Excel using AI concepts. (**Apply)**
- Demonstrate the function of various electronic components and devices. (**Apply)**
- Apply the knowledge of basic concepts of Arduino to demonstrate various real time applications. (**Apply)**
- Apply appropriate software tools to make measurements of physical quantities.
- (**Apply)**
- Demonstrate proficiency in using discipline specific tools. (**Apply)**
- Function effectively as an individual for efficiently executing the given task.
- (**Organize**)

R21UPH113	PHYSICS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To create scientific temper among the students.
- To know how to execute experiments properly, presentation of observations and arrival of conclusions.
- To view and realize the theoretical knowledge acquired by the students through experiments

LIST OF EXPERIMENTS

(Common to All Branches)

1. Laser – (a) Determination of particle size (b) wave length of Laser source.
2. Determination of numerical aperture and acceptance angle of an optical fiber using diode laser.
3. Spectrometer –Determination of dispersive power of a prism.
4. Air Wedge method-Determination of thickness of a thin wire.
5. Determination of Energy band gap of a semiconductor.
6. Spectrometer-Determination of wavelength of mercury spectrum using grating.
7. Newton's rings – Determination of radius of curvature of a convex lens
8. Determination of Solar cell characteristics using optical transducers kit.
9. Determination of Plank constant
10. Uniform bending method–Determination of Young's modulus of the given rectangular beam
11. Torsion pendulum-Determination of Moment of inertia of a metallic disc and rigidity modulus of a given metallic wire.
12. Poiseuille's method- Determination of coefficient of viscosity of liquid

A minimum of FIVE experiments shall be offered **TOTAL: 30 Periods**

R21UGM131	INDUCTION PROGRAMME	L	T	P	C
		0	3	0	P/F

COURSE OBJECTIVES :

- To rejuvenate the Body and Mind
- To strengthen Attitude and soft skills
- To practice Moral values of life.

UNIT I	PHYSICAL ACTIVITY	10 Hrs

Zumba - Bokwa Fitness – Yoga – Mediation – Fine Arts

UNIT II	CREATIVE ARTS	5 Hrs

Painting – Class Painting – Wall Painting – Art from waste

UNIT III	UNIVERSAL HUMAN VALUES & EMINENT SPEAKERS	5 Hrs

Ethical values – Ambition and Family Expectation, Gratitude, Competition and Excellence – Belief – Morality of life – Guest Lecture by Eminent personality

UNIT IV	LITERARY	5 Hrs

Elocution - Essay writing Competition - Impromptu Session - Dance and singing competition

UNIT V	PROFICIENCY MODULES	10 Hrs

Toastmaster club meet

UNIT vI	INDUSTRIAL & LOCAL VISIT	8 Hrs

Vaigai Dam – Theni - VOC- Port-Tuticorin - Madurai Radio City-Madurai - Aavin Milk –Madurai-NSS Activities.

UNIT vII	FAMILIARIZATION OF THE DEPT. AND INNOVATION	2 Hrs

Department Introduction and Purpose of Course - Eminent speakers – Scope and Feature of the Course - Latest Innovation

TOTAL : 45 Periods

COURSE OUTCOMES:

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

- Practice physical activities regularly.
- Implement creativity in drawing and waste material.
- Communicate their ideas effectively.
- Identify inputs and outputs of different industry process.
- Describe the scope and features of their programme of study

Reference Book:

1. Student Induction Programme: A Detailed Guide by AICTE, New Delhi.

R21UGT140	HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1

PRE-REQUISTIES:

COURSE OBJECTIVES:

UNIT I	HERITAGE AND CIVILIZATION OF TAMIL THROUGH ARCHAEOLOGY	4 HRS

Introduction - Basics of archaeology – Historical Source - Archaeological Excavations in Keeladi - Findings based on Keeladi Excavation - Excavations near Mayiladumparai - Excavations near Sivagalai - Excavations at Adichanallur - An Analysis of the excavations in Tamilnadu

UNIT II	TAMIL HERITAGE IN SANGAM AGE	3 HRS

Introduction - Sangam Literature - Political History of Sangam Period - Sangam Polity and Administration - Sangam Society - Position of Women during Sangam Age - Economy of the Sangam Age

UNIT III	SOURCES OF ANCIENT TAMIL HERITAGE AND HISTORY	4 HRS

Evidences of Tamilakam in Greek and Roman Literature - Archaeological sources - Evidence for economic activities - Literary sources in Tamil - Literary Evidences about Tamil History in other languages - Epigraphical sources - Cave inscriptions - Pottery inscriptions - Numismatic (Coins) sources.

UNIT IV	EVIDENCE FOR ANCIENTNESS OF TAMIL LITERAURE AND HERITAGE	4 HRS

Tamil Literature - India's Earliest Script: Tamili (Tamil Brahmi) - Literary work of Ancient Tamil - Tolkappiam - Thirukkural&Naladiyar - Tracing Ancient Tamil Literature by
U.V. SaminaythaIyer - Tamil, a Classical Language

TOTAL : 15 PERIODS

COURSEOUTCOMES:

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

- Describe the Heritage and Civilization of Tamil through Archaeology.(Understand)
- Interpret the Tamil Literature and Civilization in historical manner. (Understand)
- Demonstrate the ability to appreciate the ancientness Tamil heritage and literature.(Apply)
- (Valuing – Affective Domain)
- Analyze the sources of Tamil Civilization relating to Indus Valley Civilization. (Analyze)

TEXT-CUM-REFERENCE BOOKS

1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

2. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: 36 International Institute of Tamil Studies.)

5. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology& Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)

7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)

8. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL)

Semester II

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UEN201	Communication Skills for Professionals (Integrated Course) (Common to All Branches except CSBS)	1	0	1	1.5	HSS
R21UMA203	Differential Equations and Complex Analysis (Common to CSE,IT,IoT and Cyb.Sec.,)	3	1	0	4	BS
R21UIT206	Programming Fundamentals using Python (Common to CSE, IT,CSD,AIML,IOT, Cyb.Sec.,)	3	0	0	3	PC
R21UCS205	Digital Electronics (Common to CSE, Cyb.Sec.,)	3	0	0	3	PC
R21UCY206	Principles of Chemistry in Engineering (Common to CSE,IT, AIDS,CSD,AIML,IoT and Cyb.Sec.,)	3	0	0	3	BS
PRACTICAL						
R21UCY213	Applied Chemistry Laboratory (Common to CSE,IT, AIDS,CSD,AIML, IoT and Cyb.Sec.,)	0	0	2	1	BS
R21UIT207	Programming Fundamentals using Python Laboratory (Common to CSE, IT,CSD, AIML,IoT and Cyb.Sec.,)	0	0	3	1.5	PC
MANDATORY						
R21UGT241	Tamils and Technology (Common to All Branches)	1	0	0	1	MC
R21UAC231	Biology for Engineers (Common to All except BME and BT)	2	0	0	P/F	MC
	TOTAL	**16**	**1**	**6**	**18**	
Total No of Credits - 18						

R21UEN201	COMMUNICATION SKILLS FOR PROFESSIONALS (INTEGRATED COURSE)(Common to ALL Branches except CSBS)	L	T	P	C
		1	0	1	1.5

PRE-REQUISITE:

COURSE OBJECTIVES :

- To improve the communication skills
- To develop the public speaking skills
- To develop their confidence and ability to speak in public
- To develop the leadership capacity

UNIT I	ERROR FREE LANGUAGE	3 HOURS

Parliamentary English words, Pronounce the words with stress, Words often confused. Finding Common Errors.

UNIT II	LUCID WRITING	3 HOURS

Principles of Communicative English, Business Letters, Writing Technical Proposal.

UNIT III	INDIVIDUAL AND TEAM WORK	3 HOURS

Creative Writing- Writing Paragraph, Dialogue Writing (Various situations), Rearrange the jumbled sentences

UNIT IV	LIFE SKILLS	3 HOURS

Professional Ethics, Code of Conduct, Relative Clauses

UNIT V	INTERPERSONAL SKILLS	3 HOURS

Swot Analysis& Life Positions

5 Oral Projects

Project 1: SELF INTRODUCTION&DELIVER A SPEECH BEFORE AUDIENCE (Time: 5 to 7 minutes)

- **To Speak in front of an audience with courage.**
- **Make your message clear, with supporting material.**
- **Create a strong opening and conclusion.**

Project 2: SPEAK ON THE CHOSEN CONTENT (Time: 5 to 7 minutes)

- Select a general topic and bring out specific purposes.
- Avoid using notes.
- Use symbolicideas to developyour ideas.

Project 3: USE EFFECTIVE BODY LANGUAGE& INTONATION(Time: 5 to 7 minutes)

- Use appropriateposture, gestures, facial expressions and eye contact to express your ideas.
- Use proper intonation and adequate speech module.

Project 4: PRESENT YOUR TOPIC WITH VISUAL AIDS (Time: 5 to 7 minutes)

- Persuade your points with suitable illustration, specific facts, examples
- Use suitable visual aids to present your topic with confidence.

Project 5: GRASP THE ATTENTION OF THE AUDIENCE (Time: 5 to 7 minutes)

- Influence your listeners by adopting holistic viewpoint.
- Use emotions, stories, and positive quotes in your speech.

TOTAL : 15 +15=30 Periods

COURSE OUTCOMES:

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

- Communicate orally with fluency and clarity in a given contextual situation.(Responding A2)
- Adapt them to work in a group as a member or leader for effectively executing the task. (Organizing A4)
- Write language appropriately without error in any given circumstances. (Responding A2)
- Communicate information ideas and opinions in any given situations. (Responding A2)
- Present the ideas creatively with coherence for given topic. (Organizing A4)

Reference Books:

1. CompetentCommunication- A Practical Guide to becoming a better speaker, Toastmasters International, USA.
2. Raman, Meenakshi, Sangeetha Sharma, Business Communication, New Delhi, Oxford University Press, 2014.
3. Norman Lewis – Word Power Made Easy, Pocket Book Publication, 2019.

R21UMA203	DIFFERENTIAL EQUATIONS AND COMPLEX ANALYSIS (COMMON TO CSE ,IT,CYBER SECURITY)	L	T	P	C
		3	1	0	4

PRE-REQUISITE:

COURSE OBJECTIVES :

- To develop an understanding of the basics of vector calculus comprising of gradient, divergence and curl, and line, surface and volume integrals and the classical theorems involving them.
- To acquaint the student with the concepts of analytic functions and their interesting properties which could be exploited in a few engineering areas, and be introduced to the host of conformal mappings with a few standard examples that have direct application.
- To make the student knowledgeable in formulating certain practical problems in terms of partial differential equations, solve them and physically interpret the results.

UNIT I	SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS	9+3

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Applications of ODE in Computer Science Engineering

UNIT II	VECTOR CALCULUS	9+3

Gradient Divergence and Curl – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopiped.

UNIT III	ANALYTIC FUNCTIONS	9 +3

Functions of a complex variable – Analytic function – Necessary and Sufficient Conditions (excluding Proofs) – Harmonic function - Properties of an analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping- Simple transformation w = z+c, cz, 1/z, and Bilinear transformation.

UNIT IV	COMPLEX INTEGRATION	9 +3

Statement and applications of Cauchy's integral theorem, Cauchy's integral formula and Cauchy Residue Theorem – Taylor's and Laurent's expansions – Applications of residue theorem to evaluate real integrals – Unit circle and semi-circular contour (excluding Poles on the real axis).

UNIT V	PDE & APPLICATION OF PDE	9+3

Formation of partial differential equations – Singular integrals- Lagrange's linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both

homogeneous and non-homogeneous types- Solutions of one dimensional wave equation

TOTAL : 45 (L) + 15 (T) = 60 Periods

COURSE OUTCOMES:

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

- Apply the knowledge of higher order ordinary differential equations in real life Engineering problems.(CO1) AP – K3
- Apply the knowledge of vector calculus to solveEngineering problems.(CO2) AP – K3
- Apply the knowledge of complex derivatives and transformation to solve engineering problems.(CO3) AP – K3
- Apply the knowledge of complex integrationto solve engineering problems.(CO4) AP – K3
- Apply the knowledge of partial differential equationsto solve Engineering problems. (CO5). AP – K3
- Explainthe concepts ofordinary differential equations, vector identities and complex analysis. (CO6) U-K2

TEXT BOOKS:

1. VEERARAJAN.T “Engineering Mathematics” Tata McGraw Hill Publishing Company, New Delhi, vol 15.
2. BALI N. P and MANISH GOYAL, “Text book of Engineering Mathematics”, Laxmi Publications (P) Ltd., New Delhi, 3rd Edition, (2008).
3. THOMAS G.B. and FINNEY R.L. “Calculus and Analytic Geometry”, 9th Edition, Pearson Reprint 2002.

REFERENCE BOOKS:

1. RAMANA B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, 11th Reprint, (2010).
2. KREYSZIG. E, “Advanced Engineering Mathematics”, John Wiley & Sons, New York, 10th Edition, (2011).
3. JAIN R.K and IYENGAR S.R.K, “Advanced Engineering Mathematics”, Narosa Publishing House Pvt. Ltd., New Delhi, 3rd Edition, (2007).
4. GREWAL. B.S, “Higher Engineering Mathematics”, Khanna Publications, New Delhi, 43rd Edition, (2014).

R21UIT206	PROGRAMMING FUNDAMENTALS USING PYTHON (COMMON TO CSE,IT,CSD,AL&ML,IOT& CYBER SECURITY)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To understand the basic structure and syntax of python concepts.
- To understand the python libraries for time conventional programming.
- To understand the fundamental concepts of file systems and exception handling.

UNIT I	INTRODUCTION TO PROGRAMMING	9

Problem Solving – Types of Programming Paradigms – Features of Python -Variables – Data types and Operators - Decision Constructs - Type Conversion in Python.

UNIT II	LOOPS AND COLLECTION DATA TYPES	9

.Python While and For Loop - Introduction to Collections- List in Python – Tuple in Python – Sets in Python- Dictionaries in python.

UNIT III	FUNCTIONS	9

Introduction to functions, Function definition and calling, Function parameters, Default argument function, Variable argument function, in built functions in python, Scope of variable in python.

UNIT IV	STRINGS AND MODULES	9

String functions and Methods - Built-in Modules: Date time module, Math module, CSV module, JSON module.

UNIT V	HANDLINGFILESANDHIGHERORDERFUNCTIONS	9

Introduction to File Handling – Handling Exceptions in Code – Regular Expressions – Concurrency – Lambda Expressions – Higher Order Functions

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Understand the basic concepts of structure and syntax of python.(Understand)

Apply the knowledge of fundamental concepts of python to find solutions to solve complex engineering problems.(Apply)

Analyze various features of python programming for a given scenario. (Analyze)

Demonstrate the implementation of various applications using modern frameworks and

tools.(Apply)

Work individually or in teams and demonstrate the solutions to the given exercises through presentation.(Affective-Value)

TEXT/ REFERENCEBOOKS:

1. url:https://infytq.infosys.com/toc/lex_auth_012540961624342528106 1
2. AnuragGupta&GPBiswas,“PythonProgramming – Problemsolving, packagesand libraries”, McGraw Hill Education, 2020.
3. Ashok NamdevKamthane& Amit Ashok Kamthane, “Problem solving and python programming”,McGrawHill Education,2018(copyright)
4. ReemaThareja, “Python Programming Using Problem Solving Approach”, Oxford University Press 2017.

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R21UCS205	DIGITAL ELECTRONICS	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To present the Digital fundamentals, Boolean algebra and its applications in digital systems.
- To familiarize with the design of various combinational digital circuits using logic gates.
- To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits.
- To explain the various semiconductor memories and related technology.
- To introduce the electronic circuits involved in the making of logic gates.

UNIT I	DIGITAL FUNDAMENTALS	9

Number Systems – Decimal, binary, Octal, Hexadecimal, 1's and 2's complements, Codes- Binary, BCD, Excess3, Gray,Alphanumeric codes, Boolean theorms, Logic gates, Universal gates, Sum of products and Product of sums, Minterms and Maxterms, Karnaugh map Minimization and QuineMcCluskey method of minimization.

UNIT II	COMBINATIONAL CIRCUITS	9

Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Magnitude Comparator, Code Conversion- Binary to Gray , Gray to Binary, BCD to Excess 3,Multiplexer, Demultiplexer, Decoder, Encoder, Priority Encoder

UNIT III	SYNCHRONOUS SEQUENTIAL CIRCUITS	9

Flip flops- SR,JK,T,D, Master/Slave FF –operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation- Design of Counters- Ripple Counters, Ring Counters, Shift registers, Universal Shift Register.

UNIT IV	ASYNCHRONOUS SEQUENTIAL CIRCUITS	9

Analysis and design of asynchronous sequential circuits,cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Design of Hazard free circuits.

UNIT V	MEMORY DEVICES AND DIGITAL INTEGRATED CIRCUITS	9

Basic memory structure – ROM – PROM – EPROM – EEPROM – EAPROM. RAM – Static and dynamic RAM – Programmable Logic Devices – Programmable Logic Array(PLA) – Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FGPA) – Implementation of combinational logic circuits using PLA, PAL. Digital integrated circuits: Logic levels, propagation delay, power dissipation, fan-out and fan-in, noise margin, logic families and their characteristics- RTL,TTL, ECL, CMOS.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Explain the functions of a digital circuit (Understand)
- Apply simplification techniques to design minimized logic circuits. (Apply)
- Analyze synchronous and asynchronous sequential circuits to provide solutions for engineering problems. (Analyze)
- Evaluate the design of a digital circuit using the fundamental concepts. (Evaluate)
- Develop a digital system for a real time application to meet the functional requirements. (Create)
- Communicate the purpose and result of a design project in written and oral presentation. (Affective Domain)

TEXT BOOKS:

1. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 4th Edition,2016.
2. A.Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
3. R.P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.

REFERENCE BOOKS:

1. Leach D ,Malvino A P &Saha, " Digital Principles and Applications", 8th Edition, Tata McGraw – Hill Publishing Company, 2014.
2. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education, New Delhi, 2009.
3. John M Yarbrough, "Digital Logic Applications and Design", Thomson – Vikas Publishing House, New Delhi,2002.
4. W H Gothman, "Digital Electronics: An introduction to theory and practice", 2nd Edition, Prentice Hall of India, 2000.
5. A.P.Godse&D.A.Godse, "Digital Electronics", Technical Publications, 2017.

WEB REFERENCES:

1. Digital System Design URL:http://nptel.ac.in/courses/117105080
2. Introductionto Digital Circuits and Systems URL:http://nptel.ac.in/video.php/subjectId = 117106086
3. DigitalLogicURL:http://freevideolectures.com/Course/2319/Digital-Systems-Design/3.

R21UCY206	PRINCIPLES OF CHEMISTRY IN ENGINEERING (Common to CSE,IT, AIDS,CSD,AIML,IoT and Cyb.Sec.,)	L	T	P	C
		3	0	0	3

Unit I	WATER TECHNOLOGY	9

Characteristics of water – Specification of water for Industries and domestic purposes – Physical and Chemical impurities, Hardness – Types of hardness (problems on hardness)– Estimation by EDTA–Boiler feed water – Boiler Trouble -Requirements – Priming and foaming, Scales and sludges Caustic embrittlement and Boiler corrosion – External conditioning (Ion-exchange) – Internal conditioning – Domestic water treatment –Disinfection methods – Break point chlorination – Desalination by reverse osmosis.

Unit II	ELECTROCHEMISTRY AND CORROSION	9

Introduction – Cell terminologies (Current, Electrode, Anode, Cathode, Electrolyte, Half-cell, Cell) – Electrode potential – Nernst equation (Problems)– Electrochemical series.Corrosion – Chemical corrosion – Electrochemical corrosion – Factors influencing corrosion – Different types of Corrosion – Corrosion control – Cathodic protection -Sacrificial anode and Impressed current cathodic protection method – Pretreatment of surface – Fundamentals of Copper electroplating and Applications for Next generation - Electroless plating of Nickel

Unit III	ENERGY SOURCES & STORAGE DEVICES	9

Introduction – Classification of Fuels – Comparison of Fuels – Knocking – Improvement of Anti-knock characteristics and agents, Octane number, Cetane number. Nuclear energy – Light water nuclear power plant, breeder reactor –Batteries: Types of batteries, Primary battery –Alkaline battery, Secondary battery - lead acid battery and lithium-ion-$LiTiS_2$ battery; Principle and Working of Super capacitors: types and examples, working principles of Electric-vehicles.

Unit IV	CHEMISTRY OF NANOMATERIALS	9

Introduction - Classification of nanomaterials - Size dependent properties - Types of nanomaterials:Preparation of Metal and Carbon Nanoparticles: Synthesis by chemical reduction; Bio-reduction method; Sol-Gel method; Hydrothermal method; Chemical vapor deposition method. Carbon Nanotubes (CNTs): Single walled and multi-walled carbon nanotubes – Properties of Mechanical and electrical properties of CNTs and Applications. Application of nanomaterial in medicine

Unit-V	SMART MATERIALS AND GREEN CHEMISTRY	9

Introduction, Quantum dots-Electroluminescence -OLED types, principle and applications. Liquid crystals; Classification, chemical constitution, stability and applications. Introduction and applications of Electro-active polymers (conducting polymers-Poly acetylene). Green chemistry; Principles of green chemistry, Applications of green chemistry in day today life, Environmental related issues. Green processes and sustainability (3R concept).

Total: 45 Periods

COURSE OUTCOMES:

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

CO1: Describe the basic concepts of chemistry involved in water technology, electrochemistry, energy sources and its storage devices, nano materials, smart materials. (Understand-K2)

CO2: Explain the principles and applications of, organic light emitting diodes, liquid crystals and green chemistry (Understand-K2)
CO3: Apply the electrochemical concepts towards corrosion and its protection strategies (Apply-K3)
CO4: Apply the knowledge of electrodynamics to identify the types of energy storage devices (Apply-K3)
CO5: Analyze the impurities of water to find its hardness and remove the hardness causing substances (Analyze-K4)
CO6: Write a report on chemical application for Industries (Respond-A2)

TEXT BOOKS:

1. Engineer Chemistry, G.V.Subba Reddy et al., McGraw Hill Education (India Private Limited
2. Chemistry for Engineers, K.UmaMaheswari et al., McGraw Hill Education (India Private Limited
3. Engineer Chemistry, O. G. Palanna., McGraw Hill Education (India Private Limited)
4. Engineer Chemistry, P. B. Joshi, S. Deep, Oxford University Press.

R21UCY213	APPLIED CHEMISTRY LABORATORY (COMMON TO CSE,IT,AI&DS,CSD,AIML,IOT,CYBER SECURITY)	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To impart knowledge on basic concepts in applications chemical analysis
- To explain the knowledge of various instruments and analysis of various metal ions
- To explain the water quality parameters for the analysis of industrial effluents

LIST OF EXPERIMENTS:

1)Preparation of molar and normal solutions of the following substances – Oxalic acid , Sodium Carbonate , Sodium Hydroxide and Hydrochloricacid

2)Conductometric Titration of strong acid with strong base

3)Conductometric Titration of Mixture of Acids

4)Estimation of Iron by Potentiometry

5)Determination of Strength of given acid using PH metry

6)Determination of molecular weight of polymer by Viscometry

7)Comparison of the electrical conductivity of two samples-Conductometric method

8)Estimation of copper in brass by EDTA method

9)Estimation of hardness of water by EDTA method.

10)Estimation of alkalinity of water sample.

11)Estimation of Chloride in water sample (Argentometric method)

12)Determination of DO in water

13)Estimation of chromium in tannery wastes

14)Estimation of available chlorine in bleaching powder

15)Estimation of iron by Spectrophotometry.

16)Determination of acidity of industrial effluents.

TOTAL : 30 Periods

COURSE OUTCOMES:

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

- Apply the knowledge of Molarity and Normality to prepare standard solution for chemical analysis. (Apply K2)
- Apply the knowledge of electrochemical techniques to study various ions present in the industrial effluents. (ApplyK2)
- Analyze the given solution quantitatively using titration.(Analyze K3)
- Apply the basic knowledge of testing methods of water to identify the water quality for environmental sustainability. (Apply K2)

- Estimate the quality of water parameters that suits for domestic application. (Apply K2).
- Analyze the industrial effluents to identify the quality parameters and impurities to prevent water pollution. (Analyze K3)

R21UIT207	PROGRAMMING FUNDAMENTALS USING PYTHON LABORATORY (COMMON TO CSE, IT,CSD, AIML, IOT,CYBER SECURITY)	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES:

- To enhance the problem solving and programming skill using python as a platform.
- To work with python libraries for time conventional programming.
- To work with file systems and exception handling.

LIST OF EXPERIMENTS:

1. Implement Simple Python Programs
2. Implement Python programs using Decision constructs
3. Implement Python Programs using Iteration constructs
4. Implement Python Programs using Lists
5. Implement Python Programs using tuples
6. Implement Python Programs using Dictionary
7. Implement Python Programs using Sets
8. Implement Python Programs using Functions
9. Implement Python Programs using Recursive Functions
10. Implement Python Programs using String
11. Implement a Program to demonstrate File Handling in Python
12. Implement a program to demonstrate Exception Handling in Python

TOTAL : 45 Periods

COURSE OUTCOMES:

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

- Formulate algorithms and programs for arithmetic computations and sequential logic. (Apply)
- Choose appropriate data structures like lists, dictionaries and sets to representcomplex data in python. (Analyze)
- Design and develop python applications to solve complex engineering problems. (Create)
- Evaluate the performance of python application to improve the accuracy of a real time system. (Evaluate)
- Function effectively as a member or leader in a team by participating in the development of software Project using oops concepts in python. (Individual and Team work)

HARDWARE AND SOFTWARE REQUIRMENTS

HARDWARE REQUIREMENTS:

PERSONAL COMPUTERS WITH 4GB RAM ,500 GB HDD,MOINTOR ,KEYBOARD AND MOUSE-30 NUMBERS

SOFTWARE REQUIREMENTS:

Python version 3 and above, Windows/Linux OS, IDE

R21UGT241	TAMILS AND TECHNOLOGY	L	T	P	C
		1	0	0	1

UNIT I	WEAVING AND CERAMIC TECHNOLOGY	3

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

UNIT II	DESIGN AND CONSTRUCTION TECHNOLOGY	3

Designing and construction of Buildings & Construction materials during Sangam Age- Hero stones of Sangam age – Kallanai Dam – Construction on rocks Pallava period – Chozha Architecture – ThirumalaiNaickerMahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III	MANUFACTURING TECHNOLOGY	3

Art of Ship Building – Catamaran – Navy Ships- Metallurgical studies – Coins of Sangam Era – Beads making-industries Stone beads -Glass beads - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV	AGRICULTURE AND ANIMAL HUSBANDRY	3

Agriculture in Sangam period – Land Classification – Land ownership – Agriculture Technology – irrigation - Animal Husbandry – Cowherds and Shepherds - Cattle rearing – Cattle raiding – EruThazhuvuthal – MattuPongal – PonneruPootuthal – Cattle Shed.

UNIT V	SCIENTIFIC TAMIL & TAMIL COMPUTING	3

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

TOTAL: 45 Periods

COURSE OUTCOMES:

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

- Explain the environmental issues, consequences and suitable solution. (Understand-K2)
- Explain the various types of renewable energy sources for sustainable development of natural resources (Understand-K2)
- Apply the principles of value education with respect to human population to preserve environment (Apply-K3)
- Apply the knowledge of various pollution types to prevent the ecosystem and Environment (Apply-K3)
- Analyze the environmental problem to report the social issues and provide sustainable solution. (Analyze-K4)
- write a report on environmental issues and provide solution for sustainable development (Respond-A2)

TEXT-CUM-REFERENCE BOOKS

1)Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

2) Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

3) Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

4)The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

5) Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology& Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

6) Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)

7) Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)

8) Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL)

R21UAC231	BIOLOGY FOR ENGINEERS (Common to ALL Branches except BIO-TECH,BME)	L	T	P	C
		2	0	0	P/F

OBJECTIVES:

- To provide a basic understanding of biological mechanisms of living organisms and the human biology from the perspective of engineers.
- To encourage engineering students to think about solving biological problems with engineering principles and tools.

UNIT – I	INTRODUCTION AND CLASSIFICATION	5

Introduction to Biology – Comparison of Biology and Engineering – Eye and Camera – Bird flying and Aircraft – Brownian motion and Thermodynamics – Classification – Unicellular or multicellular – Unicellular: Bacteria, Protozoa, Yeast – Multi Cellular: Animals, Humans, Plants, fungi etc. – Ultra structure: prokaryotes or eukaryotes – Habitat: aquatic or terrestrial.

UNIT – II	DIGESTIVE & RESPIRATORY SYSTEMS – ENZYME	6

Study of digestive – Respiratory systems and their functions –.Enzyme – Classification of Enzyme – Mechanism of Enzyme activity – Enzymes for Industrial Applications: Waste management – Food processing industry – Beverages – Pharmaceutical – Paper Industry etc.

UNIT – III	GENETICS AND BIO MOLECULES (Basics only)	7

Basics of Genes – DNA structure – Genes and hereditary – Genetic Code – Coding and decoding Genetic information – Gene Mapping – Gene Interactions – Mutations – Genetic disorders – Gene therapy – Biomolecules: Carbohydrates, lipids, nucleic acids, proteins. Biological Applications in Engineering: Genetic Algorithm – Computer Application in Genetic Engineering – Genetic Programming – Genetic Computers.

UNIT – IV	NERVOUS SYSTEM AND CELL SIGNALING	7

Central Nervous System: Brain and Spinal Cord – Peripheral Nervous System – Sensory Division – Motor Division – Neurons – sensory, motor, and interneurons – Signals –Transfer of Information – Bio Signals – Electrocardiography (ECG) – Electroencephalography (EEG) – Electromyography (EMG) – Electrooculography (EOG) – X-ray – CT Scan – MRI scan – Biological Applications in Engineering –Neurons and Neural Network.

UNIT – V	BIOLOGY AND ITS INDUSTRIAL APPLICATION	5

Bioreactors – Bio pharming – Recombinant vaccines – Cloning – Drug discovery – Bioremediation – Bio fertilizer – Bio control – Bio filters – Biosensors – Biopolymers – Bioenergy – Biomaterials – Biochips.

TOTAL : 30 Periods

COURSEOUTCOMES:

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

- Explain the fundamentals of living things, their classification, cell structure and biochemical constituents. [Understand]
- Apply the concept of plant, animal and microbial systems and growth in real life situations. [Apply]
- Analyze biological engineering principles and procedures needed to solve societal issues. [Analyze]

TEXT BOOKS:

1. R.C.Dubey, “A Text book of Biotechnology”, S. Chand Higher Academic Publications, 2013.
2. R. Khandpur, “Biomedical instrumentation - Technology and applications”, McGraw Hill Professional, 2004.

REFERENCES:

1. Arthur T. Johnson, “Biology for Engineers”, CRC Press, Taylor and Francis, 2nd Edition, 2019.
2. Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, “Cell Biology and Genetics (Biology: The unity and diversity of life Volume I)”, Cengage Learning, 12th Edition, 2008.
3. Gerard J. Tortora and Bryan H.Derrickson, “Principles of Anatomy and Physiology”,15thEdition,Wiley publications, 2016.

Semester III

ourse Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UMA322	Probability, Queueing Theory and Numerical Methods (Common to CSE,IT,IoT and Cyb.sec)	3	1	0	4	BS
R21UIT302	Data Structures (Common to CSE,IT,AIDS,CSD,AIML,IOT and Cyb.sec)	3	0	0	3	PC
R21UCS303	Object Oriented Programming using C++ (Common to CSE,IT,CSBS,CSD,AIML, IOT and Cyb.sec)	3	0	0	3	PC
R21UIT304	Principles of Operating Systems (Common to CSE,IT,AIDS,CSD,AIML)	3	0	0	3	PC
R21UCS305	Computer Organization (Common to CSE,IT,CSBS,AIDS,AIML and Cyb.sec)	3	0	0	3	PC
R21UCD306	Database System Design (Common to CSE,IT,AI&DS,CSD,AIML,IOT)	3	0	0	3	PC
PRACTICAL						
R21UIT307	Data Structures Laboratory (Common to CSE,IT,AI&DS,CSD,AIML,IOT and Cyb.sec)	0	0	2	1	PC
R21UCD308	Database System Design Laboratory (Common to CSE,IT,AI&DS,CSD,AIML,IOT)	0	0	2	1	PC
R21UCS309	Object Oriented Programming using C++ Laboratory(Common to CSE,IT,CSBS,CSD,AIML,IOT and Cyb.sec)	0	0	2	1	PC
MANDATORY						
R21UGM331	Environmental Science (Common to All Branches)	2	0	0	P/F	MC
	TOTAL	**20**	**1**	**6**	**22**	
Total No of Credits - 22						

R21UMA322	PROBABILITY, QUEUEING THEORY AND NUMERICAL METHODS (COMMON TO CSE AND IT)	L	T	P	C
		3	1	0	4

PRE-REQUISITE:

COURSE OBJECTIVES :

- To make the student acquire sound knowledge of standard distributions that can describe real life phenomena.
- To provide the basic characteristic features of a queuing system and develop the skills in analyzing queuing models.
- To acquaint the student with the roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations and Eigen value problem of a matrix can be obtained numerically where analytical methods fail to give solution.

UNIT I	PROBABILITY & RANDOM VARIABLES	9 +3

Axioms of probability - Conditional probability - Total probability - Discrete and continuous random variables - Moments - Moment generating functions and their properties. Binomial, Poisson, Normal and Exponential- Joint probability distributions - Marginal and Conditional distributions – Covariance - Correlation and Regression.

UNIT II	QUEUEING THEORY	9+3

Definitions – Basic terms of Queueing theory - Markovian models – Birth and Death Queuing models - Steady state results: Single and multiple server queuing models - Little's Formula - Queues with finite waiting rooms - Finite source models.

UNIT III	CURVE FITTING	9+3

Method of Group Averages – The least squares method – Fitting a straight line - Fitting a Parabola - Fitting a curve of the form y = axb - Fitting an exponential curve – Method of moments.

UNIT IV	SOLUTION OF ALGEBRAIC, TRANSCENDENTAL EQUATIONS AND EIGENVALUE PROBLEMS	9 +3

Iteration method – Newton-Raphson method – Gauss Elimination method – Pivoting – Gauss Jordan methods –iterative methods : Gauss Jacobi method ,Gauss Seidel method - Eigen values of a matrix by Power method – Jacobi's method for a real symmetric matrix

UNIT V	NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS	9+3

Single step methods: Taylor series method – Euler method, Modified Euler's Method – Fourth order Runge – Kutta method for solving first and second order equations – Multistep methods: Milne's and Adam's predictor and corrector methods

TOTAL : 45 (L) + 15 (T) = 60 Periods

COURSE OUTCOMES:

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

- Apply the knowledge of probability and distributions to solve Engineering problems. (CO1) AP – K3
- Analyze the characteristic features of queuing models in computer system and networks.(CO2) A – K4
- Apply the knowledge of curve fitting methods to fit a curveof a given data set inEngineering problems. (CO3). AP – K3
- Apply Numerical techniques to solve the Engineering problems involving system of equations and Eigen values. (CO4) AP – K3
- Apply Numerical techniques to solve first and second order Ordinary Differential Equation. (CO5). AP – K3
- Explain the concepts of probability, Markovian queue and Numerical techniques. (CO6) U-K2

TEXT BOOKS:

- GUPTA S.C, KAPOOR V.K. "Fundamental of Mathematical Statistics", 10th Edition,Sultan Chand and Sons, New Delhi, 2002.
- GREWAL, B.S. "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 35th Edition, (2010).
- VEERARAJAN T. "Probability, Statistics and Random Process with Queueing theory and Queueing Networks", Tata McGraw Hill Education, New Delhi-6, 4th Edition, (2006).
- IYENGAR S.R.K , JAIN R.K. , MAHIDEN KUMAR JAIN " Numerical Methods for Scientific and Engineering Computations" New Age International Publishers 7th Edition 2019

REFERENCE BOOKS:

1. ALLEN.A.O, "Probability, Statistics and Queuing Theory with Computer Applications", Elsevier, New Delhi, 2nd Edition, (2005).
2. TAHA.H. A., "Operations Research-An Introduction", Pearson Education, New Delhi, 9th Edition, (2010).
3. TRIVEDI.K. S., "Probability & Statistics with Reliability, Queuing & Computer Science Applications", Prentice Hall of India, New Delhi, 2nd Edition, (2009).
4. JOHNSON R.A, and GUPTA C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, New Delhi, 8thEdition, (2011).
5. SUBRAMANIAN .N "Probability and Queueing Theory ", SCM Publishers 2010.

R21UIT302	DATA STRUCTURES (Common to CSE,IT,AI&DS,CSD,CSE(AI&ML))	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To introduce the fundamental concept of data structures and to emphasize the importance of data structures in developing and implementing efficient algorithms.
- To impart a thorough understanding of linear non-linear data structures such as list, stacks, queues, trees, graphs and their applications.
- To impart familiarity with various sorting, searching and hashing techniques and their performance comparison

UNIT I	LINEAR DATA STRUCTURE –LIST	9

Basic Terminologies: Elementary Data Organizations, Abstract Data Types (ADTs) – List ADT– linked list implementation –singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

UNIT II	LINEAR DATA STRUCTURE – STACK, QUEUE	9

Stack ADT – Operations – Applications – Evaluating arithmetic expressions- Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – Priority Queue – deQueue – applications of queues.

UNIT III	NON-LINEAR DATA STRUCTURE – TREE, HEAP	9

Introduction – Basic Terminology – Traversal – Operations: Binary trees – Binary Search trees. Heap: Binary Heaps – Binomial Heaps– Comparison – Applications.

UNIT IV	NON-LINEAR DATA STRUCTURE – GRAPH	9

Introduction – Graph Terminology – Representation of Graphs – Graph Traversal – Topological sort – Minimum Spanning Trees – Prim's and Kruskal's Algorithm – Shortest path algorithm – Dijkstra's algorithm -Applications of graphs.

UNIT V	SEARCHING, SORTING AND HASHING	9

Searching: Linear Search – Binary Search, Sorting: Selection Sort – Bubble Sort – Insertion Sort – Merge sort – Quick sort – Hashing: Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

COURSE OUTCOMES:

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

- Understand the basic concepts of data structures and algorithm like linear and non-linear (Understand)
- Apply appropriate data structure and algorithm design method for a specified application. (Apply)
- Compare and contrast alternative data structure applications to select the best process . (Analyze)
- Design and develop efficient linear, non-linear, sorting, searching and hashing data structure algorithms to solve problems.(Create)
- Evaluate the problems and find solutions using linear, non-linear applications, searching, sorting and hashing algorithms.(Evaluate)
- Work individually or in teams and demonstrate the solutions to the given exercises through presentation. (Affective Domain)

TEXT BOOKS

1. ReemaThareja, “Data Structures Using C”, Oxford University Press, Second Edition, 2014.
2. Weiss. M.A, "Data Structures and Algorithm Analysis in C", Pearson Education, 2nd Edition, 2012.

REFERENCE BOOKS

1. Aaron M.Tenenbaum, YedidyahLangsam, Moshe J.Augenstein, "Data Structures using C", Pearson Education India, 7th Edition, New Delhi, 2009.
2.Aho.V, Hopcroft.J.E, Ullman.J.D, "Data Structures and Algorithms", Pearson Education, 1st Edition Reprint, 2006

R21UCS303	OBJECT ORIENTED PROGRAMMING USING C++ (Common to CSE,IT,CSBS,CSD,CSE(AI&ML))	L	T	P	C
		3	0	0	3

PROGRAMMING COURSE OBJECTIVES:

- To explain OOP principles in C++.
- To introduce generic programming and exception handling mechanism.
- To enable the students to work with files

UNIT I	INTRODUCTION	9

Object-Oriented Paradigm – Elements of Object Oriented Programming — Directives – Operators – Control Statement – Arrays – Structures – Enumerations - Functions-Inline functions – default arguments.

UNIT II	CLASSES AND OBJECTS	9

Classes and Objects – Passing objects as arguments – returning objects – Friend functions– Constructors –Parameterized constructor– Copy constructor – Destructor - Array of Objects – pointer to object members – Static member. .

UNIT III	POLYMORPHISM	9

Polymorphism – Function overloading – Unary operator overloading – binary operator overloading – Data Conversion – Overloading with Friend Functions.

UNIT IV	INHERITANCE AND VIRTUAL FUNCTIONS	9

Inheritance –Derived class – Abstract Classes – Types of Inheritance - Virtual functions – Need – Definition – Pure Virtual Functions – Virtual Destructors

UNIT V	TEMPLATES, EXCEPTION HANDLING AND FILES	9

Template – Class template – Function Template - Exception handling – catching multiple exceptions – - Streams and formatted I/O – I/O manipulators - File modes – File I/O

COURSE OUTCOMES:

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

- Explain the concepts of object oriented programming principles and its benefits. (Understand)
- Apply the object orientation to solve real world problems.(Apply)
- Analyze the complex engineering problems and reach the conclusion using the object oriented programming standards. (Analyze)
- Design object oriented programming solutions for real world problems that meet the specified needs with appropriate consideration (Create)
- Apply appropriate techniques and modern IT tools with an understanding of the limitations in object oriented programming. (Modern Tool Usage)
- Work individually or in teams and communicate effectively to solve real world problems using object oriented programming principles. (Affective domain)

TEXT BOOK :

1. K.R.Venugopal, RajkumarBuyya, T.Ravishankar, ”Mastering C++”, Tata McGraw Hill, 2nd Edition, 2013.

REFERENCE BOOKS:

1. Robert Lafore, Object Oriented Programming in C++, Pearson, 4th Edition, 2002.
2. Ira Pohl, “Object Oriented Programming using C++”, Pearson Education, Second Edition,Reprint, 2004.
3. Lippman.S.B, JoseeLajoie, Barbara E. MooC++ Primer”, Pearson Education, ,fourth Edition, 2005.
4. E.Balagurusamy, Object-Oriented Programming with C++, 7th Edition,2017.

R21UIT304	PRINCIPLES OF OPERATING SYSTEMS (Common to CSE,IT,AI&DS,CSD,CSE(AI&ML))	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To impart major Operating System components and its principles
- To provide an in-depth exposure to process, memory, device and file management techniques
- To initiate knowledge on various security challenges related to Operating Systems.

UNIT I	FUNDAMENTALS AND PROCESS CONCEPTS	9

Introduction: Introduction: Mainframe systems – Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems – Real Time Systems – Handheld Systems - Hardware Protection Operating System operations, Kernel data structures, computing environments.

Operating System structure: Operating System Services, User- Operating System interface, System Calls, Types of system calls, system programs, Operating System design and implementation.

Processes:Interprocess communication, cooperating Process

UNIT II	PROCESS SYNCHRONIZATION AND SCHEDULING	8

Threads: Overview, Multithreading models, Threading issues

Process Synchronization: The critical section problem, Peterson's solution, Mutex locks, Semaphores, Classical problems of synchronization.

Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms

UNIT III	DEADLOCK AND MAIN MEMORY MANAGEMENT	9

Deadlocks: System Model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection and recovery from deadlock.

Main Memory: Background, swapping, Contiguous memory allocation, Segmentation, Paging, Structure of page table.

UNIT IV	VIRTUAL MEMORY MANAGEMENT AND VIRUTALIZATION	10

Virtual Memory: Background, Demand paging, Copy on write, Page replacement algorithms, Allocation of frames, Thrashing

Virtualization : Virtual Machines Virtualization (Hardware/Software, Server, Service, Network)

Hypervisors -OS - Container Virtualization - Cost of virtualization

UNIT V	STORAGE MANAGEMENT AND SAFETY METHODS	9

File Concepts: File System Structure – File System Implementation – Directory Implementation – Allocation Methods – Free-space Management- IO Systems- Kernel I/O Subsystems – Mass Storage Structure: Disk Structure – Disk Scheduling

Disk Management – Swap-Space Management

Protection And Security : Goals, Principles, Domain, Access Matrix, Access Control, Revocation of access rights and Capability Based Systems Security Problems, Program Threats, System and Network Threats, Cryptography as a security tool

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Realize the concepts of operating system structures, services and functionalities.(Understand)
- Apply Various Process Scheduling Algorithms, Disk Scheduling algorithms, Page replacement algorithms. Deadlock detection and avoidance techniques for providing Operating System functionalities.(Apply)
- Analyze various process management concepts (including scheduling, synchronization and deadlocks), Memory Management strategies and Design considerations of file system.(Analyze)
- Design solutions for complex engineering processes that meet specified needs with Scheduling, Synchronization, Page replacement and Disk Scheduling algorithms using Programming Language and present the same along with the report.(Evaluate)
- Evaluate the Multiprogramming, Synchronization and Virtual Memory Concepts.(Evaluate)
- Make an effective communication and presentation in a team to demonstrate the concepts of OS. (Affective domain)

TEXT BOOK:

1. Abraham Silberschatz, Peter Galvin, Greg Gagne, Operating Systems Concepts,9thEdition, John Wiley Edition

REFERENCE BOOKS:

1. William Stallings, Operating Systems –Internals and Design Principles, 7th Edition, Prentice Hall, 2012

2. Andrew S.Tanenbaum, Modern Operating System, 2014, 4th Edition Pearson.

R21UCS305	COMPUTER ORGANIZATION (Common to CSE,IT,CSBS,AI&DS,SE(AI&ML))	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To familiarize the components of computer system and instructions
- To discuss in detail the operation of the arithmetic unit.
- To design pipelining and parallel processing architecture
- To give knowledge on memory and I/O systems

UNIT I	OVERVIEW AND INSTRUCTIONS	9

Components of a computer system – Basic Operational Concepts – Operations and Operands – Representing instructions – Logical Operations – Control Operations – Instruction and Instruction Sequencing – Addressing and Addressing modes.

UNIT II	ARITHMETIC OPERATIONS	9

Addition and Subtraction of signed numbers – Multiplication of unsigned and signed numbers – Fast Multiplication – Integer division – Floating point numbers and operations – ALU – Data path and Control Unit.

UNIT III	PIPELINING & PARALLEL PROCESSORS	9

Pipelining – Instruction and Arithmetic Pipeline – Data hazards – Instruction hazards – Superscalar operation.

Parallel processors: Introduction to parallel processors, Concurrent access to memory and cache coherency

UNIT IV	MEMORY CONCEPTS	9

Memory hierarchy - Memory technologies – Cache basics – Measuring and improving cache performance - Virtual memory, TLBs- Memory Management Requirements

UNIT V	I/O SYSTEMS	9

Input/output system-Accessing I/O Devices – Interrupts – Direct Memory Access – Bus Structure – Bus Operation – Arbitration – Interface Circuits – USB

TOTAL:45Periods

COURSE OUTCOMES:

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

- Explain the functional units and components of a computer system. (Understand)
- Apply the principles of computing to identify solutions for complex computing problems. (Apply)
- Analyze the design issues in terms of speed, technology, and cost to improve the performance of CPU. (Analyze)
- Analyze the technologies used to measure and improve the cache performance. (Analyze)
- Design a processor considering the performance issues of memory and CPU. (Create)
- Work individually or in teams and communicate effectively to justify the computing practice based on legal and ethical principles. (Affective domain)

TEXT BOOKS:

1. Carl Hamacher, ZvonkoVranesic and SafwatZaky, “Computer Organization”, Fifth Edition, Tata McGraw Hill, 2002.
2. David A. Patterson and John L. Hennessey, “Computer organization and design the hardware / software interface”, Morgan Kauffman / Elsevier, Fifth edition, 2014.

REFERENCE BOOKS:

1. William Stallings “Computer Organization and Architecture” , Seventh Edition , Pearson Education, 2006.
2. Vincent P. Heuring, Harry F. Jordan, “Computer System Architecture”, Second Edition, Pearson Education, 2005.
3. Govindarajalu,“Computer Architecture and Organization, Design Principles and Applications", first edition, Tata McGraw Hill, New Delhi, 2005.
4. John P. Hayes, “Computer Architecture and Organization”, Third Edition, Tata McGraw Hill, 1998.

R21UCD306	DATABASE SYSTEM DESIGN (Common to CSE,IT,AI&DS,CSD,CSE(AI&ML))	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To impart the knowledge in Relational Database Management Systems.
- To learn SQL and Normalization techniques.
- To familiarize in transaction management.
- To understand the storage and retrieval mechanisms in Databases.
- To learn query optimization techniques.
- **To gain knowledge in NoSQL.**

UNIT I	RELATIONAL DATABASES	9

Purpose of Database System – Views of data – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – Entity-Relationship model – ER Diagrams – Enhanced ER Model – ER to Relational Mapping

UNIT II	SQL AND NORMALIZATION	9

SQL fundamentals – Advanced SQL – Embedded SQL – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce-Codd Normal Form-PL/SQL

UNIT III	TRANSACTION PROCESSING AND CONCURRENCY CONTROL	9

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery - Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery

UNIT IV	IMPLEMENTATION TECHNIQUES	9

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 – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation

UNIT V	NoSQL	9

Overview of NoSQL Databases - Definition of the Four Types of NoSQL Database - Comparison of relational databases to new NoSQL stores -NoSQL Key/Value databases using MongoDB -CRUD operation in MongoDB - Column oriented NoSQL databases using Apache Cassandra, Create, Alter & Drop Key space in Cassandra - Cassandra Query Language (CQL): Insert Into, Update, Delete.

TOTAL:45 Periods

COURSE OUTCOMES:

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

- Explain the basic as well as advanced concepts of Database Management Systems.(Understand)

- Apply the database design techniques to find solutions to complex engineering problems in real world applications.(Apply)
- Analyze various database design techniques to develop a database application for a given scenario.(Analyze)
- Evaluate various storage and query evaluation plans to optimize query cost.(Evaluate)
- Design Database for a given real life scenario using the concepts of Relational model and ER diagrams (Create)
- Work individually or in teams and demonstrate the solutions to the given exercises through presentation (Affective Domain)

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, “Database System Concepts”, McGraw Hill Education (India) Private Limited, Sixth Edition, 2013.
2. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Pearson Education, Eighth Edition, 2006
3. PramodJ.Sadalage, Martin Fowler “NoSQLA Brief Guide to the emerging World of Polyglot Persistence Distilled”, Pearson Education Inc, 2013

REFERENCE BOOKS:

1. RamezElmasri and ShamkantB.Navathe, “Fundamentals of Database Systems”, Fifth Edition, Pearson Education, 2008.
2. Raghu Ramakrishnan, “Database Management Systems”, Fourth Edition, Tata McGraw Hill, 2010.
3. AtulKahate, “Introduction to Database Management Systems”, Pearson Education, New Delhi, 2006.
4. Alexis Leon and Mathews Leon, “Database Management Systems”, Vikas Publishing House Private Limited, New Delhi, 2003.

R21UIT307	DATA STRUCTURES LABORATORY (Common to CSE,IT,AI&DS,CSD,AIML,IOT and Cyb.sec)	L	T	P	C
		0	0	2	1

PRE-REQUISITE :

COURSE OBJECTIVES:

- To teach the students to write programs in C.
- To implement the various data structures as Abstract Data types.
- To demonstrate the systematic way of solving problems using linear and non – linear data structures
- To demonstrate the sorting, searching algorithms

LIST OF EXPERIMENTS

1. Simple C Programs
    a. Programs using recursion
    b. Programs using structures
    c. Programs using pointers
2. Linked List Implementation of List ADT
3. Array implementation of stack ADT
4. Linked list implementations of stack ADT
5. Checking 'Balanced Parentheses' using Array implementation of stack
6. Implementation of queue using
    a. Arrays
    b. Linked List
7. Binary Search Trees – implementation
8. Implement the Dijkstra's Algorithm
9. Implementation of minimum spanning using
    a. Kruskal algorithm
    b. Prims algorithm
10. Program to sort set of elements using
    a. Insertion sort
    b. Merge sort
    c. Quick sort

TOTAL : 30 Periods

COURSE OUTCOMES:

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

- Apply the knowledge of linear, non- linear & sorting algorithm in data structures to develop optimal solution for various applications. (**Apply**)
- Apply the knowledge in various algorithms to find solution for complex engineering problem. (**Apply**)
- Analyze the data structures algorithms by finding a best solution for real world problem. (**Analyze**)
- Evaluate the algorithms to improve the efficiency and effectiveness in a complex engineering problem. (**Evaluate**)
- Build innovative solutions for complex computational problems by Integrating multiple algorithms in data structures. (**Create**)

- Work individually or in teams and demonstrate the solutions to the given problems through presentation. (**Value**)

HARDWARE AND SOFTWARE REQUIRMENTS

Hardware requirements:

Personal computers with 16GB RAM ,1 TB HDD,Mointor ,Keyboard and Mouse-30 Numbers

Software requirements:

Turbo C Windows OS /Linux Operating System with GCC

R21UCD308	DATABASE SYSTEM DESIGN LABORATORY (Common to CSE,IT,AI&DS,CSD,AIML,IOT)	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To demonstrate the creation and usage of database
- To understand the concepts of SQL, NoSQL

LIST OF EXPERIMENTS

1. A TV Company wishes to develop a database to store data about the TV series that the company produces. The data includes information about actors who play in the series, and directors who direct the episodes of the series. Actors and directors are employed by the company. A TV series are divided into episodes. Each episode may be transmitted at several occasions. An actor is hired to participate in a series, but may participate in many series. Each episode of a series is directed by one of the directors, but different episodes may be directed by different directors.
   Create tables with necessary integrity constraints. Insert minimum of 10 records in each table.

2. A departmental store has many sections such as Toys, Cosmetics, Clothing, Household Items, and Electronics etc. Each section has many employees. Employees can belong to only one section. In addition, each section also has a head that is responsible for the section's performance.
   The department store also has many customers who purchase goods from various sections. Customers can be of two types Regular and Ad-hoc. Regular customers get credit at the department store. Maximum credit limit allowed is Rs.10000. The store procures goods from various suppliers. The goods are stored in a warehouse and transferred to the store as and when requirement comes up. Quantity of goods supplied cannot be less than 0 and cannot be greater than 10000 for a particular supply. The store has a computerized system for all its operations.
   Create the tables with all appropriate constraints. Use the constraints UNIQUE, NOT NULL, CHECK, PRIMARY KEY, FOREIGN KEY etc. wherever necessary.

3. Solve the following queries using the database created in Ex.1:
   i. Which actors play in the series 'The Devil'?
   ii. In which series does the actor 'Rayan' participate?
   iii. Which actors participate in more than one series?
   iv. How many times has the first episode of the series 'The Devil' been transmitted? At what times?
   v. How many directors are employed by the company?
   vi. Which director has directed the greatest number of episodes?

4. Solve the following queries using the database created in Ex.2:
   i. Find all employees whose names begin with A and end with A.
   ii. Find all products whose descriptions have the characters me.
   iii. Find the total salary paid by each section to employees.
   iv. Display the section names and the names of the employees who belong to that section.
   v. Display the section name and the name of the person who heads the section.
   vi. Display supplier names and cities. If the city is null, display LOCAL.
   vii. Display the customer names and the customer type. If the customer type is R, display

as ‘Regular’. If the customer type is A, display ‘Ad-hoc’.

5. A municipality needs a database containing information concerning the inhabitants of the municipality. The database will be used for the planning of schools, health care and child care. From the database, you should be able to receive answers to queries of the following types: (Use library functions and aggregate functions)
   i. How many boys and girls will start school during year *x*?
   ii. How many people will become old-age pensioners during year *x*?
   iii. How many households have more than *x* people?
   iv. How many people are single parents?
   v. In how many households is at least one member unemployed?
   vi. How many households have a total income that is less than the norm for receiving social benefits?

6. A medical health research project has a database containing data about all patients at a hospital. For each patient, data about the symptoms that the patient shows is registered: fever, headache, cough, chest pains, . . . Symptoms can have different severity: low, middle, or high. A patient may show several symptoms, e.g., high fever, medium headache and some cough. The database also contains data about diseases. Each disease is characterized by different symptoms: a patient with a cold should have fever and a cough, a malaria patient should have fever and fits of shivering, etc.
   Write SQL statements that answer the following questions (define and use views). Find the names of all patients that:
   i. don’t have any symptom of high severity,
   ii. have at least two different symptoms,
   iii. have at least one of the symptoms of malaria
   iv. have all the symptoms of malaria.

7. A company has several employees, all with different names, who perform interviews with job applicants (one applicant is interviewed by one employee). The job applicants also have different names. The interviewer makes appointments for interviews with the applicants. Each applicant may be interviewed at several occasions, possibly by different interviewers, but in that case the interviews take place during different days.
   The company has special interview rooms. Each interviewer uses the same room for all interviews during a day. A room may, however, be used by different interviewers during a day, as long as the interviews don’t collide in time.
   The reservation of interview appointments is to be computerized. The database developer has decided to use a single relation for all data, with the following schema:
   Interviews(interviewer, applicant, day, time, room)
   i. From the text, find functional dependencies in the relation.
   ii. Find the keys of the relation.
   iii. Show that the relation is in 3NF but not in BCNF.
   iv. Decompose the relation in relations that are in BCNF.
8. Shops sell items at varying prices. Customers buy items from shops. This is described by the following relations:
   Shops(shopId, name, address)
   Items(itemId, name, description)
   Sells(shopId, itemId, price)
   Customers(customerId, name, address)
   Sales(saleId, customerId, itemId, shopId, date)
   i. Write a procedure to print the name and address of all customers who haven’t bought any item.
   ii. Write a procedure for all customers that have bought at least one item: print the

customer id and the total sum of all purchases.

iii. Write a function to print the number of shops that sell items with id's starting with 'EF'.

iv. Write a function to print the name and address of the shop(s) that sell the item with id = 'EF123-A' at the lowest price.

9. A company organizes its activities in projects. Products that are used in the projects are bought from suppliers. This is described in a database with the following schema:

   Projects(projNbr, name, city)
   Products(prodNbr, name, color)
   Suppliers(supplNbr, name, city)
   Deliveries(*supplNbr, prodNbr, projNbr*, number)

   i. Write a trigger which displays a message whenever an entry is made in the table 'Deliveries'.
   ii. Write a trigger which is invoked automatically whenever a product is supplied to the city 'London'.
   iii. Execute an exception if the 'number' field in 'Deliveries' table is zero.

10. Design a logical data model for Hotel App using a cassandra physical Model. A hotel that wants to allow guests to book a reservation. Our conceptual domain includes hotels, guests that stay in the hotels, a collection of rooms for each hotel, and a record of the reservation, which is a certain guest in a certain room for a certain period of time (called the "stay"). Hotels typically also maintain a collection of "points of interest," which are parks, museums, shopping galleries, monuments, or other places near the hotel that guests might want to visit during their stay. Both hotels and points of interest need to maintain geo location data so that they can be found on maps for mash ups, and to calculate distances.

TOTAL : 30 Periods

COURSE OUTCOMES:

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

- Apply the concepts of database systems to design a good database schema for a given application. (Apply)
- Construct queries using SQL and NoSQL to extract information from a database. (Apply)
- Analyze various database design techniques to develop a database application for a given scenario. (Analyze)
- Design Database application for a given real-life scenario using the concepts of SQL, PL/SQL, and NoSQL. (Create)
- Communicate effectively to justify the computing solutions based on legal and ethical principles. (Value-Affective domain)
- Function effectively as an individual or in teams to develop database applications for a given scenario. (Value-Affective domain)

HARDWARE AND SOFTWARE REQUIRMENTS

- **HARDWARE REQUIREWMENTS:**

  Personal computers with 16GB RAM ,1 TB HDD,Mointor ,Keyboard and Mouse – 30 Numbers

- **SOFTWARE REQUIREMENTS:**

  Oracle Apex Cloud Workspace SQL /NoSQL

R21UCS309	OBJECT ORIENTED PROGRAMMING USING C++ LABORATORY (COMMON TO CSE,IT,CSBS,CSD,AIML,CYBER SECURITY,IoT)	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To demonstrate OOP principles using C++.

List of Exercises

1. Implement Simple C++ Programs
2. Implement C++ programs using functions
3. Implement C++ Programs using classes
4. Implement C++ Programs to demonstrate Constructors and Destructors
5. Implement C++ Programs to demonstrate Function overloading
6. Implement C++ Programs to demonstrate Operator overloading
7. Implement C++ Programs to demonstrate Inheritance
8. Implement C++ Programs to demonstrate Polymorphism and Virtual functions
9. Implement C++ Programs using function templates and class templates.
10. Write a program to apply Exception handling methods for a given problem.

TOTAL: 30 Periods

COURSE OUTCOMES:

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

- Apply the concepts of object oriented programming principles and its benefits**.(Apply)**
- Apply the object orientation concepts to solve complex real world problems. **(Apply)**
- Analyze the complex engineering problems and reach the conclusion using the object oriented programming standards. **(Analyze)**
- Design object-oriented programming solutions for real world problems that meet the specified needs with appropriate consideration **(Create)**
- Evaluate the performance of C++ application to improve the efficiency of a real time system. **(Evaluate)**
- Function effectively as a member or leader in a team by participating in the development of software Project using oops concepts in C++. (**Individual and Team work**)

HARDWARE AND SOFTWARE REQUIRMENTS

- **HARDWARE REQUIREWMENTS:**

  Personal computers with 16GB RAM ,1 TB HDD,Mointor ,Keyboard and Mouse – 30 Numbers

- **SOFTWARE REQUIREMENTS:**

  Any C++ compiler compatible with Linux / Windows

R21UGM331	ENVIRONMENTAL SCIENCE (COMMON TO ALL BRANCHES)	L	T	P	C
		2	0	0	P/F

PRE-REQUISITE:

COURSE OBJECTIVES:

- To explain the concepts of Environment and ecosystem.
- To describe the knowledge about the impact of environmental pollution.
- To impart the environmental issues in the society.
- To explain the knowledge about the impact of environment related to human health.
- To describe the knowledge in alternative energies**.**

UNIT I	ENVIRONMENT AND ECOSYSTEMS	6

Definition, scope and importance of environment – Need for public awareness – Concept of ecosystem–Structure and function of ecosystem–Producers, consumers and decomposers-Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Aquatic ecosystems (c) Grassland ecosystem.

UNIT II	ENVIRONMENTAL POLLUTION	6

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution - pollution case studies - Role of an individual in prevention of pollution –Disaster management: floods, earthquake, cyclone and landslides.

UNIT III	SOCIAL ISSUES AND THE ENVIRONMENT	6

Water conservation, rain water harvesting, watershed management – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. Environmental laws/Acts, (EPA).

UNIT IV	HUMAN POPULATION AND THE ENVIRONMENT	6

Population growth, variation among nations – Population explosion – Human rights – Family welfare programme – Environment and Human Health – Human Rights - Value education – HIV / AIDS – Women and child welfare – Role of information technology in environment and human health.

UNIT V	FUTURE POLICY AND ALTERNATIVES	6

Introduction to future policy and alternatives - fossil fuels - nuclear energy - solar energy- wind energy - hydroelectric energy - geothermal energy - tidal energy – sustainability- green power - nano technology.

Total: 30 Periods

COURSE OUTCOMES:

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

- Understand the basic concept of structure and function of ecosystem (Understand)

- Apply the knowledge of various pollution types to prevent the ecosystem and Environment (Apply)
- Analyze the environmental problem to report the social issues and the environment. (Analyze)
- Compare the suitable methods for conservation and sustainable development of natural resources (Analyze)
- Apply the principles of value education with respect to human population to preserve environment (Apply)
- Analyze the current energy crisis and suggest suitable sustainable alternatives that promote social health and environmental prospects. (Analyze)

TEXT BOOKS:

1. AnubhaKaushik, kaushik C.P., “Environmental Science and Engineering”, Third Edition, New Age International, New Delhi, 2009
2. Benny Joseph “Environmental Science and Engineering”, Tata Mc-Graw Hill, New Delhi, 2006.

REFERENCE BOOKS:

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', Pearson Education,Upper saddle River, New Jersey, 2008.
2. Miller T.G. Jr., Environmental Science”, Wadsworth Publishing Company, Belmont, California, 2005.
3. De A.K., “Environmental Chemistry”, Wiley Eastern Ltd., New Delhi, 2001.
4. Trivedi R.K., Goel P.K., “Introduction to Air Pollution”, Techno-Science Publication,Jaipur, 2005.

Semester IV

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UMA421	Transforms and Discrete Mathematics (Common to CSE,IT ,AIML, IoT &Cyb.sec))	3	1	0	4	BS
R21UCS402	Computer Networks (Common to CSE ,IT,CSD, Cyb.sec)	3	0	0	3	PC
R21UCS403	Algorithm Analysis (Common to CSE ,IT,CSD,AIDS,AIML, IoT &Cyb.sec)	3	0	0	3	PC
R21UIT404	Java Programming (Common to CSE ,IT,CSD,AIML, IoT & Cyb.sec)	3	0	0	3	PC
R21UIT405	Software Engineering Methodology (Common to CSE ,IT , IoT)	3	0	0	3	
R21UEC425	Microprocessors and Microcontrollers	3	0	0	3	ES
PRACTICAL						
R21UEC426	Microprocessors and Microcontrollers Laboratory	0	0	2	1	ES
R21UCS407	Computer Networks Laboratory (Common to CSE ,IT,CSD, Cyb.sec)	0	0	2	1	PC
R21UIT408	Java Programming Laboratory (Common to CSE ,IT,CSD,AIML, IoT & Cyb.sec)	0	0	2	1	PC
MANDATORY						
R21UGM431	Gender Equality (Common to allBranches)	1	0	0	P/F	MC
	TOTAL	**19**	**1**	**6**	**22**	
Total No of Credits -22						

R21UMA421	TRANSFORMS AND DISCRETE MATHEMATICS (Common to CSE,IT ,AIML, IoT &Cyb.sec))	L	T	P	C
		3	1	0	4

OBJECTIVES :

- To make the student acquire sound knowledge to test the logic of program.
- To familiarize the student to be aware of generating functions.
- To acquaint the student with the basics of Z - transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the Z - transform technique bringing out the elegance of the procedure involved

UNIT I	LOGIC AND PROOF METHODS	9 + 3

Propositional Logic – Propositional equivalences - Predicates and quantifiers – Nested Quantifiers - Rules of inference - Introduction to Proofs - Proof Methods and Strategy.

UNIT II	COMBINATORICS	9 + 3

Permutations and Combinations - Mathematical inductions - Strong induction and well ordering - The basics of counting – The pigeonhole Principle – Recurrence relations – Solving Linear recurrence relations - Generating functions - Inclusion and exclusion and applications.

UNIT III	ALGEBRAIC STRUCTURES	9 + 3

Algebraic systems - Semi groups and Monoids – Groups - Subgroups and Homomorphisms - Cosets and Lagrange's theorem - Ring & Fields – Vector Spaces (Definitions and examples).

UNIT IV	FOURIER TRANSFORM	9 + 3

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity - Application of Fourier Transform

UNIT V	Z-TRANSFORM AND DIFFERENCE EQUATIONS	9 + 3

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and Final value Theorems - Formation of difference equations – Solution of difference equations.

TOTAL : 45 (L) + 15 (T) = 60 Periods

COURSE OUTCOMES:

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

- Apply the knowledge of logic and proofs to find the logical consistency of a given Engineering problems. (CO1) AP- K3
- Apply the knowledge of various combinatorical techniques to solve the real life Engineering problems.(CO2) AP – K3

- Apply the knowledge of algebraic structures to asses the properties of groups of Engineering problems. (CO3) AP – K3
- Apply the knowledge of Fourier transform to solve the Engineering problems. (CO4) AP – K3
- Apply the knowledge of Z transform to solve the Engineering problems.(CO5) AP – K3
- Explain the concepts of Logics, combinatorics and transforms.(CO6) U-K2

TEXT BOOKS:

1. KENNETH H.ROSEN, "Discrete Mathematics and its Applications", Special Indian Edition, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 5th Edition, (2008).
2. TREMBLY J.P and MANOHAR R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 35th Re-print, (2008).
3. VEERAJAN.T, "Engineering Mathematics for semester III", Tata McGraw-Hill, New Delhi (2000).

REFERENCE BOOKS:

1. RALPH. P. GRIMALDI, "Discrete and Combinatorial Mathematics: An Applied Introduction", Pearson Education, New Delhi, 4th Edition, (2002).
2. TAMILARASI.A, and NATARAJAN.A.M, "Discrete Mathematics and its Applications", Khanna Publishers, New Delhi, 3rd Edition, (2008).
3. SEYMOUR LIPSCHUTZ and MARK LIPSON, "Discrete Mathematics", Schaum's Outlines, Tata McGraw-Hill, New Delhi, 2nd Edition, (2007).
4. VEERARAJAN, T. "Discrete Mathematics with Graph Theory and Combinatorics", Tata McGraw-Hill, New Delhi, 7th Edition, (2008).
5. KANDASAMY.P, THILAGAVATHY.K, and GUNAVATHY.K, Engineering Mathematics III, Chand & Company Ltd., New Delhi, 3rd Edition, (1996).

R21UCS402	COMPUTER NETWORKS (Common to CSE ,IT,CSD, Cyb.sec)	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To describe the general principles of data communication components
- To describe the various functionalities of the different layers of the network
- To learn the logical addressing and different routing protocols
- To familiarize the transmission of data and the quality of service in the network
- To acquire the knowledge on the applications of the different protocols.

UNIT I	INTRODUCTION AND PHYSICAL LAYERS	9

Data Communication - Networks – Network Types – Protocol Layering – OSI Model - TCP/IP Protocol suite –– Physical Layer: Performance – multiplexing -Transmission media – Switching.

UNIT II	DATA LINK LAYER AND MEDIA ACCESS CONTROL	9

Error Detection and Error Correction –DLC Services – Data-Link Layer Protocols – HDLC – PPP - Media Access Control- Wired LANs- Ethernet –Wireless LAN- IEEE 802.11 –Bluetooth – Connecting Devices-FDDI

UNIT III	NETWORK LAYER	9

Network Layer Services – Logical Addressing- Internet Protocols (IPV4 and IPv6)– Address Mapping – Network Layer Protocols: ICMP – IGMP – ICMP v6 – Delivery- Forwarding – Routing Protocol (Unicast – Multicast)

UNIT IV	TRANSPORT LAYER	9

Transport Services – Elements of Transport Protocols -Process to Process Communication-UDP, TCP and SCTP- Congestion Control- QoS improving techniques- RPC

UNIT V	APPLICATION LAYER	9

WWW and HTTP- FTP –Email-Telnet-DNS-SNMP, Basic concepts of Cryptography and digital signature – Firewalls.

TOTAL : 45 Periods

COURSE OUTCOMES:

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

- Understand the data communication components and the various functionalities of different network layers (Understand)
- Apply the knowledge of layer functionalities to provide error free and congestion free data

flow. (Apply)

- Analyze the working principles of various protocols for effective data communication. (Analyze)
- Estimate the performance of various network parameters to improve QoS. (Evaluate)
- Design a LAN network with the principles of protocol stack for a given real world scenario. (Create)
- Work individually or in teams and demonstrate the solutions to the given exercises through presentation (Affective Domain)

TEXT BOOKS:

1. Behrouz A. Forouzan, “Data Communications and Networking”, Fifth Edition TMH, 2013.
2. William Stallings , “Data and Computer Communications”, Tenth Edition, Pearson Education, 2013.

REFERENCE BOOKS:

1 James F. Kuross, Keith W. Ross, “Computer Networking, A Top-Down Approach Featuring the Internet”, Addison Wesley, Third Edition, 2004.

2 Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.

3 Andrew S Tanenbaum, “Computer Networks”, PHI, 2010.

4 Nader F. Mir, “Computer and Communication Networks”, Pearson Education, 2007.

5 Comer, “Computer Networks and Internets with Internet Applications”, Pearson Education, Fourth Edition, 2007.

6 Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011.

R21UCS403	ALGORITHM ANALYSIS (Common to CSE ,IT,CSD,AIDS,AIML, IoT &Cyb.sec)	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To analyze a problem and identify the computing requirements appropriate for its solutions
- To summarize sorting , searching algorithms and report algorithm design methods
- To become familiar with the different algorithm design techniques

UNIT I	INTRODUCTION	9

Introduction – Notion of an Algorithm - Important Problem Types – Fundamentals of the Algorithm Analysis- Analysis Framework – Asymptotic Notations and its properties – Mathematical analysis for Recursive and Non-recursive algorithms.

UNIT II	SEARCHING AND TRAVERSAL TECHNIQUES	9

Brute Force - Selection Sort and Bubble Sort - Sequential Search and Brute-force string matching - Divide and conquer methodology – Merge sort – Quick sort – Binary search –Binary tree traversal algorithm, Graph traversals - Breadth first search and Depth first search.

UNIT III	ALGORITHMIC TECHNIQUES	9

Dynamic Programming – Warshall's and Floyd' algorithm – Optimal Binary Search Trees – Greedy Technique – Prim's algorithm- Kruskal's Algorithm - Dijkstra's Algorithm-Huffman Trees

UNIT IV	BACKTRACKING AND BRANCH AND BOUND	9

Backtracking – n-Queens problem – Hamiltonian Circuit Problem – Subset Sum Problem-Branch and Bound – Assignment problem – Knapsack Problem– Traveling Salesman Problem-Iterative Improvement-Maximum Flow Problem-Maximum Matching in Bipartite Graphs

UNIT V	NP-COMPLETE AND APPROXIMATION ALGORITHM	9

Tractable and intractable problems: Polynomial time algorithms – Venn diagram representation - NP-algorithms - NP-hardness and NP-completeness, Problem reduction: TSP – 3-CNF problem. Approximation Algorithms: TSP ,Knapsack Problem

Total: 45 Periods

COURSE OUTCOMES:

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

- Understand the concept of Notation of Algorithm that apply in various methodologies like brute force divide and Conquer, Greedy Techniques. [Understand]
- Apply various Methodology based algorithm and different types of searching sorting techniques for providing Betterment solution for the problems. [Apply]

- Analyze various methodology-based algorithm for enhancing the efficiency of the problem [Analyze]
- Analyze different set of problem and to Design a solution using algorithm design methodology [Design]
- Evaluate running time, efficiency of the problem using different set of algorithms [Evaluate]
- Demonstrate the algorithms with analyzed solution based on time complexity, efficiency and also shows the concepts of difference between different methodology using Virtualization tools**.** [Modern Tool Usage]

TEXT BOOKS:

1. AnanyLevitin, "Introduction to the Design & Analysis of Algorithm", Pearson Education Asia,Third Edition, 2012.

2. Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, "Computer Algorithms / C++", Universities Press, Second Edition, 2007.

REFERENCE BOOKS:

1.Thomas H Cormen, Charles E.L Leiserson, Ronald L Rivest, Clifford Stein, "Introduction to Algorithm", PHI Pvt. Ltd, Third Edition, 2012.

2.Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, Fundamentals of Computer Algorithms,Second Edition, Universities Press, Hyderabad, 2008.

3.FayezGebali," Algorithms and Parallel Computing", Willy (Indian Paperback Edition), 2011.

4.Aho.A.V, Hopcroft.J.E, Ullman.J.D, "The Design and Analysis of Computer Algorithms", Pearson Education Asia, Third Edition, 2008.

5.Lee. R.C.T, Tseng.S.S, Chang.R.C, Tsai Y.T, "Introduction to the Design and Analysis of Algorithms A Strategic Approach", McGraw-Hill Education, First Edition, 2005.

R21UIT404	JAVA PROGRAMMING (Common to CSE ,IT,CSD,AIML, IoT & Cyb.sec)	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To implement object-oriented designs with Java.
- To extend Java classes with inheritance and dynamic binding.
- To work with Java Collections API and Packages.
- To handle Exceptions with Exceptions classes.
- To make use of String Classes in Java

UNIT I	Java Fundamentals	9

Introduction to Java - Java Architecture –keywords –Identifiers –Variables – Data types– Operators– Type conversion–Selection control Structure –Iteration Control Structure

UNIT II	Introduction to Object Oriented Programming	9

Introduction to Object Oriented Programming–Methods – Constructors – This keyword — Memory management- Encapsulation - Abstraction - Access Modifiers – Arrays

UNIT III	Advanced Java Concepts	9

Inheritance- Introduction to inheritance- Single Inheritance – Multilevel Inheritance –Polymorphism – Method overloading –Method Overriding –Constructor overloading –Super keyword –Final Keyword- Static modifier –Abstract class – Interfaces

UNIT IV	Collections , Packages and Exception Handling	9

Collection Interface – Collection Class – Array List –Linked List –Introduction to Package – Import – Exception – Try – Throw – Catch –Finally – User defined Exception – throws

UNIT V	String Handling	9

String Constructors – Character extraction – String Comparison – Searching strings – String Buffer

TOTAL : 45 Periods

COURSE OUTCOMES:

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

- Explain the Object oriented features of Java . (Understand)
- Apply java programming to solve real world problems.(Apply)
- Analyze the suitable object oriented methodology for solving complex engineering problem.(Analyze)

- Design various real time applications.(Create)
- Use modern tools to implement java coding.(Modern Tool Usage[Apply])
- Work effectively with responsibility and positive attitude in a diversified team while solving complex problems.(Individual and Team Work)

Text Book:

1.Cay S. Horstmann "Core Java Volume I—Fundamentals", Pearson Publishers, Eleventh Edition, 2018

References:

1. Infosys Offered Course (https://infyspringboard.onwingspan.com/)

2. Herbert Schildt“ The Complete Reference Java “, McGraw Hill , Eleventh Edition , 2018

R21UIT405	SOFTWARE ENGINEERING METHODOLOGY (Common to CSE ,IT , IoT)	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- Understand the phases in asoftware project
- Understand fundamental concepts of requirements engineering and Analysis Modeling
- Understand the major considerations for enterprise integration and deployment
- Learn various testing and maintenance measures

UNIT I	Software Process	9

Introduction to Software Engineering, Software Process, Prescriptive Process Models and Specialized Process Models – Agile Process Model -Agile Manifesto and Principles

UNIT II	Requirement Analysis and Specification	9

Software Requirements: Functional and Non-Functional, User requirements, System Requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements Elicitation and Analysis, Requirements Validation, Requirements Management-Classical Analysis: Structured System Analysis, Petri Nets-Data Dictionary

UNIT III	Software Design and Development	9

Design Process – Design Concepts – Design Model-Design Heuristic – Architectural Design – Architectural Styles, Architectural Design, Architectural Mapping using Data Flow – User Interface Design: Interface Analysis, Interface Design – Introduction to Real Time Software Design – Component Level Design: Designing Class Based Components, Traditional Components

UNIT IV	Software Testing and Maintenance	9

Software Testing Fundamentals – Internal and External Views of Testing- White Box Testing – Basis Path Testing- Control Structure Testing- Black Box Testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing and Debugging –Software

Implementation Techniques: Coding Practices – Refactoring-Maintenance and Reengineering-BPRModel-Reengineering Process Model-Reverse and Forward Engineering.

UNIT V	Project Management	9

. Software Project Management: Estimation, Make/Buy Decision,COCOMO-II-Project Planning-Project Scheduling- Risk Management-RMMM Plan- CASE Tools

Total: 45 Periods

COURSE OUTCOMES:

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

- Elaborate the software engineering methodologies and project management techniques.(Understand)
- Apply the software development and management techniques for real time projects in agile scenario.(Apply)
- Analyze various software methodologies, design techniques,testing strategies by means of software project management .(Analysis)
- Design a process model which suits the business need.(Design)
- Use modern tools to demonstrate the software engineering process.(Modern Tool Usage)
- Work individually and as a member in multidisciplinary teams.(Individual and Team Work)
- Communicate effectively with the team in workplace.(Communication)

Text Books:

1. RogerPressman.S,"SoftwareEngineering–A Practitioner'sApproach",McGrawHillInternationalEdition,9th Edition,2019.

2. Ian Sommerville, "Software Engineering", Pearson Education Asia10th Edition,2017

References:

1. RajibMall,"FundamentalsofSoftwareEngineering",PHI Learning Private Limited, 3rd Edition,2009.
2. PankajJalote, "Software Engineering, A Precise Approach Fundamentals of SoftwareEngineering",WileyIndia, 2010.
3. Stephen R.Schach,"Software Engineering", Tata McGraw-Hill Publishing Company Limited,2007.

R21UEC425	MICROPROCESSORS AND MICROCONTROLLERS	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES:

- To develop an in-depth understanding of the operation of Microprocessors & Microcontrollers assembly language programming.
- To develop skills in interfacing peripheral devices with Microprocessor & Microcontroller.
- To learn about advanced microcontrollers

UNIT I	8086 MICROPROCESSOR ARCHITECTURE AND PROGRAMMING	9

8086 Microprocessor architecture – Signals – Maximum & Minimum mode Configuration - Addressing modes - Instruction set and assembler directives – Assembly Language Programming – Procedures –Macros – Interrupts and interrupt service routines

UNIT II	PERIPHERAL INTERFACING	9

Memory interfacing and I/O interfacing - Serial Communication Interface (8251)- parallel port Interface (8255) - Keyboard and Display controller (8279) – Programmable Interval Timer(8253/8254) – Programmable Interrupt Controller(8259) - DMA Controller(8237).

UNIT III	8051 MICROCONTROLLER ARCHITECTURE AND PROGRAMMING	9

8051 Architecture– Memory organization - Special Function Registers (SFRs) - I/O Pins / Ports – Instruction sets and Addressing modes - 8051 Modes and Programming – Timer, Interrupts, Serial ports- Assembly Language Programming

UNIT IV	8051 INTERFACING AND APPLICATIONS	9

8051 Interfacing: LCD & Keyboard interfacing - ADC, DAC & Sensor interfacing, External Memory Interfacing - Stepper Motor and Wave form generation-Traffic light controller.

UNIT V	ADVANCE MICROCONTROLLER	9

Arduino – Features – Architecture and Applications, PIC - Features – Architecture and Applications.

Total: 45 Periods

COURSE OUTCOMES:

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

- Describe the architecture and operation of typical microprocessors and microcontrollers. (Understand)

- Apply knowledge of addressing modes and instructions set to demonstrate programming ability.(Apply)
- Apply the knowledge of interfacing techniques to develop code for specific problem. (Apply)
- Develop microprocessor and microcontroller-based applications by analyzing various interfacing techniques. (Analyze)
- Design and develop code for Microcontroller based real time Applications.(Create)
- Develop microprocessor & Microcontroller based programs using modern tools.(Apply)

TEXT BOOKS:

1. Douglas V Hall, “Microprocessors and Interfacing, Programming and Hardware”, Tata McGraw Hill,2006.

2. Kenneth J Ayala, “The 8051 Microcontroller Architecture Programming and Application”, Penram International Publishers (India), 2nd Edition,1996

3. Mazidi M. A., McKinlay R. D., Causey D “PIC Microcontroller and Embedded Systems”, Pearson Education International, 2008

REFERENCES:

1. Kenneth J. Ayla, “The 8051 Micro controller”, Thomson learning, 3rd edition, 2004.

2. Ray A.K, Bhurchandi K.M, “Advanced Microprocessor and Peripherals”, TMH, 2nd Edition, 2012.

3. Manish K. Patel, “The 8051 Microcontroller Based Embedded Systems”, McGraw Hill, 1st Edition, 2014.

R21UEC426	MICROPROCESSORS AND MICROCONTROLLERS LABORATORY	L	T	P	C
		0	0	2	1

PRE-REQUISITE :

COURSE OBJECTIVES:

- To develop knowledge in assembly language programming with microprocessor and microcontrollers.
- To give knowledge in various peripheral interfacing with microprocessor and microcontrollers.

LIST OF EXPERIMENTS

1. Basic Arithmetic and Logical operation using 8086 Microprocessor
2. Code conversion and Matrix operation using 8086 Microprocessor
3. String manipulation using 8086 Microprocessor
4. Searching and Sorting operation using 8086 Microprocessor
5. Basic Arithmetic and Logical Operation using 8051 Microcontroller
6. Square and cube Program, 2"s compliment of a number using 8051 Microcontroller
7. Interfacing 8086 microprocessor with 8255
8. Interfacing 8086 microprocessor with 8279
9. Interfacing ADC and DAC with 8086 microprocessor.
10. Stepper Motor interfacing with 8051 microcontroller.
11. LCD display interfacing using Arduino

TOTAL : 30 Periods

COURSE OUTCOMES:

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

- Develop assembly language programs to perform arithmetic and logical operations using 8086 and 8051(Apply)
- Develop assembly language programs for various applications using 8086 microprocessor and 8051 microcontroller (Analyze)
- Analyze the various interfacing techniques to develop real time applications using 8086 microprocessor and 8051 Microcontroller. (Apply)
- Apply appropriate instrumentation tools to make measurements of physical quantities.(Apply)
- Use appropriate procedure to conduct experiments and collect data (Apply)
- Adapt themselves to work in a group as a member or a leader for efficientlyexecuting the given task.(Organize)

HARDWARE AND SOFTWARE REQUIRMENTS

HARDWARE REQUIREWMENTS:

Personal computers with 16GB RAM ,1 TB HDD,Mointor ,Keyboard and Mouse – 30Nos

SOFTWARE REQUIREWMENTS:

EMU 8086,Edsim51-di

R21UCS407	COMPUTER NETWORKS LABORATORY (Common to CSE ,IT,CSD, Cyb.sec)	L	T	P	C
		0	0	2	1

PRE-REQUISITE :

COURSE OBJECTIVES:

- To learn and use network commands
- To learn socket programming
- To implement and analyze various network protocols & RPC.
- To learn and use simulation tools
- To use simulation tools to analyze the performance of network routing protocol.

LIST OF EXPERIMENTS

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine and Implementation of Data Encryption and Decryption
2. Simulation of error correction code (like CRC and Hamming Code generation).
3. Implementation of Stop and Wait Protocol and Sliding Window Protocol
4. Simulation of Distance Vector / Link State Vector Routing Protocol algorithm
5. Applications using TCP sockets like:

(i) Data and Time Server & Client & Chat

(ii) Echo Server & Client

(iii) File Transfer

(iv) Web page Upload and Download

6. Simulation of DNS using UDP socket
7. Write a code simulating ARP/RARP Protocols & RPC
8. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
9. Study of TCP/UDP performance using Simulation tool.
10. Performance evaluation of Routing protocols using Simulation tool.

TOTAL : 30 Periods

COURSE OUTCOMES:

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

- Apply various error detection and correction algorithms to implement secure data transfer. (Apply)
- Analyze various interfaces to implement application layer protocols. (Analyze)
- Apply the concept of encryption and decryption for secure message transfer. (Apply)
- Simulate various routing protocols to find an optimal solution for the effective data communication. (Create)
- Communicate effectively to justify the computing solutions based on legal and ethical principles. (Affective domain)
- Work effectively as an individual or in teams to simulate routing protocols for a given scenario. (Affective domain)

HARDWARE AND SOFTWARE REQUIRMENTS

HARDWARE REQUIREWMENTS:

Personal computers with 16GB RAM ,1 TB HDD,Mointor ,Keyboard and Mouse – 30Nos

SOFTWARE REQUIREWMENTS:

C/C++ Compiler, J2SDK, Network Simulators NS2 /Packet Tracer

R21UIT408	JAVA PROGRAMMING LABORATORY (COMMON TO CSE, IT & CSD, AIML IoT& Cyber Security)	L	T	P	C
		0	0	2	1

PRE-REQUISITE:

COURSE OBJECTIVES :

- To make the students understand the object oriented concepts in JAVA
- To familiarize with JAVA Packages, Exceptions and String
- To make the students develop programs for a given application

LIST OF EXPERIMENTS:

1. Develop Basic JAVA Programs
2. Develop JAVA Programs using Data types & Operators
3. Develop JAVA Programs on Selection & Iteration control structures
4. Develop JAVA Programs using Classes and Objects
5. Develop JAVA Programs using Methods
6. Develop JAVA Programs using constructors and this keyword
7. Develop JAVA Programs using Encapsulation
8. Develop JAVA Programs using Array
9. Develop JAVA Programs using Inheritance
10. Develop JAVA Programs using Polymorphism
11. Develop JAVA Programs using Interfaces
12. Develop JAVA Programs using Array List and Linked List
13. Develop JAVA Programs using Packages
14. Develop JAVA Programs using Exceptions
15. Develop JAVA Programs using String

COURSE OUTCOMES:

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

- Apply the knowledge of Java programming for various complex engineering problems. (Apply)
- Analyze suitable object oriented methodology for a given application.(Analyze)
- Design a application that implements the object oriented features and concepts of JAVA. (Design)
- Develop an application using modern java tools .(Apply)
- Work individually and as a member in multidisciplinary teams.(Individual and Team Work)
- Communicate effectively when working on Mini projects as teams.(Value)

HARDWARE AND SOFTWARE REQUIRMENTS

HARDWARE REQUIREWMENTS:

Personal computers with 16GB RAM ,1 TB HDD,Mointor ,Keyboard and Mouse – 30 Numbers

SOFTWARE REQUIREMENTS:

Operating System: Linux / Windows

JDK version 6, any IDE like NetBeans, Eclipse.

R21UGM431	GENDER EQUALITY	L	T	P	C
		1	0	0	P/F

PRE-REQUISITE:

COURSE OBJECTIVES :

- To introduce basic concepts relating to gender and to provide logical understanding of gender roles.

UNIT I	GENDER SENSITIZATION	5

Definition of gender, Perspectives-Gender sensitive approach- Gender and sex- Social construction of gender and gender roles- Socialization- institutions of socialization- changing content and context of gender-need for re-socialization. Gender Stereotyping and Gender Discrimination.

UNIT II	GENDER EQUALITY AND CONSTITUTION	5

Indian constitution related to equality - Fundamental rights - Directive principles of state policy - right to equality - rights against exploitation - cultural and educational rights - the right to constitutional remedy - University Declaration of Human Rights - Enforcement of Human Rights for Women and Children - Role of Cells and Counseling Centers- Internal Complaints Committee - Legal AID cells, Help line, State and National level Commission.

UNIT III	GENDER ROLES & EQUALITY	5

Gender & Morality – Structural and functionalist views of Gender- Gender in the Classroom-Beyond access for girls and boys-Gender equality in schools-Gender equality and adult basic education-Developing capacity to achieve gender equality in education-Individuality and removal of gender stereotypes- Respect for each other's-Promote equal opportunity.

TOTAL:15 Periods

COURSE OUTCOMES:

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

- Describe the social construction of gender and sexuality and their influence in social context. (Understand)
- Analyze how the concepts of gender equality are created, maintained, and/or challenged. (Analyze)
- Apply concepts of gender roles and equality in classroom, school, disciplinary or interdisciplinary creative, scholarly, and/or activist project. (Apply)

REFERENCES:

1. Sheila Aikman and Elaine Unterhalter, “Practising Gender Equality in Education”, Oxfam GB, 2007.
2. Pasadena and Hackensack, “Gender roles and Equality”, Salem Press,2011.

Semester V

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UGS531	Reasoning and Aptitude (Common to CSE, IT, CSBS, AIDS, CSD,AIML,IoT and Cyb.Sec.,)	1	0	0	1	BS
R21UCS501	Graphics and Multimedia	3	0	0	3	PC
R21UCS502	Mobile Applications Design and Development (Common to CSE &IT)	3	0	0	3	PC
R21UCS503	Theory of Computation (Common to CSE & AIML)	3	1	0	4	PC
PE1	ProfessionalElective–I	3	0	0	3	PE
OE1	Open Elective–I	3	0	0	3	OE
PRACTICAL						
R21UGS532	Soft Skills Laboratory (Common to CSE, EEE, IT,CSBS,AIDS,CSD,AGRI and AIML)	0	0	2	1	HSS
R21UCS507	Creative Thinking and Innovation	0	0	2	1	PW
R21UCS508	Graphics and Multimedia Laboratory	0	0	2	1	PC
R21UCS509	Mobile Applications Design and Development Laboratory	0	0	2	1	PC
MANDATORY						
R21UGM535	Universal Human Values II	2	1	0	3	MC
	TOTAL	**18**	**2**	**8**	**24**	
Total No of Credits –24						

NOTE: Any One of the Six Professional Elective Courses should be replaced by the equivalent NPTEL Course.

R21UCS501	GRAPHICS ANDMULTIMEDIA	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the fundamental concepts of Computer Graphics.
- To impart the knowledge of 2D and 3D geometric Transformations and algorithms.
- To acquire the knowledge of Color & Shading Models and Curves & Surfaces.
- To know the Advance Topics of Computer Graphics.

UNIT I	Basics of Output Primitives	9

Output Primitives- Attributes of output primitives - Introduction and Line Generation- Points and lines, Line drawing algorithms – DDA Line Drawing Algorithm and Bresenham's Line Drawing Algorithm .

UNIT II	Two-Dimensional Graphics	9

Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – Line Clipping Algorithm – Cohen Sutherland Clipping algorithm

UNIT III	Three-Dimensional Graphics	9

Three Dimensional Concepts - Three-Dimensional object representations Polygons, Curved lines, Splines, Quadric Surfaces -Visualization of data sets − Three-Dimensional geometric and modeling transformations − Three-Dimensional viewing –visible surface detection.

UNIT VI	Illumination And Color Models	9

Color Models- RGB,CMYK ,YIQ,HSV,HLS – Light Modeling Techniques- Illumination Model- Shading Models- Flat Shading, Polygon Mesh Shading, Phong shading, Gouraud shading, interpolative shading model- Graphics File Formats.

UNIT V	MULTIMEDIA SYSTEMS AND APPLICATIONS	9

Multimedia -Optical Storage Systems - Multimedia Communication Systems - Database System – Synchronization issues – Applications – Video conferencing – Virtual reality.

TOTAL – 45 Periods

Course Outcomes:

After the completion of the course, the student will be able to

1. Explain the basics of Computer graphics and its applications.[Understand]
2. Apply computer graphics concepts in the development of information visualization, business applications and Computer games.[Apply]
3. Analyze various algorithms for processing the data and image effectively.[Analyze]
4. Evaluate the realism of wide range of computer graphics techniques and multimedia concepts

for assessing its value in graphical applications. [Evaluate]

5. Create a graphics application programs using different graphical techniques and multimedia concepts to make a realistic scene.[Create]
6. Work with a team to prepare a video or film that to display in the given specifications.[Affective Domain]

TEXT BOOKS:

1. Donald Hearn and M.Pauline Baker, “Computer Graphics”, Second Edition, PHI/Pearson Education.
2. Zhigandxiang, Roy Plastock, Schaum’s outlines, “Computer Graphics Second Edition”, Tata McGrawhill edition.
3. C. Foley, VanDam, Feiner and Hughes, “Computer Graphics Principles & Practice”, Second Edition,Pearson Education

REFERENCE BOOKS:

1. W. M. Newman, R. F. Sproull – “Principles of Interactive computer Graphics” – Tata McGraw Hill.
2. Donald Hearn and M Pauline Baker, “Computer Graphics with OpenGL”, Pearson education
3. Computer Graphics, R. K. Maurya, John Wiley.
4. Mathematical elements of Computer Graphics, David F. Rogers, J. Alan Adams, Tata McGraw-Hill.
5. Procedural elements of Computer Graphics, David F. Rogers, Tata McGraw-Hill.
6. http://web.cs.wpi.edu/~emmanuel/courses/cs563/S07/talks/cs563_intro.pdf

R21UCS502	MOBILE APPLICATIONS DESIGN AND DEVELOPMENT	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSEOBJECTIVES:

- Aims at providing techniques for deploying and testing mobile applications, and for enhancing their performance and scalability
- Identify the capabilities and limitations of mobile platforms that affect application development and deployment
- Elaborating the characterization and architecture of mobile applications
- Analyzing the impact of technology and business trends in mobile application development

UNITI	INTRODUCTIONTOMOBILEAPPLICATIONDEVELOPMENT	9

Introduction – Android architecture overview –Android Application lifecycle – Write and view logs with Logcat – Android user interface fundamentals – User interaction - Android activities –Android widgets-Layouts—User input controls–Event Handling.

UNITII	USER INTERFACE DESIGN AND LOCATION BASED SERVICES	9

Menus–Fragments–Views–Drawables-styles–themes–Intent overview: Implicit intents–Explicit intents–Intents with activities–Intents with broadcast receivers : Location Based Services. Maps–Geocoding and location based services–Using location based services–Selecting allocation provider–Using geocoder–Creating Map based activities.

UNITIII	Flutter	9

Introduction to Flutter and Dart: Features of Flutter - Flutter Architecture – Flutter Widgets and UI development . Dart : Variables , Data types – operators and Control Flow- Object Oriented Programming in Dart.

UNIT IV	MULTIMEDIA , Animation on Flutter	9

Audio, Video and Using the camera Bluetooth and WI-FI Animation on Flutter: Introduction to Animation Based Classes-Work flow of the Flutter Animation- Working Application- Android Specific Code on Flutter- Introduction to Package- Types of Packages- Using a Dart Package- Develop a Flutter Plugin Package- Accessing Rest API- Basic Concepts- Accessing Product service API

UNITV	DATABASE CONNECTIVITY	9

Introduction to SQLlite and Firebase – SQLlite: CRUD Operations. Firebase: Adding Android application to Firebase–Firebase Database-Stored at a into Firebase–Read data from Firebase–Firebase Authentication–Firebase storage–Firebase hosting.

TOTAL:45 Periods

COURSEOUTCOMES:

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

- Understand the fundamentals of mobile application development tools and concepts (Understand)

- Develop solutions to existing problems by building an effective and advanced application using integrated development environment. (Apply)
- Analyze the existing security issues in real world scenario and build a secure, reliable and effective mobile application. (Analyze)
- Evaluate the prominence of the deployed android application using Cloud hosting function. (Evaluate)
- Design a full stack android mobile application that canbe deployed to the real world.(Create)

Follow the design pattern and effectively communicate with team members to develop an effective software product. (Affective domain)

TEXT BOOK:

1.“Head first android development,Abrainfriendlyguide”– Dawn Griffiths and David Griffiths, Oreilly, third edition,2015.

REFERENCE BOOKS:

1.“Android Application development”, O’reilly, Rick rogers, John Lombardo ,Zegurdmednieks & Blake meike,2009.

2.“Android4Applicationdevelopment”,Retomeier,Jonhwiley&sons,2007.

R21UCS503	THEORY OF COMPUTATION	L	T	P	C
		3	1	0	4

PRE-REQUISITE: Transforms and Discrete Mathematics, Design and Analysis of Algorithms

COURSE OBJECTIVES :

- To understand various formal languages like Regular Language, Context Free Language, Context Sensitive Language and Recursively Enumerable language.
- To understand various Computing models like Finite State Machine, Pushdown Automata, Linear Bounded Automata and Turing Machine.
- To understand Decidability and Undecidability of various problems.

UNIT I	FINITE AUTOMATA	9+3

Introduction –Concepts of Automata theory– Chomsky Hierarchy of formal languages– Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Finite Automata with Epsilon Transitions – Equivalence of NFA and DFA– Equivalence of € NFA and DFA –Equivalence of NFA and € NFA.

UNIT II	REGULAR LANGUAGE AND GRAMMAR	9+3

Regular Expression, Regular Language and Regular Grammar – Equivalence of FA and Regular Expressions– Equivalence of FA and Regular Grammar-Properties - Pumping Lemma for Regular Languages –Equivalence and Minimization of Automata.

UNIT III	CONTEXT FREE AND CONTEXT SENSITIVE LANGUAGE	9+3

Context-free grammars (CFG) and languages (CFL)–Derivation and Parse trees– Equivalence of Derivations and Parse Trees–Ambiguity in CFG– Normal forms of CFG – Chomsky and Greibach normal forms–Context Sensitive Grammars-Context Sensitive Languages.

UNIT IV	PUSH DOWN AUTOMATA AND LINEAR BOUNDED AUTOMATA	9+3

Introduction– Pushdown automata– Languages of PDA–Equivalence of PDA and CFG– Deterministic pushdown automata–Properties - Pumping lemma for context-free languages– Closure properties of CFLs– Linear Bounded Automata – Equivalence of LBA‘s and CSG‘s

UNIT V	TURING MACHINE AND UNDECIDABILITY	9+3

Turing Machines – Language of a Turing Machine – Turing Machine as a Computing Device – Programming Techniques for TM – Multi Tape Turing Machines, Equivalence of One Way and Multi–Tape Turing Machines.

A Language that is not Recursively Enumerable (RE) – An Undecidable Problem that is RE – Undecidable Problems about Turing Machine – Properties of Recursive and Recursively Enumerable

Languages – Post's Correspondence Problem (PCP) – Modified Post Correspondence Problem– Time and tape Complexity measure of TM – the classes of P and NP – NP –completeness.

TOTAL:45 (L)+ 15(T)= 60 Periods

COURSE OUTCOMES:

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

- Explain the concepts of formal languages and automata theory for solving various engineering problems. (Understand)
- Apply the knowledge of formal languages and automata theory to solve complex engineering problems. (Apply)
- Identify the suitable automata model for complex engineering problems for reaching sustained conclusions. (Analyze)
- Evaluate the design of a model using the concepts of the automata theory, formal languages or grammars.(Evaluate)
- Design computational models for a given real world problem using any modern tools.(Create)
- Summarize the conclusions for the different problems through presentation with teams or individually. (Affective Domain)

TEXT BOOK:

1. **J.E.Hopcroft, R.Motwani and J.D Ullman, "Introduction to Automata Theory, Languages and Computations", Pearson Education, Third Edition, 2008.**

REFERENCE BOOKS :

1. Mishra K L P and Chandrasekaran N, "Theory of Computer Science-Automata, Languages and Computation", Prentice Hall of India, Third Edition, 2007.

2. Harry R. Lewis and Christos H. Papadimitriou, "Elements of the theory of Computation", Prentice-Hall of India Pvt. Ltd, Second Edition, 2009.

3. Kamala Krithivasan and R. Rama, "Introduction to Formal Languages, Automata Theory and Computation", Pearson Education, Delhi, 2009.

4. J. Martin, "Introduction to Languages and the Theory of Computation", Tata McGraw Hill, New Delhi, Third Edition, 2007.

5. MichealSipser, "Introduction to the Theory and Computation", Cengage Learning India, 2012.

R21UCS507	CREATIVE THINKING AND INNOVATION	L	T	P	C
		0	0	2	1

PREAMBLE:

Creativity is vital in nearly every industry and occupation. Creativity and innovation are key to generation of new ideas and methods of improving goods and services for customer satisfaction. This course enhances the creative thinking and innovation skills of the students. Being creative helps one to be a better problem solver in all areas of life and work.

COURSE OBJECTIVES:

- To develop next generation Entrepreneurs and Creative Leaders to resolve live challenges.
- To transform innovative ideas into successful businesses
- To use a range of creative thinking tools to develop Out of the Box Ideas

Course Content

Introduction to Creativity and Innovation- Creative Techniques - Problem Identification through Brain Storming - Solution Identification through Creative Techniques - Presentation on the Innovative Idea - Market Analysis - Revenue and Business Model - Preparation of promotional aids - Customer Feedback Analysis.

List of Activities:

Duration	What does the Faculty do?	What do the students do?
Week 1	plains creativity and innovation	am Formation eam Size: 3)
Week 2	plains the Creative Techniques (Through Video / Presentation)	scovering Consumer Need through Need Analysis (Customer Segment)
Week 3	cilitates the brain storming	oblem Identification through brain storming
Week 4	cilitates problem solving	ntify the solution for the chosen problem through creative techniques
Week 5	aluates the presentation	esentation on the Innovative Idea and Value Proposition
Week 6	aluates the presentation	esentation on the Innovative Idea and Value Proposition
Week 7	plains about the Market Research /	rket Analysis after the explanation

	Competitor Analysis, Revenue Model and Business Model	
Week 8	cilitates the students work	eparation of Innovation Development Plan, Business Development Plan and Financial Plan
Week 9	cilitates the students work	eparing product promotional material
Week 10	cilitates the students work	provement through Feedback

Total Hours: 30 Periods

Assessment Pattern

1. Internal Assessment: Presentation on the Innovative Idea
2. End Semester Assessment:
    - Submission of Business Plan
    - Presentation on My Startup Idea (Evaluator : From Industry)

Course Outcomes:

After successful completion of the course students will be able to

- Demonstrate the ability to assess societal, health and safety issues and the consequent responsibilities relevant to the professional engineering practice (Valuing – Affective Domain)
- Examine impact on environment and society in the proposed innovative idea and provide solutions for sustainable development (Organization – Affective Domain)
- Adapt themselves to work in a group as a member or a leader for efficiently executing the given task (Organization – Affective Domain)

R21UCS508	GRAPHICS AND MULTIMEDIA LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To implement various algorithms and Transformations
- To Perform animations using animation software

LIST OF EXPERIMENTS

1. Implement DDA Algorithm (incremental scan conversion algorithm) for drawing a line segments between two given end points A (x1, y1) and B(x2, y2).Implement Bresenham's line drawing algorithm for drawing a line segment between two given endpoints A(x1, y2) and B(x2, y2).
2. Apply 2D Transformation to change the square shaped object into diamond shape.
3. Write a program to implement Cohen Sutherland line clipping algorithm.
4. Apply the 3D transformation to translate and rotate the 3D-BAR of angle 175 degree along Y-axis.
5. Draw a simple house using inbuilt graphics function and brighten the house using RGB Colors.
6. Write a program to draw a car using in-build graphics function and translate it from bottom left corner to right bottom corner of screen.
7. Construct a fractal and display the name of the fractal that you have drawn on your window
8. Create an animation to indicate a ball bouncing on steps using any animation software.
9. Perform an animation of Solar System using any animation software.

TOTAL: 30 Periods

COURSE OUTCOMES:

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

- Apply the concepts of transformations and Clipping for a given application. (Apply)
- Analyze various techniques to develop a graphical application for a given scenario. (Analyze)
- Design graphical application for a given real life scenario using the concepts of OpenGL Primitives etc. (Create)
- Communicate effectively to justify the computing solutions based on legal and ethical principles. (Affective domain)
- Work effectively as an individual or in teams to develop graphical application for a given scenario. (Affective domain)

HARDWARE AND SOFTWARE REQUIRMENTS

HARDWARE REQUIREMENTS:

Personal computers with 16GB RAM ,1 TB HDD,Mointor ,Keyboard and Mouse

SOFTWARE REQUIREMENTS:

Turbo C / C++ compiler that supports graphics package. Any Animation Software[Macromedia Flash]

R21UCS509	Mobile Applications Design and Development Laboratory	L	T	P	C
		0	0	2	1

pre –requisite: Java Programming Laboratory

COURSE OBJECTIVES:

- To demonstrate and develop the Mobile Application using various Tools and Techniques

LIST OF EXPERIMENTS

1. Develop an application that uses GUI components, Font and Colors in various layouts.
2. Develop an android application to demonstrate simple event handling.
3. Develop an android application to implement Menus.
4. Develop an android application to implement Fragments.
5. Develop an android application customized Sending Email, Sending SMS and Phone Calls using Intent and intent filter.
6. Develop an android application to implement a Location Based Services.
7. Develop an application to capture image using built in camera
8. Develop a simple Video player like application using video view and video Recorder.
9. Develop an application that creates an alert upon receiving a message and call.
10. Develop an android application to demonstrate Firebase Database.

TOTAL : 30 Periods

COURSE OUTCOMES:

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

- Develop user interface for mobile Application using widgets with event handling.
- Design and Develop different menu button controls.
- Design and Develop Video player application using Android Studio
- Design and Develop notifications for incoming messages
- Apply database connectivity for mobile application development

HARDWARE & SOFTWARE REQUIREMETs:

HARDWARE & SOFTWARE REQUIREMETS:

HARDWARE REQUIREMENTS:

Personal computers with 16GB RAM ,1 TB HDD,Mointor ,Keyboard and Mouse

SOFTWARE REQUIREMENTS

- Java JDK
- Android studio

R21UGM535	UNIVERSAL HUMAN VALUES II	L	T	P	C
		2	1	0	3

COURSE OBJECTIVES:

- To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Module 1 **Introduction-Basic Human Aspiration, its fulfillment through All-encompassing Resolution**

The basic human aspirations and their fulfillment through Right understanding and Resolution, Right understanding and Resolution as the activities of the Self, Self being central to Human Existence; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution

Module 2 **Right Understanding (Knowing)- Knower, Known & the Process**

The domain of right understanding starting from understanding the human being (the knower, the experiencer and the doer) and extending up to understanding nature/existence – its interconnectedness and co-existence; and finally understanding the role of human being in existence (human conduct).

Module 3 **Understanding Human Being**

Understanding the human being comprehensively as the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Basis for harmony/contradiction in the self

Module 4 **Understanding Nature and Existence**

A comprehensive understanding (knowledge) about the existence, Nature being included; the need and process of inner evolution (through self-exploration, self- awareness and self-evaluation), particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).

Module 5 **Understanding Human Conduct, All-encompassing Resolution & Holistic Way of Living**

Understanding Human Conduct, different aspects of All-encompassing Resolution

(understanding, wisdom, science etc.), Holistic way of living for Human Being with All-encompassing Resolution covering all four dimensions of human endeavor viz. realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from Self to Nature and entire Existence

Total: 45 Periods

COURSE OUTCOMES:

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

- CO – 1: Evaluate the significance of value inputs in formal education and start applying them in their life and profession
- CO – 2: Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc
- CO – 3 Analyze the value of harmonious relationship based on trust and respect in their life and profession
- CO – 4: Examine the role of a human being in ensuring harmony in society and nature.
- CO – 5: Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession.

Text Book

1. R R Gaur, R Asthana, G P Bagaria, 2019 (2nd Revised Edition), A Foundation Course in Human Values and Professional Ethics. ISBN 978-93-87034-47-1, Excel Books, New Delhi.
2. Premvir Kapoor, Professional Ethics and Human Values, Khanna Book Publishing, New Delhi, 2022.

References

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986.
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
9. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists &Engineers, Oxford University Press
10. M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Semester VI

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UCS601	Principles of Compiler Design	3	1	0	4	PC
R21UCD602	IoT Design **(Common to CSE & CSD)**	3	0	0	3	PC
R21UCS603	Artificial Intelligence and Machine Learning **(Common to CSE & IT)**	3	0	0	3	PC
PE-II	Professional Elective–II	3	0	0	3	PE
PE-III	Professional Elective–III	3	0	0	3	PE
OE-II	Open Elective–II	3	0	0	3	OE
PRACTICAL						
R21UCS607	Product Development Project	0	0	8	4	PW
R21UGS633	Interpersonal Skills Development Lab (Common to CSE,EEE, IT, CSBS,AIDS,CSD,AGRI and AIML)	0	0	2	1	HSS
R21UCS608	Artificial Intelligence and Machine Learning Laboratory **(Common to CSE & IT)**	0	0	2	1	PC
R21UCD609	IoT Design Laboratory **(Common to CSE & CSD)**	0	0	2	1	PC
MANDATORY						
R21UGM631	Indian Constitution (Common to all Branches)	1	0	0	P/F	MC
	TOTAL	**19**	**1**	**14**	**26**	
Total No of Credits - 26						

NOTE: Any One of the Six Professional Elective Courses should be replaced by the equivalent NPTEL Course.

R21UCS601	PRINCIPLES OF COMPILER DESIGN	L	T	P	C
		3	1	0	4

PRE-REQUISITE: THEORY OF COMPUTATION

COURSE OBJECTIVES :

- To learn various phases of compiler.
- To learn the design techniques of lexical analyzer for a language.
- To give knowledge on various parsing techniques.
- To give knowledge on different levels of translation and various optimization techniques.

UNIT I	INTRODUCTION TO COMPILERS & LEXICAL ANALYSIS	8+3

Introduction- Translators- Compilation and Interpretation- Language processors -The Phases of Compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Finite Automata – Regular Expressions to Automata NFA, DFA – Minimizing DFA - Language for Specifying Lexical Analyzers – Lex tool..

UNIT II	SYNTAX ANALYSIS	11+3

Role of Parser – Grammars – Context-free grammars – Writing a grammar Top Down Parsing - General Strategies - Recursive Descent Parser Predictive Parser-LL(1) - Parser-Shift Reduce Parser-LR Parser- LR (0)Item Construction of SLR Parsing Table - Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC tool - Design of a syntax Analyzer for a Sample Language

UNIT III	SYNTAX DIRECTED TRANSLATION & INTERMEDIATE CODE GENERATION	9+3

Syntax directed Definitions-Construction of Syntax Tree-Bottom-up Evaluation of S-Attribute Definitions- Design of predictive translator - Type Systems-Specification of a simple type CheckerEquivalence of Type Expressions-Type Conversions. Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking, Back patching.

UNIT Iv	RUN-TIME ENVIRONMENT AND CODE GENERATION	9+3

Runtime Environments – source language issues – Storage organization – Storage Allocation Strategies: Static, Stack and Heap allocation - Parameter Passing-Symbol Tables - Dynamic Storage Allocation - Issues in the Design of a code generator – Basic Blocks and Flow graphs - Design of a simple Code Generator - Optimal Code Generation for Expressions– Dynamic Programming Code Generation.

UNIT v	**CODE OPTIMIZATION**	8+3

Principal Sources of Optimization – Peep-hole optimization - DAG- Optimization of Basic Blocks - Global Data Flow Analysis - Efficient Data Flow Algorithm – Recent trends in Compiler Design.

TOTAL: 45+15 Periods

COURSE OUTCOMES:

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

- Explain the fundamental concepts of compiler design (Understand).
- Apply the compiler techniques for language constructs. (Apply)
- Analyze the design issues in terms of instructions to improve the performance of compiler. (Analyze)
- Identify the techniques to produce front end and back end of the compilers. (Analyze)
- Design a compiler for a simple programming language(create)
- Work individually or in teams and communicate effectively to design a compiler based on legal and ethical principles.(Affective domain)

TEXT BOOK:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, “Compilers: Principles, Techniques and Tools”, Second Edition, Pearson Education, 2009.

REFERENCE BOOKS:

1. Randy Allen, Ken Kennedy, “Optimizing Compilers for Modern Architectures: A Dependence- based Approach”, Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, “Advanced Compiler Design and Implementation, “Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
3. Keith D Cooper and Linda Torczon, “Engineering a Compiler”, Morgan Kaufmann Publishers Elsevier Science, 2004.
4. Charles N. Fischer, Richard. J. LeBlanc, “Crafting a Compiler with C”, Pearson Education, 2008

R21UCD602	IoT Design	L	T	P	C
	(C o m m o n t o C S E a n d C S D)	3	0	0	3

PRE-REQUISITE: Fundamentals of computer networks

COURSE OBJECTIVES :

In this course, student will explore various components of Building Internet of things such as Sensors, internetworking and cyber space. In the end they will also be able to design and implement IoT circuits and solutions.

UNIT I	INTRODUCTION TO INTERNET OF THINGS	9

Introduction – Physical Design of IoT – Logical Design of IoT – IoT enabling technologies - IoT Levels and Deployment Templates - Domain specific IoTs

UNIT II	M2M TO IOT	9

The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT

UNIT III	M2M VS IOT AN ARCHITECTURAL OVERVIEW	9

Building architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. Reference Architecture and Reference Model of IoT

UNIT IV	PROGRAMMING THE MICROCONTROLLER FOR IOT	9

Basics of Sensors and actuators – examples and working principles of sensors and actuators – Cloud computing and IOT – Arduino/Equivalent Microcontroller platform –Setting up the board - Programming for IOT – Reading from Sensors.

Communication: Connecting microcontroller with mobile devices – communication through bluetooth and USB – connection with the internet using wifi / Ethernet.

UNIT V	DEVELOPING IOT SOLUTIONS	9

Implementation of IoT with Arduino and Raspberry, Cloud Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities, Privacy and Security Issues in IoT.

Total: 45 Periods

COURSE OUTCOMES:

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

- Explain the general concepts related to Internet of Things (Understand)
- Apply the concepts of IoT to provide solutions for a given problem (Apply)
- Analyze various M2M and IoT architectures to find solutions for a given problem (Analyze)
- Evaluate design issues and performance of IoT applications (Evaluate)
- Create IoT solutions using sensors, actuators and Devices for a given problem (Create)
- Work individually or in teams and communicate effectively to justify various real time concepts in IOT (Affective Domain)

TEXT BOOKS:

1. CharalamposDoukas, Building Internet of Things with the Arduino, Create space, April 2002.
2. Dieter Uckelmann et.al, “Architecting the Internet of Things”, Springer, 2011.
3. ArshdeepBahga, Vijay Madisetti, “Internet of Things – A hands on approach”, Universities Press (India) pvt Ltd. 2015.

REFERENCE BOOKS:

1. Luigi Atzor et.al, “The Internet of Things: A survey, “, Journal on Networks, Elsevier Publications, October, 2010.
2. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014.
3. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013.
4. CunoPfister, Getting Started with the Internet of Things, O‟Reilly Media, 2011, ISBN: 978-1-4493-9357-1.

R21UCS603	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To introduce the fundamental concepts in Artificial Intelligence.
- To give an idea about the basics of designing intelligent agents that can solve general purpose problems.
- To introduce the concept of Machine Learning

UNIT I	AI AND PROBLEM SOLVING	9

Introduction – Agents – Problem formulation – uninformed search strategies – heuristics– informed search strategies – Heuristic functions.

UNIT II	KNOWLEDGE REPRESENTATION AND REASONING	9

Logical agents – propositional logic – inferences – first-order logic – inferences in first order logic – Knowledge engineering in FOL -unification – forward chaining – backward chaining –resolution.

UNIT III	REASONING UNDER UNCERTAINTY	9

Uncertainty – review of probability - Inference using full joint distribution-probabilistic Reasoning – Bayesian networks –Syntax and semantics of Bayesian networks –Bayesian nets with continuous variable - Exact inference in Bayesian networks –Naive Bayes algorithim

UNIT IV	INTRODUCTION TO MACHINE LEARNING	9

Learning from agents - inductive learning - Types of Machine learning - Supervised learning - learning decision trees - support vector machines - Neural and Belief networks - Perceptron - Multi-layer feed forward networks – Regression – Linear Regression

UNIT V	UNSUPERVISED LEARNING	9

Unsupervised learning - K-means clustering - hierarchical clustering - Agglomerative and Divisive clustering - Fuzzy clustering.

TOTAL : 45 Periods

COURSE OUTCOMES:

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

- Explain the concepts of Artificial Intelligence and Machine Learning. (Understand)
- Apply the concepts of Artificial Intelligence and Machine Learning to solve the real world problems. (Apply)
- Analyze the problem solving and reasoning techniques to find an optimal solution for a real world problem. (Analyze)
- Evaluate various parameters to improve the performance of a learning algorithm to find solution of a complex engineering problem.(Evaluate)
- Design a model to develop solution for a real world problem. (Create)
- Work individually or in teams and demonstrate the solutions to the given problems through presentation. (Affective Domain)

TEXT BOOKS:

1. S. Russel and P. Norvig, “Artificial Intelligence – A Modern Approach”, Second Edition, Pearson Education, 2003.
2. D. Poole and A. Mackworth. Artificial Intelligence:Foundations of Computational Agents,Cambridge University Press, 2010.

REFERENCE BOOKS:

1. David Poole, Alan Mackworth, Randy Goebel, ”Computational Intelligence : a logical approach”, Oxford University Press, 2004.
2. G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem solving”, Fourth Edition, Pearson Education, 2002.
3. J. Nilsson, “Artificial Intelligence: A new Synthesis”, Elsevier Publishers, 1998.
4. Brachman, H. Levesque. Knowledge Representation and Reasoning, MorganKaufmann, 2004.
5. JiaweiHan ,MichelineKamber, Jian Pei ,” Data Mining: Concepts and Techniques”, 3rd edition.

R21UCS607	PRODUCT DEVELOPMENT PROJECT	L	T	P	C
		0	0	8	4

PRE-REQUISITE :

COURSE OBJECTIVES:

- To engage the student in integrated activities of reading, research, discussion and presentation around a designated subject.
- To perform literature survey on recent developments in a selected problem domain.
- To exercise various strategies to find a solution addressing the problem.
- To communicate the work done in written and oral forms.
- To develop a prototype model.

COURSE OUTCOMES:

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

- Identify and formulate a technical problem to reach substantiated conclusion using basic technical knowledge [K4-Analyze]
- Design/Develop proto type / model for societal needs applying the basic engineering knowledge. [K3-Apply]
- Evaluate the performance of the developed solution using appropriate techniques and tools [K5-Evaluate]
- Apply management principles to function as a team [Affective Domain]
- Communicate the technical information effectively [Affective Domain]

R21UCS608	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LABORATORY	L	T	P	C
		0	0	2	1

PRE-REQUISITE :

COURSE OBJECTIVES:

- Implementing the basic concepts in ArtificialIntelligence.
- Implementing Machine LearningAlgorithms

LIST OF EXPERIMENTS

1. Implement Breadth First Search (for 8 puzzle problem or Water jug problemor any AI searchproblem)
2. Implement Depth First Search (for 8-queen problem or 8 puzzle problem orWater jug problem or any AI search problem)
3. Solve travelling salesperson problem using Best FirstSearch
4. Build a Knowledge based system for forecasting theweather
5. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease DataSet.
6. Demonstrate the working of decision tree based on ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify the newsample
7. Construct model to predict the residential home prize as a function of the homes livingarea.
8. Develop a model to determine the likelihood of a patient's successful response to a specific medicaltreatment
9. Develop an algorithm to predict whether a particular customer buy a computer or not based on the following attribute age, income, student and creditrating.
10. Develop a model to predict stock market using machine learningalgorithm.

TOTAL : 30 Periods

COURSE OUTCOMES:

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

- Implement the concepts of Artificial Intelligence and Machine Learning to solve the real world problems. (Apply)
- Analyze various Artificial Intelligence and Machine Learning techniques for the effective solution for a given problem. (Analyze)
- Evaluate the performance of a machine learning model using various parameters. (Evaluate)
- Develop machine learning models to find the optimal solution for the given real world scenario.

(Create)

- Communicate effectively to justify the solutions to the given problems based on legal and ethical principles. (Affective domain)
- Work effectively as an individual or in teams to develop machine learning models for the given problem. (Affective domain)

HARDWARE AND SOFTWARE REQUIRMENTS

HARDWARE REQUIREWMENTS:

Personal Computers – 30 Numbers

SOFTWARE REQUIREMENTS:

Python 2.7 and higher versions

R21UCD609	IOT DESIGN LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To learn how to work with IoT –based sensors and microcontrollers.
- To conduct experiments using CloudSim.
- To read data from sensor and encrypt them
- To transmit and receive data using public/private cloud
- To build customized user-interface (UI) for an application

LIST OF EXPERIMENTS:

1. Sensors to microcontroller communication
2. Monitoring environment parameters using IoT sensors
3. Monitoring healthcare parameters using IoT sensors
4. Usage of Google Apps and Amazon Web Service (AWS)
5. Installation of the Guest OS using Virtual box / VMware
6. Simulation of cloud infrastructures in CloudSim
7. Secured communication from the microcontroller to the backend
8. Store sensor data in the public/private cloud
9. Analyze the insight of sensor data visually
10. Develop a customized user interface for an application

TOTAL : 30 Periods

COURSE OUTCOMES:

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

- Retrieve and process various sensors data using a microcontroller (Apply)
- Analyze the use of Cloud applications (Analyze)
- Execute various algorithms using CloudSim (Create)
- Transmit sensor data safely using an encryption algorithm (Apply)
- Communicate effectively to justify the computing solutions based on legal and ethical principles. (Affective domain)
- Function effectively as an individual or in teams to develop IOT based products for a given scenario. (Affective domain)

HARDWARE REQUIREMENTS:

Personal Computers, Sensors

SOFTWARE REQUIREMENTS:

CloudSim, Android Studio, Apache

On Windows: Vulkan SDK, GLFW, GLM

R21UGM631	INDIAN CONSTITUTION (Common To All Branches)	L	T	P	C
		1	0	0	P/F

PRE-REQUISITE:

COURSE OBJECTIVES :

- The students will be exposed to fundamental rights & duties in Indian Constitution.
- The students will be given knowledge on the components of the parliamentary system to prepare for the process of their career development.
- The student will have knowledge on powers and functions of Local bodies and Indian polity to appear for various competitive exams such as UPSC, TNPSC and RRB…
- The student will know about the functions of judiciary and electoral process followed in the country.

UNIT I	INTRODUCTION ON INDIAN CONSTITUTION	4

Preamble - Salient features of the Constitution of India. Fundamental Rights - its restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) - Fundamental Duties: its Scope and significance in Nation building - Constitution components: schedule, parts and articles of constitution- important Amendments of constitution.

UNIT II	PARLIAMENTARY SYSTEM	4

Parliamentary System – parliamentary system of other countries - Indian parliamentary system-Federal System – LS and RS,Centre-State Relations-Election of member of parliaments- Union Executive - President, Prime Minister, Union Cabinet. State Legislature -State Executives –election of MLA- Governor, Chief Minister, State Cabinet.

UNIT III	JUDICIARY AND ELECTION COMMISSION	4

Supreme Court of India: Structure, Power and Functions of Supreme Court-- Judicial Reviews - Judicial Activism. High Court and Subordinate Courts: Structure, Power and Functions. – Lokadhalats. Elections- Electoral Process - Election Commission of India - Election Laws – Emergency Provisions - types of Emergencies and its consequences.

UNIT IV	LOCAL ADMINISTRATION	3

Local Administration: Powers and functions of Municipalities and Panchayats System-Panchayat Raj-Co–operative Societies and Constitutional and Non-constitutional Bodies.

TOTAL PERIODS: 15 Periods

COURSE OUTCOMES:

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

- Apply knowledge of the fundamental rights and duties prescribed by Indian Constitution to prepare for various competitive examinations.[Apply]
- Manage complex societal issues in society with the knowledge of judiciary and local administration. [Apply]
- Interpret the societal, health, safety, legal and cultural issues with understanding of parliamentary system and electoral process through self-learning skills. [Analyze]

- Understand the ethical responsibilities of municipalities, panchayats and co-operative societies.[Understand]
- Understand and distinguish the functioning of the parliamentary system followed in various countries. [Understand]

TEXT BOOKS:

1. Shubham Singles, Charles E. Haries, et al., “Constitution of India and Professional Ethics” by Cengage Learning India Private Limited, 2018.
2. Subhash C. Kashyap,”Our Constitution: An Introduction to India’s Constitution and constitutional Law”, NBT, 2018.
3. Brij Kishore Sharma, “Introduction to the Constitution of India”, PHI Learning Pvt. Ltd., New Delhi, 2011.
4. M.V.Pylee, “An Introduction to Constitution of India”, Vikas Publishing, 2002.

Durga Das Basu, “Introduction to the Constitution on India”, Prentice Hall, 2001.

Semester VII

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UME701	Project Management and Finance (Common to All Branches Except CSBS)	3	0	0	3	HSS
R21UCS702	Cryptography and Cyber Security	3	0	0	3	PC
PE-IV	Professional Elective–IV	3	0	0	3	PE
PE-V	Professional Elective –V	3	0	0	3	PE
OE-III	Open Elective–III	3	0	0	3	OE
PRACTICAL						
R21UCS707	Cryptography and Cyber Security Laboratory	0	0	2	1	PC
R21UGE710	MDP-Phase I *	0	0	6	3	PW
MANDATORY						
R21UGM731	Sports and Social Development (Common to allBranches)	-	-	-	P/F	MC
R21UGM732	Skill Development (Common to allBranches)	-	-	-	P/F	MC
R21UCS735	Internship	-	-	-	1	MC
	TOTAL	**15**	**0**	**2**	**17**	
Total No of Credits - 17						

NOTE: Any One of the Six Professional Elective Courses should be replaced by the equivalent NPTEL Course.

Students those who opt for MDP-Phase1 are excempted from taking Open Elective III

UME701	PROJECT MANAGEMENT AND FINANCE	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To impart knowledge to find solutions and approaches for various projects.
- To familiarize the utilization of project within time, resource and financial constraints**.**

UNIT I	PROJECT MANAGEMENT CONCEPTS	9

Concept and characteristics of a project, importance of project management, types of project, project organizational structure, project life cycle, Statement of Work, Work Breakdown Structure.

UNIT II	PROJECT PLANNING	9

Project Planning and Scheduling techniques - developing the project network using CPM/PERT, Limitations of CPM/PERT, Precedence Diagramming Method, constructing diagram and computations using precedence diagramming method, PERT/CPM simulation, reducing project duration.

UNIT III	RESOURCE SCHEDULING & CRITICAL CHAIN SCHEDULING	9

Resource Scheduling - Resource allocation method, splitting and multitasking, Multi project resources scheduling - Critical Chain Scheduling -Concept of critical chain scheduling - critical chain scheduling method, application of Critical chain scheduling and limitations.

UNIT IV	PROJECT QUALITY MANAGEMENT	9

Concept of project quality, responsibility for quality in projects, quality management at different stages of project, tools and techniques, Quality Management Systems, TQM in projects - Project Performance Measurement and Control - Monitor and assess project performance, schedule, and cost. Earned Value Management, performance measurement methods to monitor, evaluate and control planned cost and schedule performance - Project Closure/ Termination - Meaning of closure/ termination, project audit process, termination steps, final closure.

UNIT V	FINANCIAL ACCOUNTING	9

Balance sheet and related concepts - Profit & Loss Statement and related concepts - Financial Ratio Analysis - Cash flow analysis - Funds flow analysis – Comparative financial statements. Investments - Average rate of return - Payback Period - Net Present Value - Internal rate of return.

Total: 45 **Periods**

COURSE OUTCOMES:

After successful completion of this course the students will be:

1. Describe the concept and characteristics of project management and application of resource scheduling and critical chain scheduling. (Understand)

2. Estimate the suitable resources required for given project work (Apply)
3. Construct the balance sheet to identify the fund flow and cash flow statements (Apply)
4. Apply the concept of CPM and PERT to develop the project network (Apply)
5. Examine the various tools and techniques at different stages of Quality management. (Analysis)
6. Evaluate the decision related to fore casting, inventory, quality control problems etc. for the industries (Evaluate)

TEXT BOOKS:

1. Prasanna Chandra, "'Fundamentals of Financial Management' ", Tata Mcgraw-Hill Publishing Ltd,2015.

2. Jack Meredith, Samuel J.Mantel, "Project Management- A Managerial Approach", John Wiley andSons.

REFERENCE BOOKS:

1. Clifford F Gray, Erik W Larson, "Project Management-The Managerial Process ", Tata Mcgraw-Hill Publishing Co Ltd.

2. John M Nicholas, "Project Management For Business And Technology", Prentice Hall of India Pvt Ltd.

3. Paresh Shah, "Basic Financial Accounting for Management", Oxford University Press, 2020.

R21UCS702	CRYPTOGRAPHY AND CYBER SECURITY	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To understand cryptography theories, algorithms and systems.
- To understand necessary approaches and techniques to build protection mechanisms in order to secure computer networks.

UNIT I	INTRODUCTION	9

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

UNIT II	SYMMETRIC KEY CRYPTOGRAPHY	9

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

UNIT III	PUBLIC KEY CRYPTOGRAPHY	9

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

UNIT Iv	MESSAGE AUTHENTICATION AND INTEGRITY	9

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

UNIT v	SECURITY PRACTICE AND CYBER SECURITY	9

Introduction to Cyber Crime and security: Cyber Crimes, types of Cyber Crime, hacking, attack vectors, Cross Site Scripting (XSS), XSS Consequences. Cyber Space and criminal behaviour, traditional problems associated with Cyber Crime, Introduction to Incident Response, Digital Forensics – Phishing.

COURSE OUTCOMES:

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

- Explain various symmetric and asymmetric cryptographic algorithms used for secure data transfer. (Understand)
- Apply the symmetric and asymmetric cryptographic algorithms to provide secure data transfer for real world applications. (Apply)
- Analyze the mathematics of public key cryptographic algorithms to ensure data secrecy with message authentication and integrity. (Analyze)
- Evaluate the suitability of security algorithms using cryptography and cyber security for real time applications. (Evaluate)
- Use Modern tool to do the research in the emerging areas of cryptography and cyber security. (Modern Tool Usage)
- Work individually or in teams and demonstrate the solutions to the given exercises through presentation (Affective Domain)

TEXT BOOK:

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

REFERENCE BOOKS:

1. Nina Godbole and SunitBelpure, Cyber Security: Understanding Cyber crimes, ComputerForeinsics and Legal Perspectives, Willey India Pvt.Ltd.
2. K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd
3. Behrouza.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
4. Dr T R Padmanabhan N Harini,"Cryptography and Security Paperback", Wiley India

R21UCS707	CRYPTOGRAPHY AND CYBER SECURITY LABORATORY	L	T	P	C
		0	0	2	1

PRE-REQUISITE :

COURSE OBJECTIVES:

- To learn different cipher techniques
- To implement the algorithms DES, RSA, MD5, SHA-1
- To use cybersecurity tools and vulnerability assessment tools

LIST OF EXPERIMENTS

1. Perform encryption, decryption using the following substitution techniques (i) Ceaser cipher, (ii) Playfair cipher iii) Hill Cipher iv) Vigenere cipher
2. Perform encryption and decryption using following transposition techniques
   i) Rail fence ii) row & Column Transformation
   ii) Apply DES algorithm for practical applications.
3. Apply AES algorithm for practical applications.
4. Implement RSA Algorithm using HTML and JavaScript
5. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
6. Calculate the message digest of a text using the SHA-1 algorithm.
7. Implement the SIGNATURE SCHEME – Digital Signature Standard.
8. Perform email analysis using the Autopsy tool.
9. Perform Memory capture and analysis using FTK imager tool
10. Perform Network analysis using the Network Miner tool

TOTAL: 30 Periods

COURSE OUTCOMES:

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

- Apply code for classical Encryption Techniques to solve the problems. (APPLY)
- Apply the concept of symmetric and public key encryption algorithms with code for authentication algorithms (Apply)
- Analyze various signature scheme using Digital signature with cyber security standard. (Analyze)
- Demonstrate the cyber security system using open source tools to find an optimal solution for the effective data communication. (Create)
- Communicate effectively to justify the computing solutions based on legal and

ethical principles. (Affective domain)

- Work effectively as an individual or in teams to simulate routing protocols for a given scenario. (Affective domain)

REFERENCES:

1. Build Your Own Security Lab, Michael Gregg, Wiley India
2. The Best Damn Cybercrime and Digital Forensics Book Period, J. Wiles and A. Reyes, Syngress, 2007.

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

C / C++ / Java or equivalent compiler GnuPG, Snort, N-Stalker or Equivalent, Autopsy tool, FTK imager tool or Equivalent.

HARDWARE:

Standalone desktops – 30 Nos. (or) Server supporting 30 terminals or more.

Semester VIII

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
PE-VI	Professional Elective–VI	3	0	0	3	PE
OE-IV	Open Elective–IV	3	0	0	3	OE
PRACTICAL						
R21UCS801	Project work	0	0	16	8	PW
R21UGE810	MDP-Phase II*	0	0	16	8	PW
MANDATORY						
R21UGM831	Professional Ethics and Human values (Common to all branches)	2	0	0	P/F	MC
	TOTAL	**8**	**0**	**16**	**14**	
Total No of Credits -14						

***Students those who opt for MDP-Phase1 are allowed to take MDP PhaseII**

R21UCS801	PROJECT WORK	L	T	P	C
		0	0	16	8

PRE-REQUISITE :

COURSE OBJECTIVES:

- To deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, research investigation, a computer based project or management project.

Project work time can be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project. The progress of the project is evaluated based on a minimum of three reviews.

COURSE OUTCOMES:

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

- Design/Develop sustainable solutions for societal issues with environmental considerations applying the basic engineering knowledge. (Create)
- Analyze and review research literature to synthesize research methods including design of experiments to provide valid conclusion. (Analyze)
- Utilize the new tools, algorithms, techniques to provide valid conclusion following the norms of engineering practice (Apply)
- Test and Evaluate the performance of the developed solution using appropriate techniques and tools. (Evaluate)
- Apply management principles to function effectively in the project team for project execution. (Affective Domain)
- Engage in learning for effective project implementation in the broadest context of technological change with consideration for public health, safety, cultural and societal needs. (Affective Domain)
- Write effective reports and make clear presentation to the engineering community and society (Psychomotor Domain)

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R21UGM831	PROFESSIONAL ETHICS & HUMAN VALUES	L	T	P	C
		2	0	0	P/F

OBJECTIVES :

- To enable the students to create an awareness on Engineering Ethics and Human Values to instill Moral and Social Values and Loyalty and to appreciate the rights of others

UNIT I HUMAN VALUES 7

Morals- Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage - Valuing Time - Co-operation – Commitment – Empathy- self-Confidence –Character.

UNIT II ENGINEERING ETHICS 7

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues –Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 4

Engineering Harmony in the family – Harmony in the society – Trust and Respect – Universal harmonious order

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 6

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES 6

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development– Engineers as Managers – Consulting Engineers – Honesty – Moral Leadership – Sample Code of Conduct.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

1. Apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

1. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.
2. Mike W. Martin and Roland Schinzinger, “Ethics in Engineering”, Tata McGraw Hill, New Delhi, 2003.

REFERENCE BOOKS:

1. Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics – Concepts and Cases”, Cengage Learning, 2009.
3. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001.
4. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003
5. Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity and Social Responsibility” Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.
6. World Community Service Centre, ‘ Value Education’, Vethathiri publications, Erode, 2011.

VERTICAL SYLLABUS

VERTICAL 1: DATA SCIENCE

Course Code	Course Title	L	T	P	C
R21CSV101	Exploratory Data Analysis	3	0	0	3
R21CSV102	Recommender Systems	3	0	0	3
R21ITV103	Neural Networks and Deep Learning	3	0	0	3
R21CSV104	Text and Speech Analysis	3	0	0	3
R21ITV105	Business Analytics	3	0	0	3
R21ITV106	Image and Video Analytics	3	0	0	3
R21CSV107	Computer Vision	3	0	0	3
R21ITV108	BigData Analytics	3	0	0	3

R21CSV101	EXPLORATORY DATA ANALYSIS	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To outline an overview of exploratory data analysis.
- To implement data visualization using Matplotlib.
- To perform univariate data exploration and analysis.
- To apply bivariate data exploration and analysis.
- To use Data exploration and visualization techniques for multivariate and time series data.

UNIT I	EXPLORATORY DATA ANALYSIS	9

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques.

UNIT II	EDA USING PYTHON	9

Data Manipulation using Pandas – Pandas Objects – Data Indexing and Selection – Operating on Data – Handling Missing Data – Hierarchical Indexing – Combining datasets – Concat, Append,Merge and Join – Aggregation and grouping – Pivot Tables – Vectorized String Operations.

UNIT III	UNIVARIATE ANALYSIS	9

introduction to Single variable: Distribution Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality.

UNIT IV	BIVARIATE ANALYSIS	9

Relationships between Two Variables - Percentage Tables - Analysing Contingency Tables -

Handling Several Batches - Scatterplots and Resistant Lines

UNIT V	MULTIVARIATEANDTIMESERIESANALYSIS	9

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Understand the fundamentals of exploratory data analysis.
- Implement the data visualization using Matplotlib.

- Perform univariate data exploration and analysis.
- Apply bivariate data exploration and analysis.
- Use Data exploration and visualization techniques for multivariate and time series data.

TEXT BOOKS:

1.SureshKumarMukhiya,UsmanAhmed,“HandsOnExploratoryDataAnalysiswithPython”,PacktPublishing,2020.(Unit1)

2.JakeVanderPlas,"Python Data Science Handbook:Essential Tools for Working with Data",FirstEdition, OReilly,2017.(Unit2)

3.CatherineMarsh,JaneElliott,“ExploringData:AnIntroductiontoDataAnalysisforSocialScientists”,WileyPublications,2nd Edition,2008.(Unit3,4,5)

REFERENCE BOOKS:

1. EricPimpler, Data Visualizationand Exploration with R,Geo Spatial Training service, 2017.

2.ClausO.Wilke,“Fundamentals of Data Visualization”,O’reillypublications,2019.

3.MatthewO.Ward,GeorgesGrinstein,DanielKeim,“InteractiveDataVisualization:Foundations, Techniques,andApplications”, 2ndEdition,CRCpress,2015.

R21CSV102	RECOMMENDER SYSTEMS	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To understand the foundations of the recommender system.
- To learn the significance of machine learning and data mining algorithms for Recommender systems
- To learn about collaborative filtering
- To make students design and implement are commender system.
- To learn collaborative filtering.

UNIT I	INTRODUCTION	9

Introduction and basic taxonomy of recommender systems - Traditional and non-personalized Recommender Systems - Overview of data mining methods for recommender systems- similarity measures-Dimensionality reduction–Singular Value Decomposition(SVD)

Suggested Activities:

- Practical learning–Implement Data similarity measures.
- External Learning–Singular Value Decomposition(SVD)applications

Suggested Evaluation Methods:

- Quiz on Recommender systems.
- Quiz of python tools available for implementing Recommendersystems

UNIT II	CONTENT-BASEDRECOMMENDATIONSYSTEMS	9

High-level architecture of content-based systems-Item profiles,Representing item profiles,Methods for learning user profiles, Similarity-based retrieval,and Classification algorithms.

SuggestedActivities:

- Assignment on content-based recommendationsystems
- Assignment of learning user profiles

SuggestedEvaluationMethods:

- Quiz on similarity-based retrieval.
- Quiz of content-based filtering

UNIT III	COLLABORATIVEFILTERING	9

A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF,components of neighborhood methods

(rating normalization,similarityweightcomputation,andneighborhood selection

Suggested Activities:

- Practical learning–Implement collaborative filtering concepts
- Assignment of security aspects of recommendersystems

Suggested EvaluationMethods:

- Quiz on collaborative filtering
- Seminar on security measures of recommendersystems

UNITIV	ATTACK-RESISTANT RECOMMENDER SYSTEMS	9

Introduction–TypesofAttacks–Detectingattacksonrecommendersystems–Individualattack –Groupattack–Strategiesforrobustrecommenderdesign-Robustrecommendationalgorithms.

Suggested Activities:

- Group Discussion on attacks and their mitigation
- Studyof the impact of group attacks
- External Learning–Use of CAPTCHAs

Suggested Evaluation Methods:

- Quiz on attacks on recommendersystems
- Seminar on preventing attacks using the CAPTCHAs

UNITV	EVALUATINGRECOMMENDERSYSTEMS	9

EvaluatingParadigms–UserStudies–OnlineandOfflineevaluation–Goalsofevaluationdesign –Design Issues–Accuracy metrics–Limitations of Evaluation measures

Suggested Activities:

- Group Discussion on goals of evaluation design
- Study of accuracy metrics

Suggested Evaluation Methods:

- Quiz on evaluation design
- Problems on accuracy measures

TOTAL:45 PERIODS

COURSEOUTCOMES:

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

- Understand the basic concepts of recommender systems.
- Implement machine-learning and data-mining algorithms in recommender systems datasets.
- Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.
- Design and implement a simple recommendersystem.
- Learn about advanced topics of recommender systems.
- Learn about advanced topics of recommender systems applications

TEXT BOOKS:

1.CharuC. Aggarwal,RecommenderSystems:TheTextbook,Springer,2019.

2. DietmarJannach,MarkusZanker,AlexanderFelfernig and GerhardFriedrich ,RecommenderSystems:AnIntroduction,CambridgeUniversity Press(2011),1sted.

3.FrancescoRicci,LiorRokach,BrachaShapira,RecommenderSytemsHandbook,1sted,Springer(2011),

4.JureLeskovec,AnandRajaraman,JeffreyDavidUllman,Miningofmassivedatasets,3rdedition,CambridgeUniversityPress,2020.

R21ITV103	NEURAL NETWORKS AND DEEP LEARNING	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE 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 auto encoders and generative models for suitable applications.

UNIT I	INTRODUCTION	9

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.

UNIT II	ASSOCIATIVEMEMORY ANDUNSUPERVISEDLEARNING NETWORKS	9

Training Algorithms for Pattern Association-Auto associative Memory Network-Hetero associative Memory Network-Bidirectional Associative Memory(BAM)-Hop field Networks-Iterative Auto associative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.

UNIT III	THIRD-GENERATION NEURALNETWORKS	9

Spiking Neural Networks-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–Structured Outputs–Data Types– Efficient Convolution Algorithms – Neuro scientific Basis – Applications: Computer Vision, Image Generation,ImageCompression.

UNIT IV	DEEP FEEDFORWARDNETWORKS	9

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

UNIT V	RECURRENTNEURALNETWORKS	9

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing.Complete Auto encoder,Regularized Auto encoder,Stochastic Encoders and Decoders,Contractive Encoders

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Apply Convolution Neural Network for image processing.
- Understand the basics of associative memory and unsupervised learning networks.
- Apply CNN and its variants for suitable applications.
- Analyze the key computations underlying deeplearning and use them to build and train deepneural networks for various tasks.
- Apply auto encoders and generative models for suitable applications

TEXT BOOKS:

1. IanGoodfellow,YoshuaBengio,AaronCourville, “DeepLearning”,MITPress, 2019.

2. Francois Chollet, “Deep Learning with Python”, Second Edition, Manning Publications,20R21.

REFERENCE BOOKS:

1. AurélienGéron,“Hands-On Machine Learning with Scikit LearnandTensorFlow”,Oreilly,2018.

2.JoshPatterson,AdamGibson,“DeepLearning:APractitioner’sApproach”,O’ReillyMedia,2017.

R21CSV104	TEXT AND SPEECH ANALYSIS	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- Understand natural language processing basics
- Apply classification algorithms to text documents
- Build question-answering and dialogue systems
- Develop a speech recognition system
- Develop a speech synthesizer

UNIT I	NATURAL LANGUAGE BASICS	9

Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop-words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model

Suggested Activities

● Flipped classroom on NLP

● Implementation of Text Preprocessing using NLTK

● Implementation of TF-IDF models

Suggested Evaluation Methods

• Quiz on NLP Basics

• Demonstration of Programs

UNIT II	TEXT CLASSIFICATION	9

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization and Topic Models

Suggested Activities

• Flipped classroom on Feature extraction of documents

• Implementation of SVM models for text classification

• External learning: Text summarization and Topic models

Suggested Evaluation Methods

• Assignment on above topics

• Quiz on RNN, Transformers

• Implementing NLP with RNN and Transformers

UNIT III	QUESTION ANSWERING AND DIALOGUE SYSTEMS	9

Information retrieval – IR-based question answering – knowledge-based question answering – language

models for QA – classic QA models – chatbots – Design of dialogue systems -– evaluating dialogue systems

Suggested Activities:

- Flipped classroom on language models for QA
- Developing a knowledge-based question-answering system
- Classic QA model development

Suggested Evaluation Methods

- Assignment on the above topics
- Quiz on knowledge-based question answering system
- Development of simple chatbots

UNIT IV	TEXT-TO-SPEECH SYNTHESIS	9

Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing - Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems **Suggested Activities:**

- Flipped classroom on Speech signal processing
- Exploring Text normalization
- Data collection
- Implementation of TTS systems

Suggested Evaluation Methods

- Assignment on the above topics
- Quiz on wavenet, deep learning-based TTS systems
- Finding accuracy with different TTS systems

UNIT V	AUTOMATIC SPEECH RECOGNITION	9

Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems

Suggested Activities:

- Flipped classroom on Speech recognition.
- Exploring Feature extraction

Suggested Evaluation Methods

- Assignment on the above topics
- Quiz on acoustic modelling

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Explain existing and emerging deep learning architectures for text and speech processing.
- Apply deep learning techniques for NLP tasks, language modelling and machine translation
- Explain coreference and coherence for text processing
- Build question-answering systems, chatbots and dialogue systems

- Apply deep learning models for building speech recognition and text-to-speech systems

TEXT BOOK:

1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Third Edition, 2022.

REFERENCES:

1. Dipanjan Sarkar, “Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data”, APress,2018.
2. Tanveer Siddiqui, Tiwary U S, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, “Fundamentals of Speech Recognition” 1st Edition, Pearson, 2009.
4. Steven Bird, Ewan Klein, and Edward Loper, “Natural language processing with Python”, O’REILLY.

R21ITV105	BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE 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

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 Modelling –Machine Learning for Predictive analytics

UNIT IV	HR & SUPPLY CHAIN ANALYTICS	9

Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain - Applying HR Analytics to make a prediction of the demand for hourly employees for a year.

UNIT V	MARKETING & SALES ANALYTICS	9

Marketing Strategy, Marketing Mix, Customer Behaviour –selling Process – Sales Planning – Analytics applications in Marketing and Sales - predictive analytics for customers' behaviour in marketing and sales.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Explain the real world business problems and model with analytical solutions.
- Identify the business processes for extracting Business Intelligence
- Apply predictive analytics for business fore-casting .
- Apply analytics for supply chain and logistics management CO5: Use analytics for marketing and

sales.

TEXT BOOKS:

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

R21UIT106	IMAGE AND VIDEO ANALYTICS	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE 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.

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 multisperalct images - Local pre-processing in the frequency domain - Line detection by local preprocessing 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-Faster R-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-FaceNet 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 problemRestNet architecture-RestNet and skip connections-Inception Network-GoogleNetarchitectureImprovement in Inception v2-Video analytics-RestNet and Inception v3.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Understand the basics of image processing techniques for computer vision and video analysis.
- Explain the techniques used for image pre-processing.
- Develop various object detection techniques.
- Understand the various face recognition mechanisms.
- Elaborate on deep learning-based video analytics..

TEXT BOOK:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing, Analysis, and Machine Vision”, 4nd edition, Thomson Learning, 2013.
2. VaibhavVerdhan,(20R21, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras,Apress 20R21(UNIT-III,IV and V)

REFERENCE BOOKS:

1. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer Verlag London 2. Limited,2011.
2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, “Video Analytics for Business Intelligence”, Springer, 2012.
3. D. A. Forsyth, J. Ponce, “Computer Vision: A Modern Approach”, Pearson Education, 2003.
4. E. R. Davies, (2012), “Computer & Machine Vision”, Fourth Edition, Academic Press

R21CSV107	COMPUTER VISION	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE 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

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 rangefinding - Surface representations - Point-based representationsVolumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.

UNIT V	IMAGE-BASED RENDERING AND RECOGNITION	9

View interpolation Layered depth images - Light fields and Lumigraphs - 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

COURSE OUTCOMES:

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

- To understand basic knowledge, theories and methods in image processing and computer vision.
- To implement basic and some advanced image processing techniques in OpenCV.

- To apply 2D a feature-based based image alignment, segmentation and motion estimations
- To apply 3D image reconstruction techniques
- To design and develop innovative image processing and computer vision applications..

TEXT BOOK:

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.

REFERENCE BOOKS:

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
3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

R21ITV108	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To understand big data.
- To learn and use NoSQL big data management.
- To learn mapreduce analytics using Hadoop and related tools.
- To work with map reduce applications
- To understand the usage of Hadoop related tools for Big Data Analytics

UNIT I	UNDERSTANDING BIG DATA	9

Introduction to big data – convergence of key trends – unstructured data – industry examples of big data – web analytics – big data applications– big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.

UNIT II	NOSQL DATA MANAGEMENT	9

Introduction to NoSQL – aggregate data models – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – master-slave replication – consistency - Cassandra – Cassandra data model – Cassandra examples – Cassandra clients

UNIT III	MAP REDUCE APPLICATIONS	9

MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats.

UNIT IV	BASICS OF HADOOP	9

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures - Cassandra – Hadoop integration.

UNIT V	HADOOP RELATED TOOLS	9

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Describe big data and use cases from selected business domains.
- Explain NoSQL big data management.
- Install, configure, and run Hadoop and HDFS.
- Perform map-reduce analytics using Hadoop.
- Use Hadoop-related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

TEXT BOOK:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
3. Sadalage, Pramod J. “NoSQL distilled”, 2013

REFERENCE BOOKS:

1. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
2. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
3. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010. 4. Alan Gates, "Programming Pig", O'Reilley, 2011.

VERTICAL 2: FULL STACK DEVELOPMENT

Course Code	Course Title	L	T	P	C
R21ITV 201	FullStack Web Development	3	0	0	3
R21ITV 202	AppDevelopment	3	0	0	3
R21CSV 303	Cloud Essentials	3	0	0	3
R21CSV 204	UI and UX Design	3	0	0	3
R21ITV 205	Software Testing And Automation	3	0	0	3
R21CSV 206	Web Application Security	3	0	0	3
R21ITV207	DevOps	3	0	0	3
R21CSV 208	Principles of Programming Languages	3	0	0	3
R21CSV 301	Cloud Computing	3	0	0	3

R21ITV201	FULL STACK WEB DEVELOPMENT	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To understand different Internet Technologies
- To learn java-specific web services architecture
- To Develop web applications using frameworks

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

Web Essentials: Clients, Servers and Communication – The Internet – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Drag and Drop – Audio – Video controls - CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations. Bootstrap Framework

UNIT II	CLIENT SIDE PROGRAMMING	9

Java Script: An introduction to JavaScript–JavaScript DOM Model-Exception Handling-ValidationBuilt-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files

UNIT III	SERVER SIDE PROGRAMMING	9

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- DATABASE CONNECTIVITY: JDBC.

UNIT IV	PHP and XML	9

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation. XML: Basic XML- Document Type Definition- XML Schema, XML Parsers and Validation, XSL ,

UNIT V	INTRODUCTION TO ANGULAR and WEB APPLICATIONS FRAMEWORKS	9

Introduction to AngularJS, MVC Architecture, Understanding ng attributes, Expressions and data binding, Conditional Directives, Style Directives, Controllers, Filters, Forms, Routers, Modules, Services; Web Applications Frameworks and Tools – Firebase- Docker- Node JS- React- DjangoUI& UX.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Construct a basic website using HTML and Cascading Style Sheets
- Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.
- Develop server side programs using Servlets and JSP.
- Construct simple web pages in PHP and to represent data in XML format.
- Develop interactive web applications..

TEXT BOOK:

1. Deitel and Deitel and Nieto, Internet and World Wide Web - How to Program, Prentice Hall, 5th Edition, 2011.

2. Jeffrey C and Jackson, Web Technologies A Computer Science Perspective, Pearson Education, 2011.

3. Angular 6 for Enterprise-Ready Web Applications, DoguhanUluca, 1st edition, Packt Publishing

REFERENCE BOOKS:

1. Stephen Wynkoop and John Burke “Running a Perfect Website”, QUE, 2nd Edition,1999.
2. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2009.

R21ITV202	APP DEVELOPMENT	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To learn development of native applications with basic GUI Components
- To develop cross-platform applications with event handling
- To develop applications with location and data storage capabilities
- To develop web applications with database access

UNIT I	FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT	9

Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, What is Progressive Web App, Responsive Web design,

UNIT II	NATIVE APP DEVELOPMENT USING JAVA	9

Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Dev elopment Frameworks, Java &Kotlin for Android, Swift & Objective-C for iOS, Basics of React Native, Native Components, JSX, State, Props

UNIT III	HYBRID APP DEVELOPMENT	9

Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks, Ionic, Apache Cordova,

UNIT IV	CROSS-PLATFORM APP DEVELOPMENT USING REACT-NATIVE	9

What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Crossplatform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native, Native Components, JSX, State, Props

UNIT V	NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS	9

Comparison of different App frameworks, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Development, UI/UX, Reusability

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Develop Native applications with GUI Components.
- Develop hybrid applications with basic event handling.
- Implement cross-platform applications with location and data storage capabilities.

- Implement cross platform applications with basic GUI and event handling.
- Develop web applications with cloud database access.

TEXT BOOK:

1. Head First Android Development, Dawn Griffiths, O'Reilly, 1st edition
2. Apache Cordova in Action, Raymond K. Camden, Manning. 2015
3. Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, Anthony Accomazzo, HousseinDjirdeh, Sophia Shoemaker, Devin Abbott, FullStack publishing

REFERENCE BOOKS:

1. Android Programming for Beginners, John Horton, Packt Publishing, 2nd Edition
2. Native Mobile Development by Shaun Lewis, Mike Dunn
3. Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach, PawanLingras, Matt Triff, RuchaLingras
4. Apache Cordova 4 Programming, John M Wargo, 2015
5. React Native Cookbook, Daniel Ward, Packt Publishing, 2nd Edition

R21CSV204	UI AND UX DESIGN	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- To understand the various Research Methods used in Design
- To explore the various Tools used in UI & UX
- Creating a wireframe and prototype

UNIT I	FOUNDATIONS OF DESIGN	9

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy

UNIT II	FOUNDATIONS OF UI DESIGN	9

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides

UNIT III	FOUNDATIONS OF UX DESIGN	9

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals

UNIT IV	WIREFRAMING, PROTOTYPING AND TESTING	9

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration

UNIT V	RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE	9

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

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Build UI for user Applications
- Evaluate UX design of any product or application
- Demonstrate UX Skills in product development
- Implement Sketching principles CO5:Create Wireframe and Prototype

TEXT BOOK:

1. Joel Marsh, “UX for Beginners”, O’Reilly , 2022
2. Jon Yablonski, “Laws of UX using Psychology to Design Better Product & Services” O’Reilly 20R21

REFERENCE BOOKS:

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, “Designing Interface” 3 rd 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.

R21ITV205	SOFTWARE TESTING AND AUTOMATION	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To understand the basics of software testing
- To learn how to do the testing and planning effectively
- To build test cases and execute them
- To focus on wide aspects of testing and understanding multiple facets of testing
- To get an insight about test automation and the tools used for test automation

UNIT I	FOUNDATIONS OF SOFTWARE TESTING	9

Why do we test Software?, Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing

UNIT II	TEST PLANNING	9

The Goal of Test Planning, High Level Expectations,Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.

UNIT III	TEST DESIGN AND EXECUTION	9

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.

UNIT IV	ADVANCED TESTING CONCEPTS	9

Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, Testing in the Agile Environment, Testing Web and Mobile Applications.

UNIT V	TEST AUTOMATION AND TOOLS	9

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test

Reports

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Understand the basic concepts of software testing and the need for software testing
- Apply Test planning and different activities involved in test planning
- Analyze the various effective test cases that can uncover critical defects in the application
- Carry out advanced types of testing
- Automate the software testing using Selenium and Testing
- Summarize the conclusions for the different types of testing with teams or individually.

TEXT BOOK:

1. Yogesh Singh, “Software Testing”, Cambridge University Press, 2012

2. UnmeshGundecha, SatyaAvasarala, "Selenium WebDriver 3 Practical Guide" - Second Edition 2018

REFERENCE BOOKS:

1. Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition, 2012, John Wiley & Sons, Inc.
2. Ron Patton, Software testing, 2nd Edition, 2006, Sams Publishing
3. Paul C. Jorgensen, Software Testing: A Craftsman’s Approach, Fourth Edition, 2014, Taylor & Francis Group.
4. Carl Cocchiaro, Selenium Framework Design in Data-Driven Testing, 2018, Packt Publishing.
5. Elfriede Dustin, Thom Garrett, Bernie Gaurf, Implementing Automated Software Testing, 2009, Pearson Education, Inc.
6. SatyaAvasarala, Selenium WebDriver Practical Guide, 2014, Packt Publishing.
7. Varun Menon, TestNg Beginner's Guide, 2013, Packt Publishing.

R21CSV206	WEB APPLICATION SECURITY	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To understand the fundamentals of web application security
- To focus on wide aspects of secure development and deployment of web applications
- To learn how to build secure APIs
- To learn the basics of vulnerability assessment and penetration testing • To get an insight about Hacking techniques and Tools

UNIT I	FUNDAMENTALS OF WEB APPLICATION SECURITY	9

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation

UNIT II	SECURE DEVELOPMENT AND DEPLOYMENT	9

Web Applications Security - Security Testing, Security Incident Response Planning,The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)

UNIT III	SECURE API DEVELOPMENT	9

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys , OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

UNIT IV	VULNERABILITY ASSESSMENT AND PENETRATION TESTING	9

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Databasebased 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

COURSE OUTCOMES:

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

- Understanding the basic concepts of web application security and the need for it
- Be acquainted with the process for secure development and deployment of web applications
- Acquire the skill to design and develop Secure Web Applications that use Secure APIs
- Be able to get the importance of carrying out vulnerability assessment and penetration testing Acquire the skill to think like a hacker and to use hackers tool sets.

TEXT BOOK:

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, TheMcGrawHill Companies.
3. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

REFERENCE BOOKS:

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, 20R21, Taylor & Francis Group, LLC.
3. PrabathSiriwardena, 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.

R21ITV207	DEVOPS	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE 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

UNIT I	INTRODUCTION TO DEVOPS	9

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

UNIT II	COMPILE AND BUILD USING MAVEN & GRADLE	9

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle

UNIT III	CONTINUOUS INTEGRATION USING JENKINS	9

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT IV	CONFIGURATION MANAGEMENT USING ANSIBLE	9

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

UNIT V	BUILDING DEVOPS PIPELINES USING AZURE	9

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

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Understand different actions performed through Version control tools like Git.
- Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins

by building and automating test cases using Maven &Gradle.

- Ability to Perform Automated Continuous Deployment
- Ability to do configuration management using Ansible
- Understand to leverage Cloud-based DevOps tools using Azure DevOps.

TEXT BOOK:

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

REFERENCE BOOKS:

1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020
   byMiteshSoni
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. MariotTsitoara, “Ansible BeginningGit and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer”, Second Edition, 2019.
5. https://www.jenkins.io/user-handbook.pdf
6. https://maven.apache.org/guides/getting-started/

R21CSV208	PRINCIPLES OF PROGRAMMING LANGUAGES	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To understand and describe syntax and semantics of programming languages
- To understand data, data types, and basic statements
- To understand call-return architecture and ways of implementing them
- To understand object-orientation, concurrency, and event handling in programming languages
- To develop programs in non-procedural programming paradigms

UNIT I	SYNTAX AND SEMANTICS	9

Evolution of programming languages – describing syntax – context-free grammars – attribute grammars – describing semantics – lexical analysis – parsing – recursive-descent – bottom up parsing

UNIT II	DATA, DATA TYPES, AND BASIC STATEMENTS	9

Names – variables – binding – type checking – scope – scope rules – lifetime and garbage collection – primitive data types – strings – array types – associative arrays – record types – union types – pointers and references – Arithmetic expressions – overloaded operators – type conversions – relational and boolean expressions – assignment statements – mixed mode assignments – control structures – selection – iterations – branching – guarded statements

UNIT III	SUBPROGRAMS AND IMPLEMENTATIONS	9

Subprograms – design issues – local referencing – parameter passing – overloaded methods – generic methods – design issues for functions – semantics of call and return – implementing simple subprograms – stack and dynamic local variables – nested subprograms – blocks – dynamic scoping

UNIT IV	OBJECT-ORIENTATION, CONCURRENCY, AND EVENT HANDLING	9

Object-orientation – design issues for OOP languages – implementation of object-oriented constructs – concurrency – semaphores – monitors – message passing – threads – statement level concurrency – exception handling – event handling

UNIT V	FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES	9

Introduction to lambda calculus – fundamentals of functional programming languages – Programming with Scheme – Programming with ML – Introduction to logic and logic programming – Programming with Prolog – multi-paradigm languages

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Describe syntax and semantics of programming languages
- Explain data, data types, and basic statements of programming languages
- Design and implement subprogram constructs
- Apply object-oriented, concurrency, and event handling programming constructs and Develop programs in Scheme, ML, and Prolog
- Understand and adopt new programming languages.

TEXT BOOK:

1. Robert W. Sebesta, “Concepts of Programming Languages”, Twelfth Edition (Global Edition), Pearson, 2022.
2. Michael L. Scott, “Programming Language Pragmatics”, Fourth Edition, Elsevier, 2018.
3. R. Kent Dybvig, “The Scheme programming language”, Fourth Edition, Prentice Hall, 2011. 4. Jeffrey D. Ullman, “Elements of ML programming”, Second Edition, Pearson, 1997.
4. W. F. Clocksin and C. S. Mellish, “Programming in Prolog: Using the ISO Standard”, Fifth Edition, Springer, 2003

VERTICAL 3: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES

Course Code	Course Title	L	T	P	C
R21CSV301	Cloud Computing	3	0	0	3
R21CSV302	Virtualization	3	0	0	3
R21CSV303	Cloud Essentials	3	0	0	3
R21ITV304	Data Warehousing	3	0	0	3
R21ITV305	Storage Technologies	3	0	0	3
R21CSV306	Software Defined Networks	3	0	0	3
R21ITV307	Stream Processing	3	0	0	3
R21ITV308	Security and Privacy in Cloud	3	0	0	3

R21CSV301	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To understand the principles of cloud architecture, models and infrastructure.
- To understand the concepts of virtualization and virtual machines.
- To gain knowledge about virtualization Infrastructure.
- To explore and experiment with various Cloud deployment environments.
- To learn about the security issues in the cloud environment.

UNIT I	CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE	9

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges

UNIT II	VIRTUALIZATION BASICS	9

Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.

UNIT III	VIRTUALIZATION INFRASTRUCTURE AND DOCKER	9

Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories.

UNIT IV	CLOUD DEPLOYMENT ENVIRONMENT	9

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack.

UNIT V	CLOUD SECURITY	9

Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyperjacking. Data Security and Storage; Identity and Access Management (IAM) - IAM Challenges - IAM Architecture and Practice.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Understand the design challenges in the cloud.
- Apply the concept of virtualization and its types.
- Experiment with virtualization of hardware resources and Docker.
- Develop and deploy services on the cloud and set up a cloud environment.
- Explain security challenges in the cloud environment.

TEXT BOOK:

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. James Turnbull, "The Docker Book", O'Reilly Publishers, 2014.
3. Krutz, R. L., Vines, R. D, "Cloud security. A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing, 2010.

REFERENCE BOOKS:

1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
2. Tim Mather, SubraKumaraswamy, and ShahedLatif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", O'Reilly Media, Inc., 2009.

R21CSV302	VIRTUALIZATION	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

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

UNIT I	INTRODUCTION TO VIRTUALIZATION	9

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

UNIT II	SERVER AND DESKTOP VIRTUALIZATION	9

Virtual machine basics- Types of virtual machines- Understanding Server Virtualization- types of server virtualization- Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform-Desktop Virtualization-Types of Desktop Virtualization

UNIT III	NETWORK VIRTUALIZATION	9

Introduction to Network Virtualization-Advantages- Functions-Tools for Network VirtualizationVLAN-WAN Architecture-WAN Virtualization

UNIT IV	STORAGE VIRTUALIZATION	9

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

UNIT V	VIRTUALIZATION TOOLS	9

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

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Analyze the virtualization concepts and Hypervisor

- Apply the Virtualization for real-world applications
- Install & Configure the different VM platforms
- Experiment with the VM with various software

TEXT BOOK:

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

R21CSV303	CLOUD ESSENTIALS	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE 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
- Select appropriate structures for designing, deploying and running cloud-based services in a business environment
- Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

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 LifeCycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service 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, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models

UNIT V	CLOUD SERVICE GOVERNANCE & VALUE	9

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Exhibit cloud-design skills to build and automate business solutions using cloud technologies.
- Possess Strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services
- Solve the real world problems using Cloud services and technologies.

TEXT BOOK:

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by EnamulHaque, 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

REFERENCE BOOKS:

1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing.
2. Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya, Christian Vechhiola, S. ThamaraiSelvi

R21ITV304	DATA WAREHOUSING	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To know the details of data warehouse Architecture
- To understand the OLAP Technology
- To understand the partitioning strategy
- To differentiate various schema
- To understand the roles of process manager & system manager

UNIT I	INTRODUCTION TO DATA WAREHOUSE	9

Data warehouse Introduction - Data warehouse components- operational database Vs data warehouse – Data warehouse Architecture – Three-tier Data Warehouse Architecture - Autonomous Data Warehouse- Autonomous Data Warehouse Vs Snowflake - Modern Data Warehouse

UNIT II	ETL AND OLAP TECHNOLOGY	9

What is ETL – ETL Vs ELT – Types of Data warehouses - Data warehouse Design and Modeling - Delivery Process - Online Analytical Processing (OLAP) - Characteristics of OLAP - Online Transaction Processing (OLTP) Vs OLAP - OLAP operations- Types of OLAP- ROLAP Vs MOLAP Vs HOLAP.

UNIT III	META DATA, DATA MART AND PARTITION STRATEGY	9

Meta Data – Categories of Metadata – Role of Metadata – Metadata Repository – Challenges for Meta Management - Data Mart – Need of Data Mart- Cost Effective Data Mart- Designing Data Marts- Cost of Data Marts- Partitioning Strategy – Vertical partition – Normalization – Row Splitting – Horizontal Partition

UNIT IV	DIMENSIONAL MODELING AND SCHEMA	9

Dimensional Modeling- Multi-Dimensional Data Modeling – Data Cube- Star Schema- Snowflake schema- Star Vs Snowflake schema- Fact constellation Schema- Schema Definition - Process Architecture- Types of Data Base Parallelism – Datawarehouse Tools

UNIT V	SYSTEM & PROCESS MANAGERS	9

Data Warehousing System Managers: System Configuration Manager- System Scheduling Manager - System Event Manager - System Database Manager - System Backup Recovery Manager - Data Warehousing Process Managers: Load Manager – Warehouse Manager- Query Manager – Tuning – Testing

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Design data warehouse architecture for various Problems
- Apply the OLAP Technology
- Analyse the partitioning strategy
- Critically analyze the differentiation of various schema for given problem
- Frame roles of process manager & system manager

TEXT BOOK:

1. Alex Berson and Stephen J. Smith “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, Thirteenth Reprint 2008.
2. Ralph Kimball, “The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling”, Third edition, 2013

REFERENCE BOOKS:

1. Paul Raj Ponniah, “Data warehousing fundamentals for IT Professionals”, 2012.
2. K.P. Soman, ShyamDiwakar and V. Ajay “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.

R21ITV305	STORAGE TECHNOLOGIES	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- Characterize the functionalities of logical and physical components of storage
- Describe various storage networking technologies
- Identify different storage virtualization technologies
- Discuss the different backup and recovery strategies
- Understand common storage management activities and solutions

UNIT I	STORAGE SYSTEMS	9

Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center, Compute systems and compute virtualization and Software-defined data center.

UNIT II	INTELLIGENT STORAGE SYSTEMS AND RAID	9

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 scaleout storage Architecture.

UNIT III	STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION	9

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	9

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service

UNIT V	SECURING STORAGE INFRASTRUCTURE	9

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

COURSE OUTCOMES:

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

- Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment
- Illustrate the usage of advanced intelligent storage systems and RAID
- Interpret various storage networking architectures - SAN, including storage subsystems and virtualization
- Examine the different role in providing disaster recovery and remote replication technologies
- Infer the security needs and security measures to be employed in information storage management.

TEXT BOOK:

1. EMC Corporation, Information Storage and Management, Wiley, India
2. Jon Tate, Pall Beck, Hector Hugo Ibarra, ShanmuganathanKumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017
3. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein ,Storage Networks Explained, Second Edition, Wiley, 2009

R21CSV306	SOFTWARE DEFINED NETWORKS	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To understand the need for SDN and its data plane operations
- To understand the functions of control plane
- To comprehend the migration of networking functions to SDN environment
- To explore various techniques of network function virtualization
- To comprehend the concepts behind network virtualization

UNIT I	SDN: INTRODUCTION	9

Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane , Control plane and Application Plane

UNIT II	SDN DATA PLANE AND CONTROL PLANE	9

Data Plane functions and protocols - OpenFLow Protocol - Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface – SDN Controllers - Ryu, OpenDaylight, ONOS - Distributed Controllers

UNIT III	SDN APPLICATIONS	9

SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering – Measurement and Monitoring – Security – Data Center Networking

UNIT IV	NETWORK FUNCTION VIRTUALIZATION	9

Network Virtualization - Virtual LANs – OpenFlow VLAN Support - NFV Concepts – Benefits and Requirements – Reference Architecture

UNIT V	NFV FUNCTIONALITY	9

NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases – SDN and NFV

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Describe the motivation behind SDN
- Identify the functions of the data plane and control plane
- Design and develop network applications using SDN
- Orchestrate network services using NFV
- Explain various use cases of SDN and NFV

TEXT BOOK:

1. William Stallings, “Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud”, Pearson Education, 1st Edition, 2015.

REFERENCE BOOKS:

1. Ken Gray, Thomas D. Nadeau, “Network Function Virtualization”, Morgan Kauffman, 2016. 2. Thomas D Nadeau, Ken Gray, “SDN: Software Defined Networks”, O’Reilly Media, 2013.
2. Fei Hu, “Network Innovation through OpenFlow and SDN: Principles and Design”, 1st Edition, CRC Press, 2014.
3. Paul Goransson, Chuck Black Timothy Culver, “Software Defined Networks: A Comprehensive Approach”, 2nd Edition, Morgan Kaufmann Press, 2016.
4. Oswald Coker, SiamakAzodolmolky, “Software-Defined Networking with OpenFlow”, 2nd Edition, O’Reilly Media, 2017.

R21ITV307	STREAM PROCESSING	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- Introduce Data Processing terminology, definition & concepts
- Define different types of Data Processing
- Explain the concepts of Real-time Data processing
- Select appropriate structures for designing and running real-time data services in a business environment
- Illustrate the benefits and drive the adoption of real-time data services to solve real world problems

UNIT I	FOUNDATIONS OF DATA SYSTEM	9

Introduction to Data Processing, Stages of Data processing, Data Analytics, Batch Processing, Stream processing, Data Migration, Transactional Data processing, Data Mining, Data Management Strategy, Storage, Processing, Integration, Analytics, Benefits of Data as a Service, Challenges

UNIT II	REAL-TIME DATA PROCESSING	9

Introduction to Big data, Big data infrastructure, Real-time Analytics, Near real-time solution, Lambda architecture, Kappa Architecture, Stream Processing,Understanding Data Streams, Message Broker, Stream Processor, Batch & Real-time ETL tools, Streaming Data Storage

UNIT III	DATA MODELS AND QUERY LANGUAGES	9

Relational Model, Document Model, Key-Value Pairs, NoSQL, Object-Relational Mismatch, Manyto-One and Many-to-Many Relationships, Network data models, Schema Flexibility, Structured Query Language, Data Locality for Queries, Declarative Queries, Graph Data models, Cypher Query Language, Graph Queries in SQL, The Semantic Web, CODASYL, SPARQL

UNIT IV	EVENT PROCESSING WITH APACHE KAFKA	9

Apache Kafka, Kafka as Event Streaming platform, Events, Producers, Consumers, Topics, Partitions, Brokers, Kafka APIs, Admin API, Producer API, Consumer API, Kafka Streams API, Kafka Connect API.

UNIT V	REAL-TIME PROCESSING USING SPARK STREAMING	9

Structured Streaming, Basic Concepts, Handling Event-time and Late Data, Fault-tolerant Semantics, Exactly-once Semantics, Creating Streaming Datasets, Schema Inference, Partitioning of Streaming datasets, Operations on Streaming Data, Selection, Aggregation, Projection, Watermarking, Window operations, Types of Time windows, Join Operations, Deduplication

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Understand the applicability and utility of different streaming algorithms
- Describe and apply current research trends in data-stream processing.
- Analyze the suitability of stream mining algorithms for data stream systems
- Program and build stream processing systems, services and applications.
- Solve problems in real-world applications that process data streams.

TEXT BOOK:

1. Streaming Systems: The What, Where, When and How of Large-Scale Data Processing by Tyler Akidau, SlavaChemyak, Reuven Lax, O'Reilly publication

2. Designing Data-Intensive Applications by Martin Kleppmann, O'Reilly Media

3. Practical Real-time Data Processing and Analytics : Distributed Computing and Event Processing using Apache Spark, Flink, Storm and Kafka, Packt Publishing

REFERENCE BOOKS:

1. https://spark.apache.org/docs/latest/streaming-programming-guide.html

2. Kafka.apache.org

R21ITV308	SECURITY AND PRIVACY IN CLOUD	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To Introduce Cloud Computing terminology, definition & concepts
- To understand the security design and architectural considerations for Cloud
- To understand the Identity, Access control in Cloud
- To follow best practices for Cloud security using various design patterns
- To be able to monitor and audit cloud applications for security

UNIT I	FUNDAMENTALS OF CLOUD SECURITY CONCEPTS	9

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, 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

COURSE OUTCOMES:

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

- Understand the cloud concepts and fundamentals.
- Explain the security challenges in the cloud.
- Define cloud policy and Identity and Access Management.
- Understand various risks and audit and monitoring mechanisms in the cloud
- Define the various architectural and design considerations for security in the cloud.

TEXT BOOK:

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

REFERENCE 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

VERTICAL 4: CYBER SECURITY AND DATA PRIVACY

Course Code	Course Title	L	T	P	C
R21ITV401	Ethical Hacking	3	0	0	3
R21ITV402	Digital and Mobile Forensics	3	0	0	3
R21CSV403	Social Network Security	3	0	0	3
R21CSV404	Modern Cryptography	3	0	0	3
R21ITV405	Engineering Secure Software Systems	3	0	0	3
R21ITV406	Cryptocurrency and Blockchain Technologies	3	0	0	3
R21CSV407	Network Security	3	0	0	3
R21ITV308	Security and Privacy in Cloud	3	0	0	3

R21ITV401	ETHICAL HACKING	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To understand the basics of computer based vulnerabilities.
- To explore different foot printing, reconnaissance and scanning methods.
- To expose the enumeration and vulnerability analysis methods.
- To understand hacking options available in Web and wireless applications.
- To explore the options for network protection.
- To practice tools to perform ethical hacking to expose the vulnerabilities.

UNIT I	INTRODUCTION	9

Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security

UNIT II	FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS	9

Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering - Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall

UNIT III	ENUMERATION AND VULNERABILITY ANALYSIS	9

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss

UNIT IV	SYSTEM HACKING	9

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – WardrivingWireless Hacking - Tools of the Trade

UNIT V	NETWORK PROTECTION SYSTEMS	9

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network-Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- To express knowledge on basics of computer based vulnerabilities
- To gain understanding on different foot printing, reconnaissance and scanning methods.
- To demonstrate the enumeration and vulnerability analysis methods
- To gain knowledge on hacking options available in Web and wireless applications.
- To acquire knowledge on the options for network protection. CO6: To use tools to perform ethical hacking to expose the vulnerabilities..

TEXT BOOK:

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.

2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.

3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, DafyddStuttard and Marcus Pinto, 2011.

REFERENCE BOOKS:

1.Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

R21ITV402	DIGITAL AND MOBILE FORENSICS	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE 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.

UNIT I	INTRODUCTION TODIGITAL FORENSICS	9

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase

UNIT II	DIGITAL CRIME AND INVESTIGATION	9

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

UNIT III	DIGITAL FORENSIC READINESS	9

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics

UNIT IV	iOS FORENSIC	9

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

UNIT V	ANDROID FORENSICS	9

Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Have knowledge on digital forensics
- Know about digital crime and investigations
- Be forensic ready.
- Investigate, identify and extract digital evidence from iOS devices
- Investigate, identify and extract digital evidence from Android devices

TEXT BOOK:

1. Andre Arnes, “Digital Forensics”, Wiley, 2018.

2. Chuck Easttom, “An In-depth Guide to Mobile Device Forensics”, First Edition, CRC Press, 2022.

REFERENCE BOOKS:

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

R21CSV403	SOCIAL NETWORK SECURITY	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To develop semantic web related simple applications
- To explain Privacy and Security issues in Social Networking
- To explain the data extraction and mining of social networks
- To discuss the prediction of human behavior in social communities
- To describe the Access Control, Privacy and Security management of social networks

UNIT I	FUNDAMENTALS OF SOCIAL NETWORKING	9

Introduction to Semantic Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Social Network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis, Historical overview of privacy and security, Major paradigms, for understanding privacy and security

UNIT II	SECURITY ISSUES IN SOCIAL NETWORKS	9

The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networked world

UNIT III	EXTRACTION AND MINING IN SOCIAL NETWORKING DATA	9

Extracting evolution of Web Community from a Series of Web Archive, Detecting communities in social networks, Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Big data and Privacy

UNIT IV	PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES	9

Understanding and predicting human behavior for social communities, User data Management, Inference and Distribution, Enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment, What is Neo4j, Nodes, Relationships, Properties.

UNIT V	ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT	9

Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity

provisioning.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Develop semantic web related simple applications
- Address Privacy and Security issues in Social Networking
- Explain the data extraction and mining of social networks
- Discuss the prediction of human behavior in social communities
- Describe the applications of social networks

TEXT BOOK:

1. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.

2. BorkoFurht, Handbook of Social Network Technologies and Application, First Edition, Springer, 2010.

3. Learning Neo4j 3.x Second Edition ByJérôme Baton, Rik Van Bruggen, Packt publishing 4. David Easley, Jon Kleinberg, Networks, Crowds, and Markets: Reasoning about a Highly Connected World‖, First Edition, Cambridge University Press, 2010.

REFERENCE BOOKS:

1. Easley D. Kleinberg J., Networks, Crowds, and Markets – Reasoning about a Highly Connected World‖, Cambridge University Press, 2010.
2. Jackson, Matthew O., Social and Economic Networks‖, Princeton University Press, 2008. 3. GuandongXu ,Yanchun Zhang and Lin Li, —Web Mining and Social Networking – Techniques and applications‖, First Edition, Springer, 2011.
3. Dion Goh and Schubert Foo, Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively‖, IGI Global Snippet, 2008.
4. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modeling‖, IGI Global Snippet, 2009.
5. John G. Breslin, Alexander Passant and Stefan Decker, The Social Semantic Web‖, Springer, 2009.

R21CSV404	MODERN CRYPTOGRAPHY	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To learn about Modern Cryptography.
- To focus on how cryptographic algorithms and protocols work and how to use them.
- To build a Pseudorandom permutation.
- To construct Basic cryptanalytic techniques.
- To provide instruction

UNIT I	INTRODUCTION	9

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations.

UNIT II	FORMAL NOTIONS OF ATTACKS	9

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM-CPA and NMCCA2, Inter-relations among the attack model

UNIT III	RANDOM ORACLES	9

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudorandom Functions (PRF)

UNIT IV	BUILDING A PSEUDORANDOM PERMUTATION	9

The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction.

UNIT V	MESSAGE AUTHENTICATION CODES	9

Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes: One-way functions Imply Secure One-time Signatures. Shamir's Secret Sharing Scheme. Formally Analyzing Cryptographic Protocols. Zero Knowledge Proofs and Protocols.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Interpret the basic principles of cryptography and general cryptanalysis.
- Determine the concepts of symmetric encryption and authentication.
- Identify the use of public key encryption, digital signatures, and key establishment.
- Articulate the cryptographic algorithms to compose, build and analyze simple cryptographic solutions.
- Express the use of Message Authentication Codes.

TEXT BOOK:

1. Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications, Springer Verlag.

2. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low Priced Edition)

REFERENCE BOOKS:

1. ShaffiGoldwasser and MihirBellare, Lecture Notes on Cryptography, Available at http://citeseerx.ist.psu.edu/.

2. OdedGoldreich, Foundations of Cryptography, CRC Press (Low Priced Edition Available), Part 1 and Part 23

3. William Stallings, “Cryptography and Network Security: Principles and Practice”, PHI 3rd Edition, 2006

R21ITV406	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To understand the basics of Blockchain
- To learn Different protocols and consensus algorithms in Blockchain
- To learn the Blockchain implementation frameworks
- To understand the Blockchain Applications
- To experiment the Hyperledger Fabric, Ethereum networks

UNIT I	INTRODUCTION TO BLOCKCHAIN	9

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, TransactionsThe 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

COURSE OUTCOMES:

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

- Understand emerging abstract models for Blockchain Technology
- Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.
- It provides conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable
- Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application

TEXT BOOK:

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.

REFERENCE BOOKS:

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”, Packt Publishing

5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

R21CSV407	NETWORK SECURITY	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To learn the fundamentals of cryptography.
- To learn the key management techniques and authentication approaches.
- To explore the network and transport layer security techniques.
- To understand the application layer security standards.
- To learn the real time security practices.

UNIT I	INTRODUCTION	9

Basics of cryptography, conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II	KEY MANAGEMENT AND AUTHENTICATION	9

Key Management and Distribution: Symmetric Key Distribution, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure. User Authentication: Remote User-Authentication Principles, Remote User-Authentication Using Symmetric Encryption, Kerberos Systems, Remote User Authentication Using Asymmetric Encryption.

UNIT III	ACCESS CONTROL AND SECURITY	9

Network Access Control: Network Access Control, Extensible Authentication Protocol, IEEE 802.1X Port-Based Network Access Control - IP Security - Internet Key Exchange (IKE). Transport-Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS standard, Secure Shell (SSH) application

UNIT IV	APPLICATION LAYER SECURITY	9

Electronic Mail Security: Pretty Good Privacy, S/MIME, DomainKeys Identified Mail. Wireless Network Security: Mobile Device Security

UNIT V	SECURITY PRACTICES	9

Firewalls and Intrusion Detection Systems: Intrusion Detection Password Management, Firewall Characteristics Types of Firewalls, Firewall Basing, Firewall Location and Configurations. Blockchains, Cloud Security and IoT security

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Classify the encryption techniques
- Illustrate the key management technique and authentication.
- Evaluate the security techniques applied to network and transport layer
- Discuss the application layer security standards.
- Apply security practices for real time applications.

TEXT BOOK:

1. Cryptography and Network Security: Principles and Practice, 6th Edition, William Stallings, 2014, Pearson, ISBN 13:9780133354690.

REFERENCE BOOKS:

1. Network Security: Private Communications in a Public World, M. Speciner, R. Perlman, C. Kaufman, Prentice Hall, 2002.

2. Linux iptables Pocket Reference, Gregor N. Purdy, O'Reilly, 2004, ISBN-13: 978- 0596005696.

3. Linux Firewalls, by Michael Rash, No Starch Press, October 2007, ISBN: 978-1-59327-141- 1.

VERTICAL 5: CREATIVE MEDIA

Course Code	Course Title	L	T	P	C
R21ITV501	Metaverse	3	0	0	3
R21ITV502	Multimedia and Animation	3	0	0	3
R21ITV503	Video Creation and Editing	3	0	0	3
R21ITV504	Digital Audio & Video Production Workflow	3	0	0	3
R21CSV505	Digital marketing	3	0	0	3
R21CSV506	Visual Effects	3	0	0	3
R21ITV507	Digital Audio and Video Design	3	0	0	3
R21ITV508	Short Film Development	3	0	0	3

R21ITV501	METAVERSE	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To understand the History of Met Averse.
- Explore the role of met averse to connect the real world and blockchain.
- To understand the advanced development of block chain in the future
- To study an open ecosystem of smart properties and assets.
- To explore the integration of futuristic technologies such as block chain, crypto currency, DAO, AR/VR

UNIT I	INTRODUCTION TO METAVERSE	9

Introduction to Metaverse and immersive experience- History of Metaverse- Metaverse value chain with 7 layer

UNIT II	TECHNOLOGIES INVOLVED IN THE METAVERSE	9

Metaverse as a product of Extended Reality- Augmented Reality (AR)- Virtual Reality (VR)- Benefits of AR/VR-Difference between AR/ VR - Mixed Reality (MR)-Artificial Intelligence (AI) Introduction in Metaverse-Financial and Economics of Metaverse-Benefits of Metaverse

UNIT III	BLOCKCHAIN ADOPTION IN METAVERSE	9

Blockchain Overview-History of Blockchain-Need of Decentralization in MV-Smart Contract Capabilities in Blockchain - Blockchain in Metaverse -Understanding Tokens-Understanding the NFT-NFT Token Standards-NFTs in MV-Cryptocurrency in MV

UNIT IV	AR, VR, AND MR IN METAVERSE	9

Everything about VR (Virtual Reality)-Everything about AR (Augmented Reality)-Everything about MR (Mixed Reality)-Block chain Identity Management in Metaverse -NFT (non-fungible token) for Metaverse-Introduction to NFTs-History of NFTs-Benefits of NFTs

UNIT V	USE-CASES	9

Gaming in Metaverse-Meetings in Metaverse-Virtual Learning in Metaverse-Social Interactions in Metaverse-Virtual Real-estate in Metaverse-e-commerce in Metaverse-Travel in MetaversePersonalized Avatars-Digital Identity in Metaverse

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Students will understand the History of Metaverse.
- Learn the role of Metaverse to connect the real world and blockchain.
- Working with advanced development of blockchain in the future.
- Exploring the open ecosystem of smart properties and assets.
- Integrating futuristic technologies such as blockchain, cryptocurrency, DAO, AR/VR

R21ITV502	MULTIMEDIA AND ANIMATION	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To grasp the fundamental knowledge of Multimedia elements and systems
- To get familiar with Multimedia file formats and standards
- To learn the process of Authoring multimedia presentations
- To learn the techniques of animation in 2D and 3D and for the mobile UI
- To explore different popular applications of multimedia

UNIT I	INTRODUCTION TOMULTIMEDIA	9

Definitions, Elements, Multimedia Hardware and Software, Distributed multimedia systems, challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata, Multimedia databases, Hypermedia, Multimedia Learning..

UNIT II	MULTIMEDIA FILE FORMATS AND STANDARDS	9

File formats – Text, Image file formats, Graphic and animation file formats, Digital audio and Video file formats, Color in image and video, Color Models. Multimedia data and file formats for the web

UNIT III	MULTIMEDIA AUTHORING	9

Authoring metaphors, Tools Features and Types: Card and Page Based Tools, Icon and Object Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools, Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing Tools, audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning, simulations.

UNIT IV	ANIMATION	9

Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation, Animation techniques: Keyframe, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, , Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.

UNIT V	MULTIMEDIA APPLICATIONS	9

Multimedia Big data computing, social networks, smart phones, surveillance, Analytics, Multimedia Cloud Computing, Multimedia streaming cloud, media on demand, security and forensics, Online social networking, multimedia ontology, Content based retrieval from digital libraries.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Get the bigger picture of the context of Multimedia and its applications
- Use the different types of media elements of different formats on content pages
- Author 2D and 3D creative and interactive presentations for different target multimedia applications.
- Use different standard animation techniques fo r2D,R21/2D,3D applications
- Understandthecomplexityofmultimediaapplicationsinthecontextofcloud,security,bigdatastreaming,socia lnetworking,CBIRetc.,

TEXT BOOKS:

1. Ze-NianLi,MarkS.Drew,Jiangchuan Liu,Fundamentals ofMultimedia", Third Edition,SpringerTextsinComputerScience,20R21.(UNIT-I,II,III)

REFERENCE BOOKS:

1. JohnMBlain,TheCompleteGuidetoBlenderGraphics:ComputerModeling&Animation,CR Cpress,3rd Edition,2016.
2. GeraldFriedland,RameshJain,"MultimediaComputing",CambridgeUniversityPress,2018.
3. PrabhatK.Andleigh, KiranThakrar, "Multimedia System Design", PearsonEducation, 1stEdition,2015.
4. MohsenAminiSalehi,XiangboLi,"MultimediaCloudComputingSystems",SpringerNature, 1st Edition,20R21.
5. MarkGaimbruno,"3DGraphicsandAnimation",SecondEdition,NewRiders,2002.
6. RogersDavid,"Animation:Master– ACompleteGuide(GraphicsSeries)",CharlesRiverMedia, 2006.
7. Rickparent,"ComputerAnimation:AlgorithmsandTechniques",MorganKauffman,3rdEditio n,2012.
8. Emilio Rodriguez Martinez, MireiaAlegre Ruiz, "UI Animations with Lottie and After Effects:Create, render, and ship stunning After Effects animations natively on mobile with ReactNative",PacktPublishing,2022.

WEBREFERENCES:

1. https://itsfoss.com/
2. https://www.ucl.ac.uk/slade/know/3396
3. https://handbrake.fr/
4. https://opensource.com/article/18/2/open-source-audio-visual-production-toolshttps://camstudio.org/
5. https://developer.android.com/training/animation/overview
6. https://developer.android.com/training/animation/overview(UNIT-IV)

R21ITV503	VIDEO CREATION AND EDITING	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To introduce the broad perspective of linear and nonlinear editing concepts.
- To understand the concept of Storytelling styles.
- To be familiar with audio and videorecording.
- To apply different mediatools.
- To learn and understand the concepts of AVIDXPRESSDV 4.

UNIT I	FUNDAMENTALS	9

Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression - risks associated with altering reality through editing.

UNIT II	STORYTELLING	9

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - mechanics of digital editing - pointer files - media management.

UNIT III	USING AUDIO AND VIDEO	9

Capturing digital and analog video importing audio putting video on exporting digital video to tape recording to CDs and VCDs.

UNIT IV	WORKING WITH FINAL CUT PRO	9

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas - Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques - Working with Audio - Using Media Tools - Viewing and Setting Preferences.

UNIT V	WORKING WITH AVID XPRESS DV 4	9

Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode - Working with Audio - Output Options.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Compare the strengths and limitations of Nonlinear editing.
- Identifytheinfrastructureandsignificanceofstorytelling.

- Apply suitable methods for recording to CDs and VCDs.
- Address the core issues of advanced editing and training techniques.CO5:Designanddevelop projects usingAVIDXPRESS DV4

TEXT BOOKS:

1. AvidXpress DV4UserGuide,2007.
2. FinalCut Pro6User Manual,2004.
3. KeithUnderdahl,“DigitalVideoforDummies”,ThirdEdition,DummySeries,2001.
4. Robert M. Goodman and PartickMcGarth, “Editing Digital Video: The Complete CreativeandTechnicalGuide”,DigitalVideo andAudio,McGraw– Hill2003.

R21ITV504	DIGITAL AUDIO & VIDEO PRODUCTION WORKFLOW	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- Describe the types and parts of cameras and demonstrate basic camera operations.
- Discuss various video formats and recording media and the important terms used in video production.
- Discuss and demonstrate the knowledge of the various lighting techniques.
- Apply various audio techniques and discuss sound mixing methods used for a successful audio video production.
- Demonstrate the steps involved in assembling a final video.

UNIT I	BASICS OF AUDIO VIDEO PRODUCTION	9

Introduction to Audio and Video Production – Basic Camera use – Elements of Audio Production – video storage

UNIT II	PRE PRODUCTION	9

Elements of Preproduction - Production Planning and Budgeting - Genres and Subgenres - An Approach to Script Writing - Writing for Different Formats.

UNIT III	BASICS OF PRODUCTION	9

Shooting a Video - Cinematography and Composition - Basics of Lighting - Audio Techniques and Sound Mixing - Equipment Management.

UNIT IV	POST PRODUCTION	9

Learning to Edit - Using Graphics and Animation - Audio Enhancement - Video Assembly.

UNIT V	INTRODUCTION TO SPECIAL EFFECTS	9

Introduction to Special/Visual Effects, Special and (Visual) Effects Categories, Physical/Practical/Props Effects, Special Make-Up Effects, In Camera Effects.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Ability to understand and utilize general digital audio processing theory
- Ability to practice active listening & audio analysis & Mixing Multitrack sessions using a DAW
- Ability to Understand and utilize pre-production Video Shooting techniques
- Ability to practice Postproduction techniques for video production
- Ability to apply special effects in the final video

REFERENCE BOOKS:

1. The Computer Music Tutorial by Curtis Roads

2. On Sonic Art by Trever Wishart

3. Video Production Handbook by Gerald Millerson, Jim Owens, Asbury College

R21CSV505	DIGITAL MARKETING	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- The primary objective of this module is to examine and explore the role andimportance ofdigitalmarketingintoday's rapidlychangingbusinessenvironment.
- It also focuses on how digital marketing can be utilized by organizations and howitseffectivenesscan bemeasured.

UNIT I	INTRODUCTION TO ONLINE MARKET	9

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

UNIT II	SEARCH ENGINE OPTIMISATION	9

Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement

UNIT III	E- MAIL MARKETING	9

E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation - Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting

UNIT IV	SOCIAL MEDIA MARKETING	9

Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing

UNIT V	V DIGITAL TRANSFORMATION	9

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Explain the principles and strategies behind successful digital marketing campaigns.

- Utilize digital marketing tools and platforms to implement and manage marketing campaigns effectively
- Analyze digital marketing data and metrics to measure the performance of campaigns
- Evaluate the success of a digital marketing campaign in achieving its objectives and reaching the target audience.
- Design and create engaging content for digital marketing channels, considering the target audience and the platform's best practices.
- Enhance communication and teamwork skills in the context of digital marketing projects

TEXT BOOKS:

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education, First edition (July 2017);ISBN-10: 933258737X;ISBN-13: 978-9332587373.
2. Digital Marketing by VandanaAhuja ;Publisher: Oxford University Press (April 2015). ISBN-10: 0199455449
3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition (April 2017); ISBN10: 9788126566938;ISBN 13: 9788126566938;ASIN: 8126566930.
4. Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited..
5. .Barker, Barker, Bormann and Neher(2017), Social Media Marketing: A Strategic Approach, 2E South-Western ,Cengage Learning.
6. Pulizzi,J Beginner's Guide to Digital Marketing , Mcgraw Hill Education

R21CSV506	VISUAL EFFECTS	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- Togetabasicideaon animation principlesand techniques
- Togetexposureto CGI,color and light elementsofVFX
- Tohavea betterunderstanding ofbasicspecialeffectstechniques
- Tohaveaknowledge ofstateoftheartvfxtechniques
- Tobecomefamiliarwithpopularcompositingtechniques

UNIT I	ANIMATION BASICS	9

VFX production pipeline, Principles of animation, Techniques: Keyframe, kinematics, Full animation, limited animation, Rotoscoping, stop motion, object animation, pixilation, rigging, shape keys, motion paths

UNIT II	CGI, COLOR, LIGHT	9

CGI – virtual worlds, Photorealism, physical realism, function realism, 3D Modeling and Rendering: color - Color spaces, color depth, Color grading, color effects, HDRI, Light – Area and mesh lights, image based lights, PBR lights, photometric light, BRDF shading model

UNIT III	SPECIAL EFFECTS	9

Special Effects – props, scaled models, animatronics, pyrotechniques, Schüfftan process, Particle effects – wind, rain, fog, fire

UNIT IV	VISUAL EFFECTS TECHNIQUES	9

Motion Capture, Matt Painting, Rigging, Front Projection.Rotoscoping, Match Moving – Tracking, camera reconstruction, planar tracking, Calibration, Point Cloud Projection, Ground plane determination, 3D Match Moving

UNIT V	COMPOSITING	9

Compositing – chroma key, blue screen/green screen, background projection, alpha compositing, deep image compositing, multiple exposure, matting, VFX tools - Blender, Natron, GIMP

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- To implement animation in 2D / 3D following the principles and techniques
- To use CGI, color and light elements in VFX applications

- To create special effects using any of the state of the art tools
- To apply popular visual effects techniques using advanced tools
- To use compositing tools for creating VFX for a variety of applications

TEXT BOOKS:

1. Chris Roda, Real Time Visual Effects for the Technical Artist, CRC Press, 1st Edition, 2022.
2. Steve Wright, Digital Compositing for film and video, Routledge, 4th Edition, 2017.
3. John Gress, Digital Visual Effects and Compositing, New Riders Press, 1st Edition, 2014.

REFERENCE BOOKS:

1. Jon Gress, “Digital Visual Effects and Compositing”, New Riders Press, 1st Edition, 2014.
2. Robin Brinkman, The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics”, Morgan Kauffman, 2008.
3. Luiz Velho, Bruno Madeira, “Introduction to Visual Effects A Computational Approach”, Routledge, 2023.
4. Jasmine Katatikarn, Michael Tanzillo, “Lighting for Animation: The art of visual storytelling, Routledge, 1st Edition, 2016.
5. EranDinur, “The Complete guide to Photorealism, for Visual Effects, Visualization
6. Jeffrey A. Okun, Susan Zwerman, Christopher McKittrick, “ The VES Handbook of Visual Effects: Industry Standard VFX Practices and Procedures”, Third Edition, 2020.and Games”, Routledge, 1st Edition, 2022.
7. https://www.blender.org/features/vfx/
8. https://natrongithub.github.io/

R21ITV507	DIGITAL AUDIO AND VIDEO DESIGN	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- Introduce the fundamental principles of Audio processing.
- Provide an overview of Audio enhancement and Audio compression techniques
- Review latest trends and future technologies in Audio processing.
- Introduce the fundamental concepts of Video processing.
- Cover the basics of Video Coding

UNIT I	DIGITAL AUDIO	9

Basics of Digital Audio - Digitization of Sound- Auditory Perception - Sampling, Normalization, Noise Reduction and Visualization. Digital and Analog audio Recording, A/D and D/A Converter, Pitch Shifting and Time Stretching, Audio Data Reduction

UNIT II	MUSICAL SOUND SYNTHESIS AND MIDI	9

Acoustic Instruments, Sound Synthesis in Music, MIDI Principles - Hardware aspects, Structure of MIDI Messages, General MIDI, MIDI-to-Wav Conversion.

UNIT III	STEREO AND SURROUND SOUND	9

Two-Channel Stereo - Principles of Loudspeaker and Microphone, Stereo and Loudspeaker Stereo, Two-Channel Signal Formats and Microphone techniques, Binaural Recording and Dummy Head Techniques, Surround Sound - Three Channel Stereo, Four Channel Surround, 5.1 Channel Surround, and other Multichannel Configurations. Surround Sound Systems, Matrix Surround Sound Systems, Dolby Digital, DTS, Ambisonics.

UNIT IV	VIDEO FUNDAMENTALS	9

Basic concepts and Terminology- Analog video standards – Digital video basics – Analog-to Digital conversion – Color representation and chroma subsampling – Digital video formats and standards – Changing Video sampling rate and standards.

UNIT V	MPEG VIDEO CODING	9

Basic Video coding and Audio Compression Techniques- Motion Detection- MPEG Video and audio Compression – Real-time video compression.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Implement basic algorithms related to Audio acquiring and processing

- Analyse audio formats and analysis.
- Understand and implement algorithms for MIDI Processing
- Acquiring and analysis of Video
- Understand the concept of motion detection.

REFERENCES

1. Francis Rumsey & Tim McCormick "Sound and Recording ", Sixth Edition, 2009, Focal Press, Elsevier Ltd.

2. Ian Mcloughlin "Applied Speech and Audio Processing with MATLAB Examples" Cambridge University Press, Cambridge, New York, 2009.

3. Oges Marques, Practical Image and Video Processing Using MATLAB, Wiley-IEEE Press, 2011.

R21ITV508	SHORT FILM DEVELOPMENT	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To understand the fundamentals of short film Making.
- To know the working principles camera.
- To acquire knowledge about the editing software.
- To train the student as a member or leader in diverse teams of short film development.
- To inculcate aesthetic sense involved in creativity and transform creative ideas into short film.

UNIT I	INTRODUCTION TO SHORT FILM	9

Introduction – Different Types of Short Film – Documentary and Non-Fiction Film – Animated Short Films – Challenges in Developing Short Films – Creative Approaches.

UNIT II	PRE PRODUCTION	9

Developing and Researching Short Film Project – Considering and Selecting an idea – Developing Questions – Research Techniques- Writing a Concept and Treatment - Shooting Script – Hiring Crew – Crew Position and Responsibilities – Producing and Budgeting – Visual Scope and Visual Evidence – Permission – Funding – Proposals – Attracting Funding – Ethics in Short Film Making

UNIT III	PRODUCTION	9

Research Leading up to the Shoot – Production Team, Production –Camera Equipment and Shooting Procedure – Lighting Location Sound – Interviewing – Directing Participants – Working Together – Teamwork – Scheduling – Problems and Issues.

UNIT IV	POST PRODUCTION	9

Designing a Structure – Working with Editor – Visual Effects – Transition – Adding Sound Effects and Music – Special Effect Dubbing – Rerecording – Narration – Voiceover — Titles –Graphics – Color Exposure and Color Correction – Credits and Acknowledgements.

UNIT V	SCREENING	9

Impact of Short Film on the Society – Various Media Techniques used in Short Film Production – Identifying Important Current Social Issues for Short Film – Exploring Background Research Current Social Issues – Making Short Film for Television and Theatrical Release – Non-Fiction Presentation – Production of an individually or Group Authored Short Film Based on Historical – Corporate – Institutional – Current Social

Issues.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Apply the knowledge of concepts and techniques used in short film development.
- Understand the social issues and projecting them effectively through short film.
- Conduct various experiments for effective short film.
- Design and implement various techniques into short film that brings impact on the society.
- Apply various tools and software for lighting and sound to uphold the professional and social obligation.
- Manage and develop a short film as a life-long activity as a team.

TEXTBOOKS:

1. Clifford Thurlow, “Making Short Films – The Complete Guide from Script to Screen” , Berg Publishers, 2008

2. James R. Matin, “Create Documentary Films, telling Techniques Videos and Multimedia: A Comprehensive Guide to Using Documentary Storytelling Techniques for Film Video, The internet and Digital Media Nonfiction project”, Real Deal Press, 2010.

3. Michael Rabiger, “Directing the Documentary”, Focal Press, 2004.

4. Daniel Faltesek, “Selling Social Media The Political Economy of Social Networking”, Bloomsbury Academic, 2018.

VERTICAL 6: EMERGING TECHNOLOGIES

Course Code	Course Title	L	T	P	C
R21CSV601	Augmented Reality/Virtual Reality	3	0	0	3
R21CSV602	Robotic Process Automation	3	0	0	3
R21ITV103	Neural Networks and Deep Learning	3	0	0	3
R21CSV604	Cyber security	3	0	0	3
R21CSV605	Quantum Computing	3	0	0	3
R21ITV406	Cryptocurrency and Blockchain Technologies	3	0	0	3
R21ITV607	Game Development	3	0	0	3
R21ITV608	3D Printing and Design	3	0	0	3

R21CSV601	AUGMENTED REALITY/VIRTUAL REALITY	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications.

UNIT I	INTRODUCTION	9

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System

UNIT II	VR MODELING	9

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

UNIT III	VR PROGRAMMING	9

VR Programming – Toolkits and Scene Graphs – World Tool Kit – Java 3D – Comparison of World Tool Kit and Java 3D

UNIT IV	APPLICATIONS	9

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education.

UNIT V	AUGMENTED REALITY	9

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation Navigation-

Wearable devices

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Understand the basic concepts of AR and VR
- Understand the tools and technologies related to AR/VR
- Know the working principle of AR/VR related Sensor devices
- Design of various models using modeling techniques
- Develop AR/VR applications in different domains

TEXT BOOK:

1. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create compelling VR experiences for mobile”, Packt Publisher, 2018

2. Dieter Schmalstieg, Tobias Hollerer, “Augmented Reality: Principles & Practice”, Addison Wesley, 2016

3. John Vince, “Introduction to Virtual Reality”, Springer-Verlag, 2004.

4. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application, Design”, Morgan Kaufmann, 2003

R21CSV602	ROBOTIC PROCESS AUTOMATION	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To understand the basic concepts of Robotic Process Automation.
- To expose to the key RPA design and development strategies and methodologies.
- To learn the fundamental RPA logic and structure.
- To explore the Exception Handling, Debugging and Logging operations in RPA.
- To learn to deploy and Maintain the software bot.

UNIT I	INTRODUCTION TO ROBOTIC PROCESS AUTOMATION	9

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

UNIT II	AUTOMATION PROCESS ACTIVITIES	9

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

UNIT III	APP INTEGRATION, RECORDING AND SCRAPING	9

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

UNIT IV	EXCEPTION HANDLING AND CODE MANAGEMENT	9

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine.

UNIT V	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

COURSE OUTCOMES:

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

- Enunciate the key distinctions between RPA and existing automation techniques and platforms.
- Use Ui Path to design control flows and work flows for the target process
- Implement recording, web scraping andprocess mining by automation
- Use UI Path Studio to detect, and handle exceptions in automation processes
- Implement and use Orchestrator for creation, monitoring, scheduling, and controlling of automated bots and processes.

TEXT BOOK:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, 2018.

2. Tom Taulli , “The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems”, Apress publications, 2020.

REFERENCE BOOKS:

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018

2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018

3. A GerardusBlokdyk, “Robotic Process Automation Rpa A Complete Guide “, 2020

R21CSV604	CYBER SECURITY	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To learn cybercrime and cyber law.
- To understand the cyber attacks and tools for mitigating them.
- To understand information gathering.
- To learn how to detect a cyber attack.
- To learn how to prevent a cyber attack.

UNIT I	INTRODUCTION	9

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.

UNIT II	ATTACKS AND COUNTERMEASURES	9

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures

UNIT III	RECONNAISSANCE	9

Harvester – Whois – Netcraft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches – SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing and OS Finger printing Techniques.

UNIT IV	INTRUSION DETECTION	9

Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort

UNIT V	INTRUSION PREVENTION	9

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Explain the basics of cyber security, cyber crime and cyber law (K2)
- Classify various types of attacks and learn the tools to launch the attacks (K2
- Apply various tools to perform information gathering (K3)
- Apply intrusion techniques to detect intrusion (K3)
- Apply intrusion prevention techniques to prevent intrusion (K3)

TEXT BOOK:

1. AnandShinde, “Introduction to Cyber Security Guide to the World of Cyber Security”, Notion Press, 20R21 (Unit 1)

2. Nina Godbole, SunitBelapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley Publishers, 2011 (Unit 1)

3. https://owasp.org/www-project-top-ten/

REFERENCE BOOKS:

1. David Kim, Michael G. Solomon, “Fundamentals of Information Systems Security”, Jones & Bartlett Learning Publishers, 2013 (Unit 2)

2. Patrick Engebretson, “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy”, Elsevier, 2011 (Unit 3)

3. Kimberly Graves, “CEH Official Certified Ethical hacker Review Guide”, Wiley Publishers, 2007 (Unit 3)

4. William Stallings, Lawrie Brown, “Computer Security Principles and Practice”, Third Edition, Pearson Education, 2015 (Units 4 and 5)

5. Georgia Weidman, “Penetration Testing: A Hands-On Introduction to Hacking”, No Starch Press, 2014 (Lab)

R21CSV605	QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

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

UNIT I	QUANTUM COMPUTING BASIC CONCEPTS	9

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

UNIT II	QUANTUM GATES AND CIRCUITS	9

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

UNIT III	QUANTUM ALGORITHMS	9

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

UNIT IV	QUANTUM INFORMATION THEORY	9

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

UNIT V	QUANTUM CRYPTOGRAPHY	9

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

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Understand the basics of quantum computing.
- Understand the background of Quantum Mechanics.

- Analyze the computation models.
- Model the circuits using quantum computation. environments and frameworks.
- Understand the quantum operations such as noise and error–correction.

TEXT BOOK:

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

REFERENCE BOOKS:

1. Scott Aaronson, “Quantum Computing Since Democritus”, Cambridge University Press, 2013.

2. N. David Mermin, “Quantum Computer Science: An Introduction”, Cambridge University Press, 2007.

R21ITV607	GAME DEVELOPMENT	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of a game engine.
- To survey the gaming development environment and tool kits.
- To learn and develop simple games using Pygame environment

UNIT I	3D GRAPHICS FOR GAME DESIGN	9

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation – Controller Based Animation.

UNIT II	GAME DESIGN PRINCIPLES	9

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.

UNIT III	GAME ENGINE DESIGN	9

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Pathfinding

UNIT IV	OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS	9

Pygame Game development – Unity – Unity Scripts –Mobile Gaming, Game Studio, Unity Single player and Multi-Player games.

UNIT V	GAME DEVELOPMENT USING PYGAME	9

Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based arcade Games – Puzzle Games.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Explain the concepts of 2D and 3d Graphics
- Design game design documents.
- Implementation of gaming engines.
- Survey gaming environments and frameworks.
- Implement a simple game in Pygame.

REFERENCE BOOKS:

1. Sanjay Madhav, “Game Programming Algorithms and Techniques: A Platform Agnostic Approach”, Addison Wesley,2013.

2. Will McGugan, “Beginning Game Development with Python and Pygame: From Novice to Professional”, Apress,2007.

3. Paul Craven, “Python Arcade games”, Apress Publishers,2016.

4. David H. Eberly, “3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics”, Second Edition, CRC Press,2006.

5. Jung Hyun Han, “3D Graphics for Game Programming”, Chapman and Hall/CRC, 2011.

R21ITV608	3D PRINTING AND DESIGN	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To discuss on basics of 3D printing
- To explain the principles of 3D printing technique
- To explain and illustrate inkjet technology
- To explain and illustrate laser technology
- To discuss the applications of 3D printing

UNIT I	INTRODUCTION	9

Introduction; Design considerations – Material, Size, Resolution, Process; Modelling and viewing - 3D; Scanning; Model preparation – Digital; Slicing; Software; File formats

UNIT II	PRINCIPLE	9

Processes – Extrusion, Wire, Granular, Lamination, Photo polymerisation; 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 – Continous jet, Mulitjet; Powder based fabrication – Colourjet.

UNIT IV	LASER TECHNOLOGY	9

Light Sources – Types, Characteristics; Optics – Deflection, Modulation; Material feeding and flow – Liquid, powder; Printing machines – Types, Working Principle, Build Platform, Print bed Movement, Support structures;

UNIT V	INDUSTRIAL APPLICATIONS	9

. Product Models, manufacturing – Printed electronics, Biopolymers, Packaging, Healthcare, Food, Medical, Biotechnology, Displays; Future trends.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Outline and examine the basic concepts of 3D printing technology
- Outline 3D printing workflow`
- Explain and categorise the concepts and working principles of 3D printing using inkjet technique
- Explain and categorise the working principles of 3D printing using laser technique
- Explain various method for designing and modeling for industrial applications

TEXT BOOKS:

1. Christopher Barnatt, 3D Printing: The Next Industrial Revolution, CreateSpace Independent Publishing Platform, 2013.

2. Ian M. Hutchings, Graham D. Martin, Inkjet Technology for Digital Fabrication, John Wiley & Sons, 2013.

REFERENCE BOOKS:

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

VERTICAL 7:ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Course Code	Course Title	L	T	P	C
R21ITV701	Knowledge Engineering	3	0	0	3
R21CSV702	Soft Computing	3	0	0	3
R21ITV103	Neural Network sand Deep Learning	3	0	0	3
R21CSV104	Tex tand Speech Analysis	3	0	0	3
R21CSV705	Optimization Techniques	3	0	0	3
R21ITV706	Game Theory	3	0	0	3
R21ITV707	Cognitive Science	3	0	0	3
R21CSV708	Ethics And AI	3	0	0	3

R21ITV701	KNOWLEDGE ENGINEERING	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To understand the basics of Knowledge Engineering.
- To discuss methodologies and modeling for Agent Design and Development.
- To design and develop ontologies.
- To apply reasoning with ontologies and rules
- To understand learning and rule learning.

UNIT I	REASONING UNDER UNCERTAINTY	9

Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering.

UNIT II	METHODOLOGY AND MODELING	9

Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios

UNIT III	ONTOLOGIES – DESIGN AND DEVELOPMENT	9

Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching. Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation – Modelling-based Ontology Specification.

UNIT IV	REASONIING WITH ONTOLOGIES AND RULES	9

Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge

UNIT V	LEARNING AND RULE LEARNING	9

.Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Understand the basics of Knowledge Engineering.
- Apply methodologies and modelling for Agent Design and Development.
- Design and develop ontologies.
- Apply reasoning with ontologies and rules.
- Understand learning and rule learning

TEXT BOOK:

1. Gheorghe Tecuci, DorinMarcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016. (Unit 1 – Chapter 1 / Unit 2 – Chapter 3,4 / Unit 3 – Chapter 5, 6 / Unit 4 - 7 , Unit 5 – Chapter 8, 9)

REFERENCE BOOKS:

1. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.

2. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.

3. John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000.

4. King , Knowledge Management and Organizational Learning , Springer, 2009.

5. Jay Liebowitz, Knowledge Management Learning from Knowledge Engineering, 1st Edition,2001

R21CSV702	SOFT COMPUTING	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
- To provide the mathematical background for carrying out the optimization associated with neural network learning
- To learn various evolutionary Algorithms.
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
- To introduce case studies utilizing the above and illustrate the Intelligent behavior of programs based on soft computing

UNIT I	INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC	9

Introduction - Fuzzy Logic - Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems

UNIT II	NEURAL NETWORKS	9

Supervised Learning Neural Networks – Perceptrons – Back propagation -Multilayer Perceptrons – Unsupervised Learning Neural Networks – Kohonen Self-Organizing Networks

UNIT III	GENETIC ALGORITHMS	9

Chromosome Encoding Schemes -Population initialization and selection methods - Evaluation function - Genetic operators- Cross over – Mutation - Fitness Function – Maximizing function

UNIT IV	NEURO FUZZY MODELING	9

ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling – Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum - Analysis of Adaptive Learning Capability

UNIT V	APPLICATIONS	9

.Modeling a two input sine function - Printed Character Recognition – Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition - Soft Computing for Color Recipe Prediction.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Understand the fundamentals of fuzzy logic operators and inference mechanisms
- Understand neural network architecture for AI applications such as classification and clustering
- Learn the functionality of Genetic Algorithms in Optimization problems
- Use hybrid techniques involving Neural networks and Fuzzy logic
- Apply soft computing techniques in real world applications

TEXT BOOK:

1. SaJANG, J.-S. R., SUN, C.-T., & MIZUTANI, E. (1997). Neuro-fuzzy and soft computing: A computational approach to learning and machine intelligence. Upper Saddle River, NJ, Prentice Hall,1997

2. Himanshu Singh, Yunis Ahmad Lone, Deep Neuro-Fuzzy Systems with Python

3. With Case Studies and Applications from the Industry, Apress, 2020

REFERENCE BOOKS:

1. rojKaushik and Sunita Tiwari, Soft Computing-Fundamentals Techniques and Applications, 1st Edition, McGraw Hill, 2018.

2. S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2003.

3. Samir Roy, UditChakraborthy, Introduction to Soft Computing, Neuro Fuzzy and Genetic Algorithms, Pearson Education, 2013.

4. S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Third Edition, Wiley India Pvt Ltd, 2019.

5. R.Eberhart, P.Simpson and R.Dobbins, “Computational Intelligence - PC Tools”, AP Professional, Boston, 1996

R21CSV705	OPTIMIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

The objective of this course is to enable the student to

- Formulate and solve linear programming problems (LPP)
- Evaluate Integer Programming Problems, Transportation and Assignment Problems.
- Obtain a solution to network problems using CPM and PERT techniques.
- Able to optimize the function subject to the constraints
- . • Identify and solve problems under Markovian queuing models.

UNIT I	LINEAR MODELS	9

Introduction of Operations Research - mathematical formulation of LPP- Graphical Methods to solve LPP- Simplex Method- Two-Phase method

UNIT II	INTEGER PROGRAMMING AND TRANSPORTATION PROBLEMS	9

Integer programming: Branch and bound method- Transportation and Assignment problems - Traveling salesman problem.

UNIT III	PROJECT SCHEDULING	9

Project network -Diagram representation – Floats - Critical path method (CPM) – PERT- Cost considerations in PERT and CPM.

UNIT IV	CLASSICAL OPTIMIZATION THEORY	9

Unconstrained problems – necessary and sufficient conditions - Newton-Raphson method, Constrained problems – equality constraints – inequality constraints - Kuhn-Tucker conditions

UNIT V	QUEUING MODELS	9

Introduction, Queuing Theory, Operating characteristics of a Queuing system, Constituents of a Queuing system, Service facility, Queue discipline, Single channel models, multiple service channels.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Formulate and solve linear programming problems (LPP)
- Evaluate Integer Programming Problems, Transportation and Assignment Problems.
- Obtain a solution to network problems using CPM and PERT techniques.

- Able to optimize the function subject to the constraints.
- Identify and solve problems under Markovian queuing models

TEXT BOOK:

1. Hamdy A Taha, Operations Research: An Introduction, Pearson, 10th Edition, 2017.

REFERENCE BOOKS:

1. ND Vohra, Quantitative Techniques in Management, Tata McGraw Hill, 4th Edition, 2011. 2. J. K. Sharma, Operations Research Theory and Applications, Macmillan, 5th Edition, 2012. 3. Hiller F.S, Liberman G.J, Introduction to Operations Research, 10th Edition McGraw Hill, 2017.

4. Jit. S. Chandran, Mahendran P. Kawatra, KiHoKim, Essentials of Linear Programming, Vikas Publishing House Pvt.Ltd. New Delhi, 1994.

5. Ravindran A., Philip D.T., and Solberg J.J., Operations Research, John Wiley, 2nd Edition, 2007.

R21ITV706	GAME THEORY	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To introduce the student to the notion of a game, its solutions concepts, and other basic notions and tools of game theory,and the main applications for which they are appropriate ,including electronic trading markets.
- To formalize the notion of strategic thinking and rational choice by using the tools of game theory,and to provide insights into using game theory in ModeIling applications.
- To draw the connections between game theory,computerscience,and economics ,especially emphasizing the computational issues.
- To introduce contemporary topics in the intersection of game theory, computer science, and economics.
- To apply game theory in searching, auctioning and trading

UNIT I	INTRODUCTION	9

Introduction — Making rational choices: basics of Games — strategy — preferences — payoffs — Mathematical basics — Game theory — Rational Choice — Basic solution concepts-non cooperative versus cooperative games — Basic computational issues — finding equilibria and learning in games- Typical application areas for game theory (e.g. Google's sponsored search, eBay auctions, electricity trading markets).

UNIT II	GAMES WITH PERFECT INFORMATION	9

Games with Perfect Information — Strategic games — prisoner's dilemma, matching pennies - Nash equilibria —mixed strategy equilibrium — zero-sum games

UNIT III	GAMES WITH IMPERFECT INFORMATION	9

Games with Imperfect Information — Bayesian Games — Motivational Examples — General Definitions — Information aspects — Illustrations — Extensive Games with Imperfect — Information — Strategies — Nash Equilibrium —Repeated Games — The Prisoner's Dilemma — Bargaining

UNIT IV	NON-COOPERATIVE GAME THEORY	9

Non-cooperative Game Theory — Self-interested agents — Games in normal form — Analyzing games: from optimality to equilibrium — Computing Solution Concepts of Normal — Form Games — Computing Nash equilibria of two-player, zero-sum games —Computing Nash equilibria of two player, general- sum games — Identifying dominated strategies

UNIT V	MECHANISM DESIGN	9

.Aggregating Preferences — Social Choice — Formal Model — Voting — Existence of social functions — Ranking systems — Protocols for Strategic Agents: Mechanism Design — Mechanism design with unrestricted preferences

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Discuss the notion of a strategic game and equilibria and identify the characteristics of main applications of these concepts.
- Discuss the use of Nash Equilibrium for other problems.
- Identify key strategic aspects and based on these be able to connect them to appropriate game theoretic concepts given a real world situation.
- Identify some applications that need aspects of Bayesian Games. CO5:Implement a typical Virtual Business scenario using Game theory

TEXT BOOKS:

1. M. J. Osborne, An Introduction to Game Theory. Oxford University Press, 2012.

2. M. Machler, E. Solan, S. Zamir, Game Theory, Cambridge University Press, 2013.

3. N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani, Algorithmic Game Theory. Cambridge University Press, 2007.

4. A.Dixit and S. Skeath, Games of Strategy, Second Edition. W W Norton & Co Inc, 2004.

5. YoavShoham, Kevin Leyton-Brown, Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, Cambridge University Press 2008.

6. Zhu Han, DusitNiyato, WalidSaad, TamerBasar and Are Hjorungnes, “Game Theory in Wireless and Communication Networks”, Cambridge University Press, 2012.

7. Y.Narahari, “Game Theory and Mechanism Design”, IISC Press, World Scientific.

8. William Spaniel, “Game Theory 101: The Complete Textbook”, CreateSpace Independent Publishing, 2011.

R21ITV707	COGNITIVE SCIENCE	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To know the theoretical background of cognition.
- To understand the link between cognition and computation AL intelligence.
- To explore probabilistic programming language.
- To study the computation AL inference models of cognition.
- To study the computational learning models of cognition.

UNIT I	PHILOSOPHY,PSYCHOLOGY AND NEUROSCIENCE	9

Philosophy: Mental-physical Relation–From Materialism to Mental Science–Logic and the Sciences of the Mind–Psychology :Place of Psychology within Cognitive Science–Science ofInformation Processing–Cognitive Neuroscience–Perception–Decision–Learning and Memory–Language Understanding and Processing

UNIT II	COMPUTATIONAL INTELLIGENCE	9

Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making – Learning –Language—Vision.

UNIT III	PROBABILISTIC PROGRAMMING LANGUAGE	9

Web PPL Language – Syntax – Using Java script Libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Co routines: Functions that receive continuations–Enumeration

UNIT IV	INFERENCE MODELS OF COGNITION	9

Generative Models–Conditioning–Causal and statistical dependence–Conditional dependence –Data Analysis–Algorithms for Inference

UNIT V	LEARNING MODELS OF COGNITION	9

Learning as Conditional Inference–Learning with a Language of Thought–Hierarchical Models–Learning (Deep) Continuous Functions–Mixture Models.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- .Understand the underlying theory behind cognition.
- Connect to the cognition elements computationally.

- Implement mathematical functions through Web PPL.
- Develop applications using cognitive inference model.
- Develop applications using cognitive learning model Models.

TEXT BOOK:

1. VijayVRaghavan,VenkatN.Gudivada,VenuGovindaraju,C.R.Rao,CognitiveComputing :TheoryandApplications:(HandbookofStatistics 35),Elsevierpublications,2019
2. JudithHurwitz,MarciaKaufman,AdrianBowles,CognitiveComputingandBigDataAnalytics,Wiley Publications,2015
3. RobertA.Wilson,FrankC.Keil,"TheMITEncyclopediaoftheCognitiveSciences",TheMIT Press, 1999.
4. JoseLuisBermúdez,CognitiveScience-AnIntroductiontotheScienceoftheMind,CambridgeUniversityPress2020

REFERENCE BOOKS:

1. NoahD.Goodman,AndreasStuhlmuller,"TheDesignandImplementationofProbabilisticProgrammingLanguages",Electronicversionofbook,https://dippl.org/.
2. NoahD.Goodman,JoshuaB.Tenenbaum,TheProbModsContributors,"ProbabilisticModelsofCognition",SecondEdition,2019,https://probmods.org/.

R21CSV708	ETHICS AND AI	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE 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

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 Automation Systems

UNIT IV	ROBOETHICS:SOCIALAND ETHICAL IMPLICATION OF ROBOTICS	9

Robot- Robo ethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology – Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility-Robo ethics 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

COURSE OUTCOMES:

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

- Learn about morality and ethics in AI
- Acquire the knowledge of real time application ethics, issues and its challenges.

- Understand the ethical harms and ethical initiatives in AI
- Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems
- Understand the concepts of Robo ethics and Morality with professional responsibilities.
- Learn about the societal issues in AI with National and International Strategies on AI

TEXT BOOK:

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 934.452 — March2020
2. PatrickLin,KeithAbney,GeorgeABekey,"RobotEthics:TheEthicalandSocialImplicationsofRobotics",The MITPress-January2014.

REFERENCE BOOKS:

1. TowardsaCodeofEthicsforArtificialIntelligence(ArtificialIntelligence:Foundations,Theory,andAlgorithms)byPaulaBoddington,November2017
2. MarkCoeckelbergh,"AIEthics",TheMITPressEssentialKnowledgeseries, April2020
3. Weblink:4.https://sci-hub.mksa.top/10.1007/978-3-540-30301-5_95

LIST OF OPEN ELECTIVES OFFERED TO OTHER PROGRAMMES

Course Code	Course Title	L	T	P	C
R21UCS971	Artificial Intelligence and Machine Learning Fundamentals	3	0	0	3
R21UCS972	Web Technologies and Applications	3	0	0	3
R21UCS973	Data Analysis using Open Source Tool	3	0	0	3
R21UCS974	Free and Open Source Softwares	3	0	0	3
R21UCS975	Fundamentals of Deep Learning Techniques	3	0	0	3
R21UCS976	Introduction to MATLAB for Artificial Intelligence	3	0	0	3
R21UCS977	Mobile Application Development	3	0	0	3
R21UCS978	Network security essentials	3	0	0	3
R21UCS979	Usability Engineering	3	0	0	3

R21UCS971	ARTIFICIAL INTELLIGENCE& MACHINE LEARNING FUNDAMENTALS	L	T	P	C
		3	0	0	3

COURSE DESIGNATION :

PRE-REQUISTIES:

COURSE OBJECTIVE:

- To impart knowledge on build intelligent agents for search and games
- To impart knowledge for solve AI problems through programming with python
- To develop learning optimization and inference algorithms for model learning
- Study about unsupervised learning algorithms
- Learn the basics of deep learning using neural networks

UNIT I	INTRODUCTION	9

Introduction-Foundations of AI-History of AI-Definition-Future of Artificial Intelligence-**Intelligent Agents**-Structure of Agent-Characteristics of Intelligent Agents-Typical Intelligent Agents-Problem Formulations, Review of tree and graph structures, state space

UNIT II	SEARCH ALGORITHMS	9

Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm.

UNIT III	PROBABILISTIC REASONING	9

Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference.

UNIT IV	SUPERVISED LEARNING	9

Introduction to machine Learning-Supervised Learning-Classification: Decision Tree-Support Vector Machine-Regression: Linear Regression-Logistic Regression

UNIT V	UNSUPERVISED LEARNING	9

Unsupervised Learning-Principle Component Analysis-**Clustering:** Definition-Types of Clustering-K-means algorithm

Total: 45 Periods

Course Outcomes

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

- Use appropriate search algorithms for problem solvin
- Apply reasoning under uncertainty
- Build supervised learning models
- Build unsupervised models
- Build deep learning neural network models

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Fourth Edition, Pearson Education, 20R21.
2. EthemAlpaydin, “Introduction to Machine Learning”, MIT Press, Fourth Edition, 2020.

REFERENCES:

1. Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, Pearson Education,2007
2. Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2008

3. Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006
4. Deepak Khemani, “Artificial Intelligence”, Tata McGraw Hill Education, 2013 (http://nptel.ac.in/)
5. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.
6. Tom Mitchell, “Machine Learning”, McGraw Hill, 3rd Edition,1997.
7. Charu C. Aggarwal, “Data Classification Algorithms and Applications”, CRC Press, 2014

R21UCS972	WEB TECHNOLOGIES AND APPLICATIONS	L	T	P	C
		3	0	0	3

COURSEDESIGNATION:

PRE-REQUISTIES:

COURSEOBJECTIVES:

- To design a stylistic webpage using HTML and CSS
- To know the basic knowledge of client side programming
- To create webpage using web application frameworks

UNITI	HTMLBASICS	9

BasicHTML-History-PageStructure-BlockElements–InlineElements,MoreHTMLElements-List-Tables—Forms-LinkingWebPages.

UNITII	CASCADINGSTYLESHEETSFORSTYLING	9

Introduction toCSS–ImportingaStylesheet-EmbeddedStylesheet-CSSRules–Style Types-External,InternalandInlineStylesheets-CSSSelectors.

UNITIII	CLIENT-SIDE PROGRAMMING-JAVASCRIPT	9

Exploring JavaScript - Expressions and control flow in Java Script - Functions - Objects - Arrays - Validating User Input with Java Script.

UNIT IV	PYTHON FOR WEB DEVELOPMENT	9

Introduction to Python-Object-oriented programming-Introduction to Django -Model layer- View layer - Template layer

UNITV	DEPLOYMENT	9

Web Application Frameworks and Tools – Firebase – Docker – Node JS – React - Introduction to Flask-Routing-Templates –Forms - Deployment – Case Study

Total:45 Periods

COURSEOUTCOMES:

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

- Construct simple website using Html and Cascading Style Sheets (Understand)
- Building dynamic web pages with validation using Java Script objects and by applying different event handling mechanisms.(Apply)
- Analyze various frameworks of responsive web design. (Analyse)
- Be able to evaluate and embed social media content into web pages.(Evaluate)
- Devise multiple solutions to web development problems and analyze the advantages and disadvantages.(Create)
- Demonstratetheimplementation ofweb applications using modern web frameworksandtools(Modern Tool Usage)

TEXT BOOKS:

1. Learning PHP, MySQL, JavaScript,and CSS ,second edition by Robin Nixon, 2nd edition, 2012.
2. Marty Stepp, Jessica Miller, and Victoria Kirst , “Web Programming”, Step by Step Publication, 2nd Edition, 2009
3. Jeff Forcier, Paul Bissex, and Wesley J. Chun, “Python Web Development with Django”, Addison Wesley, 2008

REFERENCE BOOKS:

1. H.M.Deitel, P.J.Deitel, Goldberg, "Internet & World Wide Web How To Program", Pearson Education, Third Edition, 2006.
2. Robert. W. Sebesta, "Programming the World Wide Web", Pearson Education, Seventh Edition, 2012.
3. https://docs.djangoproject.com/en/stable/
4. https://flask.palletsprojects.com/en/2.1.x/

R21UCS 978	NETWORK SECURITY ESSENTIALS	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To Learn The Fundamentals Of Cryptography
- To Learn The Message Authentications And Encryptions
- To Explore The Network And Transport Level Security.
- To Understand The Applications Layer And Standards.
- To Learn The Real Time Security

UNIT I	Introduction	9

Osi Security- Security Attacks- Security Services- Security Mechanisms- Model For Network Security- Standards-Symmetric Encryption And Message Confidentially

UNIT II	Public Key Encryption	9

Public-Key Cryptography And Message Authentication- Approaches To Message Authentication- Secure Hash Functions- Message Authentication Codes- Public-Key Cryptography Principles- Symmetric Key Distribution Using Symmetric Encryption- Kerberos- key distribution using asymmetric encryption.

UNIT III	Transport-Level Security And Wireless Network Security	9

Web Security Considerations- Secure Socket Layer And Transport Layer Security- Transport Layer Security- Https- Secure Shell- Ieee 802.11 Wireless Lan Overview- Wireless Application Protocol Overview-Wireless Transport Layer Security-Wap End -To-End Security.

UNIT IV	Electronic Mail Security And Ip Security	9

Pretty Good Privacy- S/MIME- Domain keys Identified Mail- Ip Security Overview- Ip Security Policy- Encapsulating security payload- combining security associations

UNIT V	Malicious Software And Firewalls	9

Types Of Malicious Software- Viruses- Virus Countermeasures- Worms- Distributed Denial Of Service Attacks- Need For Firewalls- Firewall Characteristics- Types Of Firewalls- Firewall Basing- Firewall Location And Configurations.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- Describe The Osi M Odel And Security In Each Level Of The Model.(Understand)
- To Be Able To Apply Transport Layer Security(Apply)
- To Apply The Knowledge To Find Different Attack And Security In E-Mails(Apply)
- To List The Type Of Cryptography,Private And Public Key Cryptography And Use It(Analyze)
- To List The Different Web Security Considerations(Analyze)
- Be Aware Of Software Attacks Like Virus,Worms And Malious Software And Avoid Them.(Affective Domain)

Text Books:

1. William Stallings: Cryptography and Network Security, Pearson 6th edition.

2. Stallings, W. (2011). Cryptography and network security: Principles and practice (5th Ed.). Prentice Hall

3. Cryptography and Network Security Principles and Practice , Pearson Education Inc., William Stallings, Sly Edition, 2014, ISBN: 978-81- 317- 6166-3.

4. Cryptography and Network Security, Atoll Karate, TMH, 2003.

Reference Books:

1. V K Pachghare: Cryptography and Information Security, PHI 2nd Edition

2. Cryptography And Network Security Principles And Practice Fourth Edition, William Stallings, Pearson Education

3. Modern Cryptography: Theory and Practice, by Wino Mao, Prentice Hall PTR

4. Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall

5.Cryptography: Theory and Practice by Douglas R. Stinson, CRC press.

INDUSTRY DESIGNED ONE CREDIT COURSES

Course Code	Course Title	L	T	P	C
R21UCS861	R Programming	0	0	2	1
R21UCS862	Server Side Scripting	1	0	0	1
R21UCS863	Client side Scripting	1	0	0	1
R21UCS864	Ruby on Rails	1	0	0	1
R21UCS865	Wordpress	1	0	0	1
R21UCS866	Multimedia	1	0	0	1
R21UCS867	Mongo DB	0	0	2	1
R21UCS868	Software Testing Tools	1	0	0	1
R21UCS869	Animation Graphics	0	0	2	1
R21UCS870	UML Modeling	0	0	2	1
R21UCS871	Game Design	0	0	2	1
R21UCS872	Web Designing	0	0	2	1

R21UCS861	R PROGRAMMING	L	T	P	C
		0	0	2	1

PRE-REQUISITE : C, C++, Java

COURSE OBJECTIVES:

- To Provide the Procedures for R installation and develop R Programs for Data Exploration.

LIST OF EXPERIMENTS

1. Installing R and its Packages in R.
2. Programs on Data types in R
3. Built-in Functions in R
4. Creating and manipulating a vector in R
5. Creating matrix and Manipulating matrix in R
6. Creating and Operations on Factors in R
7. Operations on Data frames in R
8. Programs on control structures in R
9. Programs on loops in R
10. Customizing Graphs in R

TOTAL : 30 Periods

COURSE OUTCOMES:

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

- Use R Software to carry out statistical Computations and state the capabilities of R and its data variable. (Understand)
- Apply R Programming for Manipulation of Datasets. (Apply)
- Analyze dataset using statistical Tools available in R (Analyze)
- Evaluate Various Datasets Using R (Evaluate).
- Design Various graphs and Distribution Plots using R. (Create)
- Ability to conduct experiments using Modern tools (Affective Domain)

HARDWARE AND SOFTWARE REQUIRMENTSHARDWARE REQUIREWMENTS:

Personal Computers – 30 Numbers

SOFTWARE REQUIREMENTS:

RStudio

R21UCS862	SERVER SIDE SCRIPTING	L	T	P	C
		1	0	0	1

PRE-REQUISITE: WEB PROGRAMMING

COURSE OBJECTIVES :

- The general objectives of this course are to provide fundamental concepts of server side script programming using JavaScript and PHP respectively along with database connectivity.
- Learn the basics of the PHP programming language and how to write programs using PHP.
- Learn the basics of Java Servlets and JSP for implementing web applications written in Java.

UNIT I	INTRODUCTION TO PHP	5

PHP introduction ,Introduction to Server Side Scripting Language, Basic PHP Syntax, Comments in PHP, Variables, PHP Operators, Control Structures(If else, switch, all loops), PHP include File, File Handling, File Uploading, PHP Sessions, Sending Emails, PHP Cookies

UNIT II	MYSQL CONCEPTS	5

Introduction to MySQL, PHP MySQL Connect to a Database, Closing a Connection, MySQL Data Types, MySQL Insert, MySQL Select, MySQL Where Clause, MySQL Delete, MySQL Update, MySQL Aggregate Functions(sum, avg, count etc); MySQL Order by and Group by Clause, MySQL Sub queries, MySQL Joins

UNIT III	XML	5

Introduction to XML, Anatomy of an XML, document, Creating XML Documents, Creating XML DTDs, XML Schemas, XSL

TOTAL: 15 Periods

COURSE OUTCOMES:

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

- Explain the basic concepts of server side scripting (Understand)
- Apply suitable web technologies to design real world web applications (Apply)
- Develop real world web applications using server side scripting (Create)

TEXT BOOK:

1. Web Technologies, Uttam K Roy, Oxford University Press.
2. PHP : The Complete Reference By Steven Holzner, Tata McGrawHill.

REFERENCE BOOKS:

1. Developing Web Applications in PHP and AJAX, Harwani, McGrawHill.
2. Jeffrey C Jackson, Web Technologies A Computer Science Perspective, Pearson Education Inc. 2009..
3. Chris Bates, Web Programming Building Internet Applications, 3/e, Wiley India Edition 2009.

R21UCS863	CLIENT SIDE SCRIPTING	L	T	P	C
		1	0	0	1

PRE-REQUISITE:

COURSE OBJECTIVES :

- To learn the fundamentals of HTML.
- To add the dynamic content to pages using JavaScript that meet specific needs and interests.
- To facilitate the student to design interactive webpage using scripting language.

UNIT I	MARKUP LANGUAGES	5

An Introduction to HTML History-Versions-Basic XHTML Syntax and Semantics-Some Fundamental HTML Elements-Relative URLs-Lists-tables-Frames-Forms-HTML 5.0

UNIT II	CLIENT-SIDE SCRITING (CSS)	4

Basics of CSS, CSS properties for manipulating texts, background, colors, Gradients, Shadow Effects, borders, margins, paddings, transformations, transitions and animations.

UNIT III	JAVASCRIPT AND JQUERY	6

JavaScript: History and Versions Introduction JavaScript in Perspective-Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-inObjects-JavaScript Debuggers.**jQuery**: Basics, syntaxes, selectors, events, effects

TOTAL:15 Periods

COURSE OUTCOMES:

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

- Explain the basic concepts of client side scripting (Understand)
- Apply the client side scripting language to design a web page (Apply)
- Design an aesthetic web page using client side scripting for a real world scenario (Create)

TEXT BOOKS:

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", PearsonEducation, 2006.

REFERENCE BOOKS:

1. Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", PearsonEducation, 2006.
2. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, PearsonEducation, 2007.
3. Harvey M Deitel, Goldberg, "Internet & World Wide Web How to Program", Third Edition, PearsonEducation, 2006.
4. Marty Hall and Larry Brown,‖ Core Web Programming‖ Second Edition, Volume I and II,Pearson Education, 2001.

R21UCS864	RUBY ON RAILS	L	T	P	C
		1	0	0	1

COURSE OBJECTIVES :

- Develop programming skills and logical ability with the use of Ruby Programming language platform.
- Understanding web application development using Rails framework.

UNIT I	RUBY INSTALLATION AND BASICS	5

Introduction–Install RVM(Ruby Version Manager) - Ruby basics-IRB - Variables -Ruby Operators - Control Structures- Iterators - Arrays-Hashes

UNIT II	RUBY OOPS	5

Ruby Class - Inheritance - Ways of Creating Ruby object - Ruby Methods - String Class-File Class-Exceptions.

UNIT III	RAILS BASICS	5

Rails Installation and Ruby Gems-Databases - RAILS MVC - Model - Views– Controller- Building Hello World Rails Application Step by Step.

TOTAL : 15 Periods

COURSE OUTCOMES:

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

- •Deploy ruby version manager.
- •Implements ruby object oriented concepts and exceptions.
- •Demonstrate web application development using Rails framework.

REFERENCES:

1. Yukihiro Matsumoto (2008), The Ruby Programming Language, Shroff; First edition, 2008, ISBN-10:8184044925, ISBN-13: 978-81840449282.
2. Michael Fitzgerald, Learning Ruby, Published by O'Reilly Media, Inc.,May 2007, ISBN-10: 8184043341,ISBN-13: 978-81840433413.
3. Rails AntiPatterns, Wesley Professional Ruby Series, 1st edition, 2010, ISBN-10: 03R21604814, ISBN-13:978-03R216048114.
4. Adam Gamble, Cloves Carneiro, Jr. Rida Al Barazi (2007), Beginning Rails4, Apress, 3rd edition,2013ISBN-13 (pbk): 978-1-4302-6034-9| ISBN-13 (electronic): 978-1-4302-6035-6

R21UCS865	WORD PRESS	L	T	P	C
		1	0	0	1

PRE-REQUISITE:

COURSE OBJECTIVES :

- To learn the fundamentals in wordpress.
- To become familiar to design a content in webpage.
- Interacting with your reader, through customizing the look.

UNIT I	GETTING FAMILIAR WITH WORDPRESS	5

Setting Up WordPress- Setting Up database-Installing WordPress-How WordPress Works-Finding way to dashboard-Exporting and importing site condent-To back up your data-Upgrading WordPress. Setting: general settings-writing settings-reading settings-discussion settings- media settings-plugin settings.Managing accounts: Configuring Your Account-Managing user accounts.

UNIT II	ADDING CONTENT & WORKING WITH MEDIA,COMMENTS	5

Adding posts- Adding page-Editing post and pages- Setting Up and Using Categories- Using Tags-Internal Linking- Working with Media: Using the Media Library- Uploading audio files-Uploading video files.

UNIT III	CUSTOMIZING WORDPRESS THEME	5

Widgets and Plug-ins WordPress Default Theme- Choosing a New Theme- the Theme Editor-Setting menu-Post format- Getting Fancy With Themes: Customizing Theme with CSS- Adding favicon-Editing the Functions File.

TOTAL:15Periods

COURSE OUTCOMES:

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

- Explain the procedure to install and set up for WordPress. **(**Understand**)**
- Use suitable plugins and contents to a WordPress theme to enhance the website. (Apply)
- Create web pages to add images, media libraries and Themes. (Create)

TEXT BOOK:

1.WordPress Visual QuickStart Guide (2nd Edition) by Matt Beck, Jessica Neuman Beck (z lib.org)

REFERENCE BOOK:

1. WordPress Absolute Beginner's Guide ,Tris Hussey March 2014.

R21UCS866	MULTIMEDIA	L	T	P	C
		1	0	0	1

PRE-REQUISITE:

COURSE OBJECTIVES :

- To learn the basic tools necessary to design Media
- To know the necessary tools & advanced knowledge of multimedia related applications.

UNIT I	INTRODUCTION TO MULTIMEDIA	5

Evolution of Multimedia – Structure and components of Multimedia – multimedia platforms- Applications ofMultimedia in Education, Communication, Medication, Business, Entertainment – Video Conferencing, Web Streaming, Video Streaming, Internet Telephony – Virtual Reality

UNIT II	2D & 3D ANIMATION	5

Animation – compositing – rendering and editing – cell & computer animation – model building – key frame animation – dynamic particles – character animation – modeling and animation techniques.

UNIT III	AUDIO AND VIDEO FORMATS	5

Video basics - Working with video - Video Formats - Video hardware - encoding – decoding – video editing – non-linear editing – Audio basics – working with audio – audio formats – audio hardware & software. Adobe Premiere – tools & features – recording audio & video – types of audio & video – time line – project planning – trimming – motion effects – digital composting

TOTAL:15 Periods

COURSE OUTCOMES:

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

- Apply appropriate design Techniques in various fields (Apply)
- Design creative ideas relevant for print medium.(Apply)
- Solve human-centric problems using multimedia.(Create)
- Use appropriate formats for storage(Create)

TEXT BOOKS:

1. The Ultimate Multimedia Handbook, Tata Mc Graw Hill
2. Multimedia at Work, Tata Mc Graw Hill
3. Adobe Photoshop Unleashed, Tata Mc Graw Hill

REFERENCES BOOKS:

1. Teach yourself Corel Draw, Sams Publishing
2. Flash Mx for Dummies, Pustak Mahal

R21UCS867	MONGO DB	L	T	P	C
		0	0	2	1

PRE-REQUISITE :

COURSE OBJECTIVES:

- To learn how to design Schema using Advanced Queries.
- To understand the troubleshoot Performance issues.

LIST OF EXPERIMENTS

- MongoDB Commands For Creating The Database, Show The Current Working Databases,Insert Items In Database, Show The Existing Database And Dropping the Database
- MongoDB Commands to Create The Collection, Show The Collection And Dropping The Collections
- MongoDB Commands to Perform Insert A Values In The Document And To Find The Valuesin the Document
- MongoDB Commands to Perform Update And Delete Document
- MongoDB Commands to Perform Logical Query Operations
- Adding an Elements into an Arrays
- Consider a Restaurant and write a MongoDB Query To Various Operations
- Sorting using Ascending Order, Descending Order, By Using Limit and Skip Methods
- Create Database Emp And Make Collection With Name "Empl" And Perform Update, Add AndRemove
- MapReduce Using MongoDB

TOTAL : 30 Periods

COURSE OUTCOMES:

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

- Execute Mong DB query by using logical query operators. (Apply)
- Design solutions for Mongo DB Query problems that meet specified needs. (Create)
- Apply the concept of Mongo DB Queries to solve complex engineering problems. (Apply)

R21UCS868	SOFTWARE TESTING TOOLS	L	T	P	C
		1	0	0	1

COURSE OBJECTIVES:

- To familiarize the students with the methodologies & usage of Tools
- To summarize competency in the logic like Testing Terminology.

UNIT I	INTRODUCTION	5

Purpose of Testing-Types of Testing-Model for testing-consequences of bugs-taxonomy of bugs-Usage ofModern Testing Tools

UNIT II	INTRODUCTION TO TESTING TOOL:JMETER	5

JMeter overview-JDBC Test Terminolgy:Creating the Thread group, creating the JDBC Request, Adding theListeners that display the result, Saving the test Plan, Running the Test Plan, Insert the timer.

UNIT III	JMETER:HTTP TEST AND ADVANCED TESTING TOOLS	5

Http Test Overview-Creating the Thread group, Creating the HTTP Request, Adding the Listeners that display the result, Saving the test Plan, Running the Test Plan, Insert the timer-Viewing a Result in a TabularFormat. (Exposure to tools like Test Director)

TestRail: Testing Methods, Tools objectives, TestRail core and Management Features.

TOTAL: 15 Periods

COURSE OUTCOMES:

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

- Explain the process involved in testing Tool & Test Terminology. (Understand)
- Apply the knowledge of testing and taxonomy of bugs to test a program module.(Apply)
- Analyze various testing tools to identify bugs in a program with less computational cost. (Analyze)

TEXT BOOKS

1. Software Testing Techniques, Boris Beizer, Dreamtech, Second Edition.
2. Software Testing Tools ,Dr. K.V.K.K.Prasad, Dreamtech. - Covering WinRunner, Silk Test,LoadRunner, JMeter and TestDirector with case studies

REFERENCE BOOKS

1. The craft of software testing- Brain Marick, Pearson Education.
2. Introduction to Software Testing: P. Ammam & J.Offutt. Cambridge Univ. Press.
3. Software Testing M.G.Limaye TMH
4. Foundations of Software Testing, D. Grahm & Others, Cengage Learning.
5. http://nancyhoekstrxa.blogspot.com/2018/11/download- software-testing-tools.html

R21UCS869	ANIMATION GRAPHICS	L	T	P	C
		0	0	2	1

PRE-REQUISITE :

COURSE OBJECTIVES:

- To acquire knowledge about different communication modes and its different communication mediums.
- Introduction to Graphic Design to discuss the visual communication process
- Use simple visual elements in communication successfully.
- To aesthetically explore the design concepts using typography and to create illustrations for print media.

LIST OF EXPERIMENTS

Develop a mini project based on thefollowing

1. Color balance in advance.
2. Define pattern and preset.
3. Importance of filters.
4. Layer and Blanding modes.
5. Photo editing and composting.
6. Digital illustration objects like vehicle, weapon and props, cartoon/ comic character etc.
7. Timeline (GIF).
8. Matte Painting, color landscape and objects.
9. Importance of filters.
10. Masking.

TOTAL : 30 Periods

COURSE OUTCOMES:

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

- To apply the various tools to Color Balance, Pattern, Blending the images animation software. (Apply)
- Apply various types of masking options to the images using the animation tools. (Apply)
- Create a symbol or a logo with specific objective and design visiting cards, letterheads, envelope design, greetings design, invitation cards using the designing tools. (Create)

HARDWARE AND SOFTWARE

REQUIRMENTSHARDWARE

REQUIREWMENTS:

Personal Computers – 30 Numbers

SOFTWARE REQUIREMENTS:

- Adobe Photoshop
- Adobe CC

R21UCS870	UML MODELING	L	T	P	C
		0	0	2	1

PRE-REQUISITE :

COURSE OBJECTIVES:

- To demonstrate the process of object-oriented analysis and design to software development using CASEtools.

LIST OF EXPERIMENTS

Develop a mini project based on thefollowing

1. To develop a problemstatement.
2. Identify Use Cases and develop the Use Casemodel.
3. Identify the conceptual classes and develop a domain model with UML Class diagram.
4. Using the identified scenarios, find the interaction between objects and represent them usingUML Sequencediagrams.
5. Draw relevant state charts and activitydiagrams.
6. Identify the User Interface, Domain objects, and Technical services. Draw the partial layered,logical architecture diagram with UML package diagramnotation.
7. Develop and test the Technical serviceslayer.
8. Develop and test the Domain objectslayer.
9. Develop and test the User interfacelayer.

SUGGESTED LIST OF MINI PROJECTS

1. Passport automationsystem.
2. BankingSystem
3. Library ManagementSystem
4. Online course reservationsystem
5. E-ticketing
6. Student InformationSystem
7. Conference ManagementSystem
8. RecruitmentSystem
9. Stock maintenance system.
10. Exam registration

TOTAL : 30 Periods

COURSE OUTCOMES:

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

- Design the projects using OOconcepts. (Apply)
- Use the UML graphical notations for the appropriatediagrams.(Create)
- Use the UML analysis and design models.(Create)
- Apply appropriate design patterns(Apply)

- Convert design into code. (Create)
- Implement the modified system and test it for various scenarios. (Apply)

HARDWARE AND SOFTWARE REQUIRMENTS

HARDWARE REQUIREWMENTS:

Personal Computers – 30 Numbers

SOFTWARE REQUIREMENTS:

R21UCS871	GAME DESIGN	L	T	P	C
		0	0	2	1

PRE-REQUISITE :

COURSE OBJECTIVES :

- To demonstrate the basic concepts of animation.
- Be familiar with the text formatting.
- Be familiar with the objects reforming.

LIST OF EXPERIMENTS:

- Animating game objects
- Implementing loops and classes
- Using Pygame package to simplify game development
- Animating game text using custom fonts
- Development of menu screens and buttons
- Taking input from the mouse/touch/keyboard
- Randomizing game events
- Resizing game objects

TOTAL : 30 Periods

COURSE OUTCOMES:

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

- Apply the knowledge of various animation concepts to the problem relevant to gaming **(Apply)**
- Develop a gaming application using various animation concepts. **(Create)**
- Communicate effectively to build application relevant to game development. **(Affective domain)**

HARDWARE AND SOFTWARE REQUIRMENTS

HARDWARE

REQUIREWMENTS:

Personal Computers – 30 Numbers

SOFTWARE REQUIREMENTS:

Python

R21UCS872	WEB DESIGNING	L	T	P	C
		0	0	2	1

PRE-REQUISITE:

COURSEOBJECTIVES:

- To design a stylistic webpage using HTML and CSS
- To know the basic knowledge of word press and Dreamweaver

LISTOFEXPERIMENTS:

- Create a timetable for your class.
- Create a Mark list of University examination
- Create a Web page with all possible elements of HTML.
- Create a responsive web page with HTML and CSS.
- Create an Online application form for admission process.
- Create a Homepage of your Own HTML tags.
- Create an HTML page to show personal details.
- Create an HTML document to describe Unordered and ordered list.
- Write a Program to demonstrate java script array object and functions.
- Create a website for Online Marketing.

TOTAL:30Periods

COURSEOUTCOMES:

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

- Apply various web markups and languages work together to create graphic and interactive Web page elements.(Apply)
- Analyze various techniques of responsive web design, including media queries.(Analyze)
- Develop web pages using the HTML and CSS features with different layouts as per need of applications.(Create)
- Use the JavaScript to develop the dynamic web pages.(Apply)
- Be able to evaluate and embed social media content into web pages.(Value)

HARDWARE AND SOFTWARE REQUIRMENTS

HARDWAREREQUIREWMENTS:

PersonalComputers–30Numbers

SOFTWAREREQUIREMENTS:

Python

COURSES OFFERED TO OTHER PROGRAMMES

Course Code	Course Title	L	T	P	C
R21UCS426	Fundamentals of C Programming	3	0	0	3
R21UCS428	Fundamentals of C Programming Laboratory	0	0	2	1

R21UCS426	FUNDAMENTALS OF C PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To impart the concepts in basic organization of computers and problem solving techniques.
- To familiarize the programming constructs of C.
- To explain the concepts of arrays, strings, functions, pointers, structures and unions in C.

UNIT I	INTRODUCTION TO C PROGRAMMING	11

Basic Organization of a Computer –Algorithm – Pseudo code – Flow Chart- Introduction to ' C' programming – fundamentals – structure of a 'C' program – Compilation and Linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations.

UNIT II	DECISION MAKING AND LOOPING STATEMENTS	9

if - if-else - nested if-else – else-if ladder statement – switch – goto – for- while – do-while – break – continue statements .

UNIT III	ARRAYS AND STRINGS	9

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays - String - String operations – string arrays.

UNIT IV	FUNCTIONS	8

Function – Definition of function – Declaration of function – Parameter passing methods – Recursion.

UNIT V	POINTERS, STRUCTURES AND UNIONS	8

Pointers - Dynamic Memory allocation – Structure – Union.

TOTAL: 45 Periods

COURSE OUTCOMES:

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

- Explain the basic problem-solving techniques and concepts of the C programming language. (Understand)
- Apply problem-solving techniques and basic concepts of the C programming language to find solutions to real-world problems. (Apply)
- Apply the concepts of looping, branching, and decision-making statements for a given problem.(Apply)
- Apply the advanced concepts of C language like, pointers, structures, unions and arrays to solve real-world problems. (Apply)
- Analyze the appropriateness of C language constructs to provide solutions to computer applied complex engineering problems. (Analyze)

- Work individually or in teams and demonstrate the solutions to the given exercises through presentation. (Affective Domain)

TEXT BOOKS :

3. Balagurusamy, E, “Programming in ANSI C”, Eighth Edition, Tats McGraw-Hill Publishing Company Limited, New Delhi, 2019.
4. Deitel and Deitel, “C How to Program”, Pearson Education, New Delhi, 2011

REFERENCE BOOKS :

7. Yashavant P. Kanetkar. “ Let Us C”, BPB Publications, 2011.
8. Kernighan.B.W ,Ritchie.D.M, “The C Programming language”, Pearson Education,Second Edition, 2006.
9. Stephen G.Kochan, “Programming in C”, Pearson Education India,Third Edition, 2005.
10. Anita Goel ,Ajay Mittal, ” Computer Fundamentals and Programming in C””, Dorling Kindersley (India) Pvt. Ltd, Pearson Education in South Asia, 2011.
11. Byron S Gottfried, ” Programming with C ”, Schaum’s Outlines, Tata McGraw-Hill,Second Edition, 2006.
12. PradipDey, ManasGhosh, “Fundamentals of Computing and Programming in C”, Oxford University Press, First Edition, 2009.

R21UCS428	FUNDAMENTALS OF C PROGRAMMING LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES :

- Familiarize with programming environment
- Familiarize the implementation of programs in C

LIST OF EXPERIMENTS

- **Familiarization with Integrated Development Environment (IDE)**(Compile, Debug)

oblems involve arithmetic computations and sequential logic

4. Write a C program to display the Bio data using printf statement.
5. Write a c program to find simple interest.
6. Writing a C program for a landscaping company. The company needs a tool to calculate the amount of material required to create circular garden beds and the length of edging required for each bed.

Problems involve decision making

6 Write a C program for an event management company that organizes seating arrangements for events such as concerts, conferences, or sports matches. The company needs a tool to efficiently assign seats to attendees based on whether their ticket numbers are even or odd.

7 Write a C program for developing software for a payroll management system used by a company with employees working on projects spanning multiple years. The system needs to calculate salaries and benefits, taking into account leap years for accurate time calculations. Your task is to write a program that determines whether a given year is a leap year or not.

8 Write a C program to read the age of a candidate and determine whether he is eligible to cast his/her own vote.

9 Write a C program to find Largest from Three Numbers given by user using Else-if Statement

10 Design a calculator to perform the arithmetic operations.

Problems involve iterations

5 You are developing a program for a financial institution that offers investment plans based on the Fibonacci sequence. The institution wants to provide a tool that visualizes the growth of investments over time using the Fibonacci series.

6 Developing a program for an online security system that requires checking whether a user's chosen PIN is a prime number. The security system wants to ensure that users have unique and secure PINs.

7 A supermarket manager wishes to keep some toys and puzzle games to enable the customers to manage their kids during the purchase time. He kept a machine called “Fortune Teller machine”, it replies the kid with some fortune message if he enters the palindrome number. It replies with “try again

later" if the kid failed to input a valid palindrome number.

8 Write a C program to print Triangle Pattern Using Nested for Loop.

Problems involve arrays

5 You are developing a program for a gradebook application used by teachers to manage student scores. The application needs a tool that allows teachers to input the scores of five different assignments for each student and then display the scores entered. Your task is to write a C program that takes 5 values from the user representing the scores of five different assignments and stores them in an array. After storing the values, the program should print the elements stored in the array.

6 You are developing a program for a scientific research project where data from multiple experiments need to be analyzed. The research team wants a tool that can calculate the average of a set of data points collected from various experiments. Your task is to write a C program that finds the average of n numbers using arrays.

7 You are developing a program for a financial analysis tool used by an investment firm. The tool requires performing matrix addition to analyze the performance of various investment portfolios over multiple periods. Your task is to write a C program that prints the elements of two 2D arrays representing the returns of two investment portfolios over a specific time period and then performs matrix addition to calculate the combined returns.

8 Write a C program to print the elements of 2D-array Matrix addition using 2D-Array.

Problem involve strings

2. Developing a program for a language learning platform that helps students practice reading and understanding words and sentences in a foreign language. As part of the exercises, the platform needs a tool to display the reverse of the words or sentences entered by the students.

Problems involve in functions, recursion

3. Write a C program to swap two values using call by value and call by reference.
4. You are developing a program for a manufacturing company that produces various components. One of the critical processes involves calculating the number of possible combinations of components that can be assembled. Your task is to write a C program that calculates the factorial of a given number representing the number of components available, using recursion.

Problems involve structures, Unions

3. Create a C programming using Union called Employee which stores the name, id, basic pay, HRA and DA as members. Find the total pay of the employee.
4. Create a C programming using an Structure called Student with name, class, rollnum, total marks as members. Find and display the grade of each student.
    - >80 – Grade A
    - >60 – Grade B
    - > 50 – Grade C

- <50 - Fail

TOTAL: 30 Periods

COURSE OUTCOMES:

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

- Write programs to solve problems involving computations. (Apply)
- Develop computer applications using suitable control structures. (Apply)
- Apply different programming constructs to solve a variety of computational problems efficiently. (Apply)
- Design solutions for computer applied complex Engineering Problems that meet specified needs. (Create)
- Communicate effectively to justify the solutions to the given problems based on legal and ethical principles. (Affective domain - Value)
- Work effectively as an individual or in teams to develop solution for the given problem.

(Affective domain - Value)

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

HARDWARE

PERSONAL COMPUTERS WITH 4GB RAM ,500 GB HDD,MOINTOR ,KEYBOARD AND MOUSE

SOFTWARE

TURBO C