SETHU INSTITUTE OF TECHNOLOGY

(An Autonomous Institution | Accredited with 'A++' Grade by NAAC) Pulloor,

Kariapatti – 626 115.

B.Tech COMPUTER SCIENCE AND BUSINESS SYSTEMS

REGULATIONS 2021

CHOICE BASED CREDIT SYSTEM

CURRICULUM & SYLLABUS

(1st SEMESTER To 8th SEMESTER)

BATCH 2023-27

CHAIRPERSON
BOARD OF STUDIES

CHAIRMAN
ACADEMIC COUNCIL

SETHU INSTITUTE OF TECHNOLOGY
An Autonomous Institution | Accredited By NAAC with 'A++' Grade
Pulloor, Kariapatti –Taluk. Virudhunagar Dist-626115.

B.TECH COMPUTER SCIENCE AND BUSINESS SYSTEMS

REGULATIONS 2021[Batch-2023-2027]

OVERALL COURSE STRUCTURE

Code	Category	Total No. of Courses	Credits	Percentage
BS	Basic Sciences	**9**	**25**	**15.63**
ES	Engineering Sciences	**6**	**13**	**8.13**
HSS	Humanities & Social Sciences	**6**	**10.5**	**6.4**
PC	Professional Core	**31**	**68.5**	**42.81**
PE	Professional Elective	**6**	**18**	**11.25**
OE	Open Electives	**4**	**12**	**7.5**
PW	Project Work	**3**	**14**	**8.13**
MC	Mandatory Course	**8**	**2**	**1.2**
AC	Audit Course	**2**	**-**	**-**
	TOTAL	**75**	**163**	**100**

COURSE CREDITS – SEMESTERWISE

Branch	I	II	III	IV	V	VI	VII	VIII	TOTAL
CSBS Batch 2023 – 2027	**22**	**21**	**17**	**22**	**27**	**22**	**18**	**14**	**163**

SEMESTER I

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UEN102	Business Communication and Value Science – I	2	0	0	2	Humanities and Social Science
R21UMA103	Probability and Inferential Statistical Techniques	3	1	0	4	Basic Science
R21UMA104	Discrete Structures And Analysis	3	0	0	3	Basic Science
R21UPH103	Physics for Information Science (Common to CSE,IT,CSBS,AIDS ,CSD,CSE(AI&ML),CSE(IOT) and CSE Cyber security)	3	0	0	3	Basic Science
R21UEE125	Principles of Electrical Engineering(Common to CSBS, AIDS & CSE(AI&ML))	3	0	0	3	Engineering Science
R21UCS107	Problem Solving and C Programming (Common to All Branches)	3	0	0	3	Engineering Science
PRACTICAL						
R21UGS113	Physics Laboratory(Common to CSE,IT,CSBS,AIDS ,CSD,AI&ML,IOT and Cyber security)	0	0	2	1	Basic Science
R21UEE128	Electrical Engineering Laboratory(Common to CSBS, AIDS & CSE(AI&ML))	0	0	2	1	Engineering Science
R21UCS111	Problem Solving and C Programming Laboratory (Common to All Branches)	0	0	2	1	Engineering Science
MANDATORY						
R21UAC131	Induction Programme (Common to ALL Branches)	0	3	0	P/F	Audit Course
R21UGT140	Heritage of Tamil	1	0	0	1	Mandatory Course
	TOTAL	**18**	**4**	**6**	**22**	
Total No of Credits - 22						

SEMESTER II

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UEN202	Business Communication and Value Science – II	2	0	0	2	Humanities and Social Science
R21UMA208	Linear Algebra and Numerical Techniques	3	1	0	4	Basic Science
R21UMA209	Statistical Methods	3	1	0	4	Basic Science
R21UEC225	Principles of Electronics Engineering	3	0	0	3	Engineering Science
R21UCB205	Algorithms and Data Structures	3	0	0	3	Professional Core
R21UCB206	Introduction to Economics	2	0	0	2	Engineering Science
PRACTICAL						
R21UEC226	Electronics Engineering Laboratory	0	0	2	1	Basic Science
R21UCB211	Algorithms and Data Structures Laboratory	0	0	2	1	Professional Core
MANDATORY						
R21UGT241	Tamil and Technology	1	0	0	1	Mandatory Course
R21UAC231	Biology for Engineers (Common to all except BME, BT)	2	0	0	P/F	Audit Course
	TOTAL	**19**	**2**	**4**	**21**	
Total No of Credits - 21						

SEMESTER III

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UCB301	Formal Languages and Automata Theory	3	1	0	4	Professional Core
R21UCB302	Computational Statistics	3	0	0	3	Professional Core
R21UCS303	Object Oriented Programming using C++(Common to CSE,IT,CSBS,CSD, CSE(AI&ML),IOT,CYBER SECURITY)	3	0	0	3	Professional Core
R21UCB503	Fundamental of Management	2	0	0	2	Professional Core
R21UCS305	Computer Organization (Common to CSE,IT,CSBS,AIDS, CSE(AI&ML), IOT,CYBER SECURITY)	3	0	0	3	Professional Core
PRACTICAL						
R21UCB307	Computational Statistics Laboratory	0	0	2	1	Professional Core
R21UCS309	Object Oriented Programming using C++ Laboratory (Common to CSE,IT,CSBS,CSD, CSE(AI&ML),IOT,CYBER SECURITY)	0	0	2	1	Professional Core
MANDATORY						
R21UGM231	Environmental Science (Common to ALL Branches)	2	0	0	P/F	Mandatory Course
	TOTAL	**16**	**1**	**4**	**17**	
Total No of Credits - 17						

SEMESTER IV

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UEN401	Business Communication and Value Science – III	2	0	0	2	Humanities and Social Science
R21UCB401	Database Management Systems	3	0	0	3	Professional Core
R21UCB402	Software Design with UML	3	0	0	3	Professional Core
R21UCB403	Operating Systems	3	0	0	3	Professional Core
R21UCB404	Design and Analysis of Algorithm	3	0	0	3	Professional Core
R21UCB405	Introduction To Innovation, IP Management And Entrepreneurship	2	0	0	2	Professional Core
R21UCB406	Introduction to Operations Research	3	0	0	3	Basic Science
PRACTICAL						
R21UCB407	Database Management Systems Laboratory	0	0	2	1	Professional Core
R21UCB408	Software Design with UML Laboratory	0	0	2	1	Professional Core
R21UCB409	Operating Systems Laboratory	0	0	2	1	Professional Core
MANDATORY						
R21UGM431	Gender Equality (Common to ALL Branches)	1	0	0	P/F	Mandatory Course
	TOTAL	**21**	**0**	**6**	**22**	
Total No of Credits - 22						

SEMESTER V

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UEN501	Business Communication and Value Science – IV	2	0	0	2	Humanities and Social Science
R21UCB501	Software Engineering	3	0	0	3	Professional Core
R21UCB502	Compiler Design	3	0	0	3	Professional Core
R21UCB504	Data Communication and Networking	3	0	0	3	Professional Core
R21UCB602	Information Security	2	0	0	2	Professional Core
	Professional Elective I	3	0	0	3	Professional Elective
	Open Elective I	3	0	0	3	Open Elective
R21UGS531	Reasoning and Aptitude(Common to CSE,ECE,IT,CSBS,AIDS,CSD, CSE(AI&ML),IOT,CYBER SECURITY)	1	0	0	1	Basic Science
PRACTICAL						
R21UCB507	Creative Thinking and Innovation	0	0	2	1	Project Work
R21UCB509	Software Engineering Laboratory	0	0	2	1	Professional Core
R21UCB508	Data communication and Information Security Laboratory	0	0	2	1	Professional Core
R21UGS532	Soft Skills Laboratory(Common to CSE,ECE,IT,CSBS,AIDS,CSD, CSE(AI&ML),IOT,CYBER SECURITY)	0	0	2	1	Humanities and Social Science
R21UGM435	Universal Human Values II	**2**	**1**	**0**	**3**	Mandatory Course
	TOTAL	**20**	**0**	**8**	**27**	
Total No of Credits – 27						

SEMESTER VI

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UCB601	Business Strategy	2	0	0	2	Professional Core
R21UCB505	Marketing Research and Management	2	0	0	2	Professiona lCore
R21UCB603	Artificial Intelligence Techniques	3	0	0	3	Professional Core
	Professional Elective II	3	0	0	3	Professional Elective
	Professional Elective III	3	0	0	3	Professional Elective
	Open Elective II	3	0	0	3	Open Elective
PRACTICAL						
R21UGS633	Interpersonal Skills Development Laboratory(Common to CSE,IT,EEE,AGRI,CSBS ,AIDS,CSD, AI&ML,IOT,CYBER SECURITY)	0	0	2	1	Humanities and Social Science
R21UCB607	Product Development Project	0	0	8	4	Project Work
R21UCB609	Artificial Intelligence Techniques Laboratory	0	0	2	1	Professional Core
MANDATORY						
R21UGM631	Indian Constitution(Common to all Branches)	1	0	0	P/F	Mandatory Course
	TOTAL	**18**	**0**	**12**	**22**	
Total No of Credits - 22						

SEMESTER VII

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UCB701	Human Resource Management	2	0	0	2	Professional Core
R21UCB702	Usability Design of Software Applications	2	0	0	2	Professional Core
R21UCB703	IT Workshop	2	0	0	2	Professional Core
	Professional Elective IV	3	0	0	3	Professional Elective
	Professional Elective V	3	0	0	3	Professional Elective
	Open Elective III	3	0	0	3	Open Elective
PRACTICAL						
R21UCB707	Usability Design of Software Applications Laboratory	0	0	2	1	Professional Core
R21UCB708	IT Workshop Laboratory	0	0	2	1	Professional Core
R21UCB709	Internship	0	0	2	1	Professional Core
21UGE710	Multi Disciplinary Project - I	0	0	6	3	Professional Core
MANDATORY						
R21UGM731	Sports and Social Development (Common to all Branches)	-	-	-	P/F	Mandatory Course
R21UGM732	Skill Development (Common to all Branches)	-	-	-	P/F	Mandatory Course
	TOTAL	**15**	**0**	**4**	**18**	
Total No of Credits - 18						

SEMESTER VIII

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
	Professional Elective VI	3	0	0	3	Professional Elective
	Open Elective IV	3	0	0	3	Open Elective
PRACTICAL						
R21UCB801	Project Work	0	0	16	8	Project Work
21UGE810	Multi-Disciplinary Project - II	0	0	16	8	Professional Core
MANDATORY						
R21UGM831	Professional Ethics and Human Values (Common to all Branches)	2	0	0	P/F	Mandatory Course
	TOTAL	**8**	**0**	**16**	**14**	
Total No of Credits - 14						

TOTAL CREDITS – 163

PROFESSIONALELECTIVECOURSES: VERTICALS

Vertical I Data Science	**Vertical II Cloud Computing and Datacenter Technologies**	**Vertical III Emerging Technologies**	**Vertical IV Artificial Intelligence and Machine Learning**	**Vertical V Marketing and Management**	**Vertical VI Digital Marketing**	**Vertical VII Digital Technology**
21CSV101 - Exploratory Data Analysis	21CSV301-Cloud Computing	21CSV501-Augmented Reality/Virtual Reality	21ITV701 Knowledge Engineering	21CBV401-Human Resource Management for Entrepreneurs	21CDV408-Marketing Research and Marketing Management	21CBV701-GUI Design and Applications
21CSV102 - Recommender Systems	21CSV302-Virtualization	21CSV602-Robot Process Automation	21CSV702-Soft Computing	21CSV102-Recommender Systems	21CBV601-Advanced social, text and media analytics	21CBV702-Application Development
21ITV103-Neural Networks and Deep Learning	21CSV203-Cloud Essentials	21ITV103-Neural Networks and Deep Learning	21ITV103-Neural Networks and Deep Learning	21CBV404-Supply Chain Management	21CBV602-Conversational Systems	21CBV703-Problem Solving and Python Programming
21CSV104 - Text and Speech Analysis	21ITV304-Data Warehousing	21CSV604-Cyber security	21CSV104-Text and Speech Analysis	21CDV408-Marketing and Social Media Web Analytics	21CBV603-Social Media Marketing	21CBV704-Programming in JAVA
21ITV105-Business Analytics	21ITV305-Storage Technologies	21CSV605-Quantum Computing	21CSV705-Optimization Techniques	21CDV407-Social Data Mining	21CBV604 - Web analytics and Search Engine Optimization	21CBV705-PERN Stack Development
21ITV106-Image and Video Analytics	21CSV306-Software Defined Networks	21ITV406-Crypto currency and Block chain Technologies	21ITV706 - Game Theory	21CBV403-Financial Management	21CBV605-Digital Marketing Analytics	21CBV706-MERN stack web Development
21CSV107 - Computer Vision	21ITV307-Stream Processing	21ITV507-Game Development	21ITV707-Cognitive Science	21CSV505-Digital Marketing	21CSV102-Recommender Systems	21CBV707-Data Wrangling
21ITV108-Big Data Analytics	21ITV308-Security and Privacy in Cloud	21ITV608-3D Printing and Design	21CSV708-Ethics and AI	21CDV408-Marketing Research and Marketing Management	21CBV606-Capstone Project	21CBV708-Software Testing Methodologies

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 1: DATASCIENCE

S. NO.	COURSE CODE	COURSETITLE	L	T	P	C
1.	21CSV101	Exploratory Data Analysis (CSE)	3	0	0	3
2.	21CSV102	Recommender Systems (CSE)	3	0	0	3
3.	21ITV103	Neural Networks and Deep Learning (IT)	3	0	0	3
4.	21CSV104	Text and Speech Analysis (CSE)	3	0	0	3
5.	21ITV105	Business Analytics (IT)	3	0	0	3
6.	21ITV106	Image and Video Analytics (IT)	3	0	0	3
7.	21CSV107	Computer Vision (CSE)	3	0	0	3
8.	21ITV108	Big Data Analytics(IT)	3	0	0	3

VERTICAL 2: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES

S. NO.	COURSE CODE	COURSETITLE	L	T	P	C
1.	21CSV301	Cloud Computing (CSE)	3	0	0	3
2.	21CSV302	Virtualization (CSE)	3	0	0	3
3.	21CSV203	Cloud Essentials (CSE)	3	0	0	3
4.	21ITV304	Data Ware housing (IT)	3	0	0	3
5.	21ITV305	Storage Technologies (IT)	3	0	0	3
6.	21CSV306	Software Defined Networks (CSE)	3	0	0	3
7.	21ITV307	Stream Processing (IT)	3	0	0	3
8.	21ITV308	Security and Privacy in Cloud (IT)	3	0	0	3

VERTICAL 3: EMERGING TECHNOLOGIES

S. NO.	COURSE CODE	COURSETITLE	L	T	P	C
1.	21CSV501	Augmented Reality/Virtual Reality (CSE)	3	0	0	3
2.	21CSV602	Robotic Process Automation (CSE)	3	0	0	3
3.	21ITV103	Neural Networks and Deep Learning (IT)	3	0	0	3
4.	21CSV604	Cyber Security(CSE)	3	0	0	3
5.	21CSV605	Quantum Computing (CSE)	3	0	0	3
6.	21ITV406	Crypto currency and Block chain Technologies (IT)	3	0	0	3
7.	21ITV507	Game Development (IT)	3	0	0	3
8.	21ITV608	3D Printing and Design (IT)	3	0	0	3

VERTICAL 4: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

S. NO.	COURSE CODE	COURSETITLE	L	T	P	C
1.	21ITV701	Knowledge Engineering (IT)	3	0	0	3
2.	21CSV702	Soft Computing (CSE)	3	0	0	3
3.	21ITV103	Neural Networks and Deep Learning (IT)	3	0	0	3
4.	21CSV104	Text and Speech Analysis (CSE)	3	0	0	3
5.	21CSV705	Optimization Techniques (CSE)	3	0	0	3
6.	21ITV706	Game Theory (IT)	3	0	0	3
7.	21ITV707	Cognitive Science (IT)	3	0	0	3
8.	21CSV708	Ethics and AI (CSE)	3	0	0	3

VERTICAL 5: MARKETING AND MANAGEMENT

S. NO.	COURSE CODE	COURSETITLE	L	T	P	C
1.	21CBV401	Human Resource Management for Entrepreneurs	3	0	0	3
2.	21CSV102	Recommender Systems	3	0	0	3
3.	21CBV404	Supply Chain Management	3	0	0	3
4.	21CDV408	Marketing and Social Media Web Analytics	3	0	0	3
5.	21CDV407	Social Data Mining	3	0	0	3
6.	21CBV403	Financial Management	3	0	0	3
7.	21CSV505	Digital Marketing	3	0	0	3
8.	21CDV408	Marketing Research and Marketing Management	3	0	0	3

VERTICAL 6: DIGITAL MARKETING

S. NO.	COURSE CODE	COURSETITLE	L	T	P	C
1.	21CDV408	Marketing Research and Marketing Management	3	0	0	3
2.	21CBV601	Advanced social, text and media analytics	3	0	0	3
3.	21CBV602	Conversational Systems	3	0	0	3
4.	21CBV603	Social Media Marketing	3	0	0	3
5.	21CBV604	Web analytics and Search Engine Optimization	3	0	0	3
6.	21CBV605	Digital Marketing Analytics	3	0	0	3
7.	21CSV102	Recommender Systems	3	0	0	3
8.	21CBV606	Capstone Project	3	0	0	3

VERTICAL 7: DIGITAL TECHNOLOGY

S. NO.	COURSE CODE	COURSETITLE	L	T	P	C
1.	21CBV701	GUI Design and Applications	3	0	0	3
2.	21CBV702	Application Development	3	0	0	3
3.	21CBV703	Problem Solving and Python Programming	3	0	0	3
4.	21CBV704	Programming in JAVA	2	0	2	3
5.	21CBV705	PERN Stack Development	3	0	0	3
6.	21CBV706	MERN stack web Development	3	0	0	3
7.	21CBV707	Data Wrangling	3	0	0	3
8.	21CBV708	Software Testing Methodologies	3	0	0	3

GENERAL VERTICALS FOR MINOR DEGREE

Vertical I **Fintech and Block Chain**	**Vertical II** **Entrepreneurship**	**Vertical III** **Public Administration**	**Vertical IV** **Business Data Analytics**	**Vertical V** **Environment and Sustainability**
Financial Management	Foundations of Entrepreneurship	Principles of Public Administration	Statistics for Management	Sustainable Infrastructure development
Fundamentals of Investment	Team Building & Leadership Management for Business	Constitution of India	Data Mining For Business Intelligence	Sustainable Agricultur and Environmental Management
Banking, Financial Services and Insurance	Creativity& Innovation in Entrepreneurship	Public Personnel Administration	Human Resource Analytics	Sustainable Bio Materials
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
Fintech Personal Finance and Payments	Human Resource Management for Entrepreneurs	Indian Administrative System	Operation and Supply Chain Analytics	Green Technology
Introduction to Fintech	Financing New Business Ventures	Public Policy Administration	Financial Analytics	Environmental Quality Monitoring and Analysis
-	-	-	-	Integrated Energy Planning for Sustainable Development
-	-	-	-	Energy Efficiency for Sustainable Development

VERTICAL I: FINTECH AND BLOCKCHAIN

Course Code	Course Title	L	T	P	C
21CBVG01	Financial Management	3	0	0	3
21CBVG02	Fundamentals of Investment	3	0	0	3
21CBVG03	Banking, Financial Services and Insurance	3	0	0	3
21CBVG04	Introduction to Block chain and its Applications	3	0	0	3
21CBVG05	Fintech Personal Finance and Payments	3	0	0	3
21CBVG06	Introduction to Fintech	3	0	0	3

VERTICAL II: ENTREPRENEURSHIP

Course Code	Course Title	L	T	P	C
21MEVG01	Foundations of Entrepreneurship	3	0	0	3
21MEVG02	Team Building& Leadership Management for Business	3	0	0	3
21MEVG03	Creativity & Innovation in Entrepreneurship	3	0	0	3
21MEVG04	Principles of Marketing Management for Business	3	0	0	3
21MEVG05	Human Resource Management for Entrepreneurs	3	0	0	3
21MEVG06	Financing New Business Ventures	3	0	0	3

VERTICAL III: PUBLIC ADMINISTRATION

Course Code	Course Title	L	T	P	C
21EEVG01	Principles of Public Administration	3	0	0	3
21EEVG02	Constitution of India	3	0	0	3
21EEVG03	Public Personnel Administration	3	0	0	3
21EEVG04	Administrative Theories	3	0	0	3
21EEVG05	Indian Administrative System	3	0	0	3
21EEVG06	Public Policy Administration	3	0	0	3

VERTICAL IV: BUSINESS DATA ANALYTICS

Course Code	Course Title	L	T	P	C
21CSVG01	Statistics for Management	3	0	0	3
21CSVG02	Data Mining for Business Intelligence	3	0	0	3
21CSVG03	Human Resource Analytics	3	0	0	3
21CSVG04	Marketing and Social Media Web Analytics	3	0	0	3
21CSVG05	Operation and Supply Chain Analytics	3	0	0	3
21CSVG06	Financial Analytics	3	0	0	3

VERTICAL V: ENVIRONMENT AND SUSTAINABILITY

Course Code	Course Title	L	T	P	C
21CEVG01	Sustainable Infrastructure Development	3	0	0	3
21CEVG02	Sustainable Agriculture and Environmental Management	3	0	0	3
21CEVG03	Sustainable Bio Materials	3	0	0	3
21CEVG04	Materials for Energy Sustainability	3	0	0	3
21CEVG05	Green Technology	3	0	0	3
21CEVG06	Environmental Quality Monitoring and Analysis	3	0	0	3
21CEVG07	Integrated Energy Planning for Sustainable Development	3	0	0	3
21CEVG08	Energy Efficiency for Sustainable Development	3	0	0	3

LIST OF OPEN ELECTIVES OPEN ELECTIVES–I

Course Code	Course Title	L	T	P	C
21UME972	Introduction to Industrial Engineering	3	0	0	3
21UCE972	Climate Change and Mitigation Management	3	0	0	3
21UEE980	Renewable energy system	3	0	0	3
21UEE977	Industrial Automation and Control	3	0	0	3
21UEN972	Speak better write better	3	0	0	3
21UJN975	Japanese for engineers	3	0	0	3
21UFR973	French for engineers	3	0	0	3

OPEN ELECTIVES– II

Course Code	Course Title	L	T	P	C
21UBT973	Nutraceuticals	3	0	0	3
21UAI990	ICT in agriculture	3	0	0	3
21UEE978	Introduction to control systems	3	0	0	3
21UBT971	Bio Nano Technology	3	0	0	3
21UEN971	English For Competitive Exam	3	0	0	3
21UGR974	German For Engineers	3	0	0	3

OPEN ELECTIVES–III

Course Code	Course Title	L	T	P	C
21UAI971	Agri Business Management	3	0	0	3
21UBM972	Bio Medical Instrumentation Systems	3	0	0	3
21UBM974	Forensic Science	3	0	0	3
21UBT972	Herbal Medicines	3	0	0	3
21UCE971	Applications of Energy Efficient Buildings	3	0	0	3
21UCE974	Remote Sensing and GIS Application	3	0	0	3
21UCD971	Applied Design Thinking	3	0	0	3
21UEC971	Automotive Electronics	3	0	0	3
21UEC980	VLSI Design	3	0	0	3

21UEE971	Computer Control Of Processes	3	0	0	3
21UEE973	Digital Design using HDL	3	0	0	3
21UEE975	Energy Conservation and Management	3	0	0	3
21UEE979	Introduction to Hybrid and Electric Vehicles	3	0	0	3
21UEE981	Solar Power Plants	3	0	0	3
21UME973	Industrial Design &Rapid Prototyping Techniques	3	0	0	3
21UME975	Introduction to Additive Manufacturing	3	0	0	3
21UME977	Mechatronics	3	0	0	3
21UME979	Product Management	3	0	0	3
21UME981	Quality Engineering	3	0	0	3
21UME983	Supply Chain Management	3	0	0	3

OPEN ELECTIVES– IV

Course Code	Course Title	L	T	P	C
21UBM973	Computer Applications in Medicine	3	0	0	3
21UAI972	Integrated Farming System	3	0	0	3
21UBM975	Robotics in HealthCare	3	0	0	3
21UBT974	Quality Assurance and Control in Food Industry	3	0	0	3
21UCE973	Developments of Smart Cities	3	0	0	3
21UEC972	Sensors	3	0	0	3
21UEC973	Design thinking for innovations	3	0	0	3
21UEC981	Wearable Devices	3	0	0	3
21UEE972	Design of Embedded Systems	3	0	0	3
21UEE974	Drone Technologies	3	0	0	3
21UEE976	Foundation of Robotics	3	0	0	3
21UEE980	Non-Conventional Energy Resources And Applications	3	0	0	3
21UME971	Hydraulics and Pneumatics	3	0	0	3
21UME974	Industry4.0	3	0	0	3
21UME976	Lean Concepts, Tools and Practices	3	0	0	3

21UME980	Production Planning and Control	3	0	0	3
21UME982	Reverse Engineering	3	0	0	3

OPEN ELECTIVES OFFERED TO OTHER PROGRAMMES

Course Code	Course Title	L	T	P	C
21UCB971	Digital Marketing Strategy	3	0	0	3
21UCB972	Strategic Management and Leadership	3	0	0	3
21UCB973	Social Media Marketing Analytics	3	0	0	3
21UCB974	Marketing Management Strategy	3	0	0	3

LIST OF INDUSTRY OFFERED COURSES

Course Code	Course Title	L	T	P	C
21UCB861	Android	0	0	2	1
21UCB862	Web Designing	0	0	2	1
21UCB863	Visualization using Tableau	0	0	2	1
21UCB864	Mongo DB Atlas Database	0	0	2	1
21UCB865	Data Analysis using SQL	0	0	2	1
21UCB866	Dev Ops Tools	0	0	2	1
21UCB867	Drone Technology	0	0	2	1
21VCB01	Python Programming	Value added Course			
21VCB02	Node JS	Value added Course			
21VCB03	C# and .Net Framework	Value added Course			
21VCB04	Excel for Data analytics and Visualization	Value added Course			

COURSE OFFERED TO ECE DEPARTMENT

Course Code	Course Title	L	T	P	C
21UCB951	Cloud Computing and its Applications	3	0	0	3

Non-Credit Mandatory Courses

Course Code	Course Title	L	T	P	C	Type of Course
21UGM131	Induction Program (Common to ALL Branches)	0	3	0	P/F	Mandatory Course
21UGT140	Heritage of Tamil	1	0	0	1	Mandatory Course
21UGM331	Biology for Engineers (Common to all except BT,BM)	2	0	0	P/F	Mandatory Course
21UGM231	Environmental Science(Common to ALL Branches)	3	0	0	P/F	Mandatory Course
21UGM431	Gender Equality (Common to ALL Branches)	1	0	0	P/F	Mandatory Course
21UGM631	Indian Constitution (Common to all Branches)	1	0	0	P/F	Mandatory Course
21UGM731	Sports and Social Development (Common to all Branches)	-	-	-	P/F	Mandatory Course
21UGM732	Skill Development (Common to all Branches)	-	-	-	P/F	Mandatory Course
21UGM831	Professional Ethics and Human Values (Common to all Branches)	2	0	0	P/F	Mandatory Course

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Department of Computer Science and Business Systems

Syllabus I to VIII
(2023-2027)

SEMESTER I

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UEN102	Business Communication and Value Science – I	2	0	0	2	Humanities and Social Science
R21UMA103	Probability and Inferential Statistical Techniques	3	1	0	4	Basic Science
R21UMA104	Discrete Structures And Analysis	3	0	0	3	Basic Science
R21UPH103	Physics for Information Science (Common to CSE,IT,CSBS,AIDS ,CSD,CSE(AI&ML),CSE(IOT) and CSE Cyber security)	3	0	0	3	Basic Science
R21UEE125	Principles of Electrical Engineering(Common to CSBS, AIDS & CSE(AI&ML))	3	0	0	3	Engineering Science
R21UCS107	Problem Solving and C Programming (Common to All Branches)	3	0	0	3	Engineering Science
PRACTICAL						
R21UGS113	Physics Laboratory(Common to CSE,IT,CSBS,AIDS ,CSD,AI&ML,IOT and Cyber security)	0	0	2	1	Basic Science
R21UEE128	Electrical Engineering Laboratory(Common to CSBS, AIDS & CSE(AI&ML))	0	0	2	1	Engineering Science
R21UCS111	Problem Solving and C Programming Laboratory (Common to All Branches)	0	0	2	1	Engineering Science
MANDATORY						
R21UAC131	Induction Programme (Common to ALL Branches)	0	3	0	P/F	Audit Course
R21UGT140	Heritage of Tamil	1	0	0	1	Mandatory Course
	TOTAL	**18**	**4**	**6**	**22**	
Total No of Credits - 22						

21UEN102	Business Communication & Value Science – I	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

To present the ideas of qualities, fundamental abilities and business correspondence.

• To tune in and talk during typical business exercises like meetings, gatherings, phone discussions and dealings.

• To compose business letters, messages, reports, articles and understand data on the Internet and other media.

• Enhance their relational abilities by familiarizing with the 2 significant parts of correspondence and assisting them with defeating from stage dread.

UNIT I	INTRODUCTION OF LIFE SKILLS	9

Values – Self exploration – Values of individuals: Presentation on favorite personality and the skills and values they demonstrate – interviewing a maid, watchman, sweeper, cab driver, beggar and narrate what you think are the values that drive them –
Writing: newspaper report on an IPL match – record conversation between a celebrity and an interviewer.

UNIT II	FUNDAMENTALS OF GRAMMAR	9

Grammar -Tenses – Verbs – Helpings verbs – Subject-verb agreement – Articles – Prepositions – Conjunctions – Adjectives – Adverbs – Voice – Parts of Sentence – Identification of errors –
Effective Communication - Types of Communication (Verbal, Written & Non-verbal Communication) –Tips to develop communication skills – Principles of Listening – The Process of Listening – Types of Listening.
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UNIT III	COMMUNICATING FORMAL RELATIONS IN WITING	9

Writing - Letter Writing -Formal and Informal letter writing, application letters, Report writing academic and business report, Job application letter,Writing a Proposal

UNIT IV	CREATIVE WRITING	9

Reading - Reading articles – Paragraph writing, Summary writing, story writing - writing your comprehensive CV - Create a podcast on a topic

UNIT V	SOFT SKILLS	9

Interpersonal skills - Self - Assessment, Self - Appraisal, Team work, Team effectiveness, Group discussion, Decision making - Team Communication. Team, Conflict Resolution, Team Goal Setting, Team Motivation Understanding Team Development, Team Problem Solving, Positive Attitude, Values and Belief Systems, Self-Esteem, Self - appraisal, Personal Goal setting, Career Planning, Personal success factors, Handling failure, Depression and Habit, relating SWOT analysis & goal setting, and prioritization

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

- Recognize the requirement for fundamental abilities and qualities
- Use jargon successfully to introduce their thoughts.
- Accomplish verbal and composed correspondences.

- Write successfully in a wide scope of formal letters.
- Prepare Business Proposals and Business Reports for different business purposes.
- Apply Life abilities for accomplishing miles stones..

TEXT BOOK:

1. Ms.Meenakshi Raman, Prakash singh: *Business Communication*, Published by Oxford Higher Education/Oxford University Press, 2012ISBN 10: 019807705X / ISBN 13: 9780198077053.

REFERENCE BOOKS:

1. Randolph Hudson. H &Bernard Selzler.J. Business Communication, JaicoPublishing House,2006
2. Michael McCarthy, Felicity O'Dell, English Collocations in Use,Noida, Cambridge University Press,2006.
3. Allan Pease, Body Language, New Delhi,Sudha Publications(P) Ltd,2005.
4. Malcolm Goodale, Professional Presentations, New Delhi,Cambridge University Press,2006.

21UMA103	PROBABILITY AND INFERENTIAL STATISTICAL TECHNIQUES	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To make the student acquire sound knowledge of random variables emerge in real life problems and its standard distributions that can describe real life phenomena.
- Analyze the various data by different statistical sampling techniques.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.
- To make the student to understand the fundamentals relation between probability and statistics which will greatly help at data analysis and interpretation.

UNIT I	PROBABILITY AND RANDOM VARIABLE	9 Hrs

Probability: Concepts of experiments, Sample space, event - Combinatorial probability - Conditional probability – Baye's theorem. Random variable: Probability mass function - Probability density function - Properties – Mathematical expectation and its properties-Moments and its properties - Moment generating functions.

UNIT II	PROBABILITY DISTRIBUTIONS	9 Hrs

Discrete Probability distributions: Binomial distribution -Poisson distribution - Geometric distribution. Continuous Probability distributions: Uniform distribution - Exponential distribution - Gamma distribution - Normal distribution.

UNIT III	TWO DIMENSIONAL RANDOM VARIABLES	9 Hrs

Joint Distribution - Discrete and continuous distributions - Marginal and Conditional Distributions – Correlation – Rank correlation - Linear Regression

UNIT IV	INTRODUCTION TO STATISTICS	9 Hrs

Definition of Statistics - Basic Objectives - Collection of Data - Population - Sample - Representative Sample – Classification and Tabulation of Univariate data - Graphical representation - Frequency curves - Central tendency and Dispersion - Applications

UNIT V	TESTING OF HYPOTHESIS	9 Hrs

Sampling - Large sample test: Tests for Single mean- Test for difference between two means. Small sample test: Tests for mean (t test), F- test - Chi-square test for Goodness of fit and Independence of attributes.

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

SUPPLEMENT TOPIC (for internal evaluation only-)

3

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

COURSE OUTCOMES:

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

- Apply the knowledge of probability in Bayes theorem and Mathematical expectation for one dimensional random variables.(CO1) AP-K3
- Apply the acquired knowledge of standard Distribution in real life phenomena.(CO2) AP – K3
- Analyze the various collection of data by methods of Correlation and regression.(CO3) A – K4
- Apply concept of statistics through various representation of datas. (CO4) AP-K3
- Analyze the various collections of data in science / engineering problems using statistical inference techniques.(CO5) A – K4
- Understand the basic concept of probability , Random Variable and statistics .(CO6) U-K2

TEXT BOOKS:

1. S. M. Ross, "Introduction of Probability Models", Academic Press, Springer Publication, 2000.
2. GREWAL B.S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 42nd Edition, (2012).
3. GUPTA S.C, KAPOOR V.K. "Fundamental of Mathematical Statistics" 10th Edition, Sultan Chand and Sons, New Delhi 2002.

REFERENCE BOOKS:

1. SHARMA J.N , GOEL J.K " Mathematical statistics", 7th Edition, Krishna Prakasham Mandis, Mearut, (1998).
2. WALPOLE. R.E., MYERS .R.H., MYERS S.L., and YE. K, "Probability and Statistics for Engineers and Scientists", Pearson Education, New Delhi, 8th edition, (2007).
3. SPIEGEL M.R., SCHILLER J. and SRINIVASAN R.A., "Schaum's Outlines Probability and Statistics", Tata McGraw Hill, New Delhi, (2004).
4. JOHNSON R.A, and GUPTA C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, New Delhi, 8th Edition, (2011).
5. A.M. Mood, F.A. Graybill and D.C. Boes, ¯Introduction to the Theory of Statistics‖, 3rd edition, McGraw Hill Education, (2010).

21UMA104	DISCRETE STRUCTURE AND ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To make the student acquire sound knowledge to test the logic of program.
- To familiarize the student to be aware of generating functions.
- Apply the different differential and integral techniques in solving the real time engineering problems.

UNIT I	BOOLEAN ALGEBRA	9 **Hrs**

Propositional Logic – Propositional equivalences - Predicates and quantifiers – Nested Quantifiers - Rules of inference - Introduction to Proofs - basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map..

UNIT II	COMBINATORICS	9 **Hrs**

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 **Hrs**

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

UNIT IV	CALCULUS	9 **Hrs**

Limits of functions -Continuity -Derivatives: Derivatives -Differentiability - Rules - Properties - Differentiation of transcendental functions - Higher order derivatives - Implicit differentiation - Integration: Anti-derivatives – Riemann sum -Indefinite and Definite integration - Mean value theorem for definite integral - Fundamental theorem of calculus.

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UNIT V	MULTIPLE INTEGRALS	9 **Hrs**

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.

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 differentiation techniques to predict the extreme values of the Engineering problems with constraints . (CO4) AP – K3
- Apply the concept of Multiple integrals to compute the graphical representation in Engineering problems (CO5) AP – K3
- Explain the knowledge of principle of counting , integration and differentiation.(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).

Course Code	Course Title	L	T	P	C
21UPH103	PHYSICS FOR COMPUTING SCIENCE	3	0	0	3

OBJECTIVES:

- 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 STRUCTURE	9

Introduction –Classification of solids–Space lattice–Basis-Lattice parameter–Unit cell –Crystal system –Miller indices – 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 .

UNIT – II	LIGHT	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.

UNIT – III	PHOTONICS	9

Introduction-Principles of Layer- Characteristic of layer-Spontaneous and Stimulated emission-Population inversion- Einstein‘s A and B coefficients-pumping methods-Basic components of Layer-Types of Layers- Nd YAG laser-CO2 laser-Holography-Construction and deconstruction of hologram- Industrial and Medical Application.

UNIT – IV	INTRODUCTION TO QUANTUM MECHANICS	9

Introduction - Blackbody radiation – Planck‘s law of radiation-Wien‘s displacement law-Rayleigh Jeans law- –Compton Effect – Theory and experimental verification – Matter waves – Schrodinger‘s wave equation – Time dependent – Time independent equation – Scanning electrons microscope-Transmission electron microscope.

UNIT – V	PROPERTIES OF SOLIDS	9

Introduction- Elasticity-stress and Strain-Hooke‘s law- Three moduli of elasticity stress- Strain curve- Poisson‘s ratio-Factors affecting elasticity- Bending moment- Depression of a cantilever-Young‘s modulus by uniform bending –I shaped girders.

TOTAL: 45 PERIODS

Course Outcomes:

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

- Apply the crystal growth Techniques
- Acquire Knowledge about laser.
- Summaries the principles of Quantum concepts.
- Analyze the nature of materials

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, NewDelhi, RevisedEdition2018.
3. Palanisami P.K., ‒Physics For Engineers‖, Scitech Publications (India), PvtLtd., Chennai, 2018.

21UEE125	PRINCIPLES OF ELECTRICAL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce electric circuits and provide knowledge on the analysis of circuits using network theorems.
- To impart knowledge on the phenomenon of resonance in series and parallel circuits and also to obtain
- The transient response of RC, RL and RLC circuits.
- To provide knowledge on the principles of electrostatics and electromechanical energy conversion devices.
- To learn the electrical measurement concepts and energy saving methods by different ways of illumination.

UNIT I	INTRODUCTION	9**Hrs**

Concept of potential difference, voltage, current, Fundamental linear passive and active elements to their functional current-voltage relation, Terminology and symbols in order to describe electric networks, voltage source and current sources, ideal and practical sources, concept of dependent and independent sources, Kirchhoff-s laws and applications to network solutions using mesh and nodal analysis, Concept of work, power, energy, and conversion of energy.

UNIT II	DC CIRCUITS	9**Hrs**

Simplifications of networks using series- parallel, Star/Delta transformation. Superposition theorem, Thevenin_ s theorem, Norton_ s Theorem, Maximum Power Transfer theorem.

UNIT III	AC CIRCUITS	9**Hrs**

AC waveform definitions, Average value, RMS value, form factor, peak factor, study of RL series circuit, RC series circuit,RLC series and parallel circuit, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3 phase Balanced AC Circuits.

UNIT IV	PRINCIPLE OF ELECTROSTATICS	9**Hrs**

Electrostatic field, electric field intensity, electric field strength, concept of permittivity in dielectrics, capacitor composite, dielectric capacitors, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors.

UNIT V	MEASUREMENTS AND SENSORS	9**Hrs**

Introduction to measuring devices/sensors and transducers (Piezoelectric and thermo-couple) related to electrical signals, Elementary methods for the measurement of electrical quantities in DC and AC systems (Current & Single-phase power). Electrical Wiring and Illumination system: Basic layout of the distribution system, Types of Wiring System &Wiring Accessories, Necessity of earthing, Types of earthing, Safety devices & system..

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TOTAL:

45 Periods

COURSEOUTCOMES:

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

- Analyze DC and AC circuits and apply circuit theorems. [Analyze]
- Realize series and parallel resonant circuits. [Apply]
- Evaluate power in three phase AC circuits. [Evaluate]
- Understand the principles of electrostatics and electromechanical energy conversion devices.

TEXTBOOKS:

- B.L.Theraja, ― A Textbook of Electrical Technology‖ , Vol. I Basic Electrical Engineering, S. Chand and Company Ltd., New Delhi.
- R.Muthusubramanian, S.Salivahanan, ― Basic Electrical and Electronics Engineering‖ , Tata McGraw Hill Publishers, Edition 1, 2010.
- H.Partab, ― Art and Science of Utilization of Electrical Energy‖ , DhanpatRai and Co., New Delhi, 2004.

REFERENCES:

1. A.E. Fitzgerald, KingselyJr Charles, D. Umans Stephen, ― Electric Machinery‖ , Sixth Edition Tata McGraw Hill.
2. V.K. Mehta, ― Basic Electrical Engineering‖ , S. Chand and Company Ltd., New Delhi.
3. J. Nagrath and Kothari, ― Theory and problems of Basic Electrical Engineering‖ , Second Edition Prentice Hall of India Pvt. Ltd.
4. Edward Hughes, ― Electrical Technology‖ , Tenth Edition, Pearson Education Publication.
5. Vincent. Del. Toro, ― Electrical Engineering Fundamentals‖ , Second Edition, Prentice Hall, India.

21UCS107	PROBLEM SOLVING AND C PROGRAMMING (Common to ALL Branches)	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	8

Generation and Classification of Computers - Basic Organization of a Computer – Problem formulation – Problem Solving - Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

UNIT II	C PROGRAMMING BASICS	9

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 III	DECISION MAKING AND LOOPING STATEMENTS	10

if - if-else - nested if-else – else-if ladder statement – switch – goto – for- while – do-while – break – continue statements – Problem solving with decision making and looping statements.

UNIT IV	ARRAYS, STRINGS AND FUNCTIONS	9

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays - String - String operations – string arrays - Function – definition of function – Declaration of function – Parameter passing methods – Recursion - Storage classes – Problem solving with arrays, strings and functions.

UNIT V	POINTERS, STRUCTURES AND UNIONS	9

Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays - Dynamic Memory allocation – Structure - need for structure data type – structure definition – Structure declaration - Structure within a structure - Union - Pre-processor directives.

TOTAL: 45Periods

COURSE OUTCOMES:

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

- Apply the knowledge of arithmetic & sequential logic to solve problems related to mathematical expressions. (Apply)
- Analyze and identify suitable control constructs to provide solutions to computer applied complex engineering problems. (Evaluate)
- Apply the concept of pointers to solve complex engineering problems.(Apply)

- Formulate problems to provide solutions to computer applied complex engineering problems using modularity.(Analyze)
- Apply the knowledge of permanent storage of data to solve computer applied complex engineering problems. (Apply)
- Design solutions for computer applied complex engineering problems that meet specified needs.(Create)

TEXT BOOKS :

1. Balagurusamy, E, “Programming in Ansi C”,Eigthh 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.

21UCS111	Problem Solving and C programming Laboratory (Common to ALL Branches)	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)
- **Problems involve arithmetic computations and sequential logic**
  1. Write a program to calculate the slope of a line.
  2. Write a program to convert polar coordinates to Cartesian coordinates
  3. A cylindrical can with radius of 10cm and height of 20cm is packed in a rectangular box with length, width, and height as 20cm. What is the volume of empty space between the can and the box? Write a simple C program to implement the above scenario.
  4. Write a C program to evaluate the net salary of an employee given the following
     Constraints:
     DA : 12% of Basic salary
     HRA : 20% of Basic salary
     TA : 15% of Basic salary
     Tax cuts – a) PF :14% of Basic salary and b) IT: 15% of Basic salary Net
     Salary = Basic Salary + DA + HRA + TA- (PF + IT)

  Problems involve decision making

  5. Design a calculator to perform the arithmetic operations.
  6. Develop a program in C to calculate and print the Electricity bill of a given customer. The customer id., name and unit consumed by the user should be taken from the keyboard and display the total amount to be paid by the customer.

Unit	Charge/unit
upto 199	@1.20
200 and above but less than 400	@1.50
400 and above but less than 600	@1.80
600 and above	@2.00

     If bill exceeds Rs. 400 then a surcharge of 15% of bill amount will be charg d and the minimum bill should be of Rs. 100/-

  7. A weather forecasting agency would like to intimate the people about the current temperature with the proper climatic message. Develop a C program to read temperature in centigrade and display a suitable message according to temperature state below :
     Temp < 0 then Freezing weather
     Temp 0-10 then Very Cold weather
     Temp 10-20 then Cold weather
     Temp 20-30 then Normal in Temp
     Temp 30-40 then Its Hot
     Temp >=40 then Its Very Hot
- **Problems involve iterations**
  8. 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.

Write a C program to help the manager to run the “Fortune Teller Machine” perfectly.

- **Problems involve 1D arrays**

9. Given an array of integers, compute the maximum value for each integer in the index, by either summing all the digits or multiplying all the digits. (Choose which operation gives the maximum value)

   Input:5120 24 71 10 59Output:3 8 8 1 45

10. Given below is the list of marks obtained by a class of 20 students in an annual examination.

    43 65 7 24 87 90 19 39 58 75 67 87 90 92 14 78 82 99 56 89

    Write a program to count the number of students belonging to each of following groups of marks: 0-9,10-19,20-29,… ..... ,100.

- **Problems involve 2D arrays**

11. Write a C program to input a set of integer numbers, count and sum the positive numbers and the negative numbers then print the count and sum of all positive numbers and negative numbers.

- **Problems involve structures**

12. A librarian wishes to maintain the details of the books such as bookid, bookname, authorname, yearofpublish, price. And he can do the following operations:
    a. He can retrieve the specific book details by giving bookid as an input.
    b. He can retrieve all the book details of specific author.
    c. He can retrieve all the book details by giving year of publish as an input.

    Develop a C program to accomplish the librarian tasks.

- **Problems involve functions**

13. As a Developer, you are designated to develop a simple ATM application which does the following operations:

a. Customer can deposit the amount.
b. Customer can withdraw the amount after checking the minimum balance of Rs. 2,000.
c. Customer can know the balance amount.

Write a C program to implement the ATM application.

- **Problems involve recursive functions**

14. Maisy is working the counter at Shmaskin Robbins. A hungry customer orders a triple scoop ice cream cone with strawberry, chocolate, and vanilla ice cream.How many different ways could she stack the ice cream flavors on top of each other? Write a program to implement the above scenario using recursive functions.

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)
- Provide modular solution to complex problems to reduce redundancy and to improve code reuse.(Apply)
- Access data stored in secondary storage in sequential and random manner.(Apply)
- Design solutions for computer applied complex engineering problems that meet specified needs. (Create)

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

HARDWARE

LAN SYSTEM WITH 30 NODES (OR) STANDALONE PCS – 30 NOS

SOFTWARE

OS – UNIX CLONE (LICENSE FREE LINUX)

COMPILER – C

SEMESTER II

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UEN202	Business Communication and Value Science – II	2	0	0	2	Humanities and Social Science
R21UMA208	Linear Algebra and Numerical Techniques	3	1	0	4	Basic Science
R21UMA209	Statistical Methods	3	1	0	4	Basic Science
R21UEC225	Principles of Electronics Engineering	3	0	0	3	Engineering Science
R21UCB205	Algorithms and Data Structures	3	0	0	3	Professional Core
R21UCB206	Introduction to Economics	2	0	0	2	Engineering Science
PRACTICAL						
R21UEC226	Electronics Engineering Laboratory	0	0	2	1	Basic Science
R21UCB211	Algorithms and Data Structures Laboratory	0	0	2	1	Professional Core
MANDATORY						
R21UGT241	Tamil and Technology	1	0	0	1	Mandatory Course
R21UAC231	Biology for Engineers (Common to all except BME, BT)	2	0	0	P/F	Audit Course
	TOTAL	**19**	**2**	**4**	**21**	
Total No of Credits - 21						

II Semester

21UEN202	**Business Communication & Value Science – II**	**L**	**T**	**P**	**C**
		2	0	0	2

COURSE OBJECTIVES:

- **To recognize the right tense structure in the sentence**
- **To make an introduction of English in different Business roads.**
- **Apply Creative deduction for communicating their imaginative thoughts.**

Understand the workplace for their effective profession

UNIT I	**BASICS OF WRITING SKILLS**	9 **Hrs**

Grammar- Application of tenses,**Vocabulary** - Job title and describing jobs; **Listening** - Listening to company culture;
Reading - Quiz; **Writing** - Writing formal and semi formal business letters; Email writing- Formal and Informal, email writing structure,Skimming and Scanning -Application of reading and writing skills

UNIT II	**VOCABULARY ENRICHMENT**	9 **Hrs**

Vocabulary–Collocations,Jargons related to Shares and stock**,** Words related to finance,Words related to employment.**Writing** – Memo
Speaking - Role play on various business situation.
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UNIT III	**INTRODUCTION OF PUBLIC SPEAKING**	9 **Hrs**

Public Speaking: Basics of effective public speaking, types- Extempore speech, manuscript speech, and ways to enhance public speaking skills, storytelling, oral review. **Presentation Skills:** PowerPoint presentations, Effective ways to structure the presentation, importance of body language. **Leadership skills and Requirements of the Skill:** Understanding good Leadership behaviours, Learning the difference between Leadership andManagement, interpersonal Skills and
Problem Solving Skill: Problem solving skill, Confidence building

UNIT IV	**EXPRESSIONS**	9 **Hrs**

Company culture –Dress code, interacting with Co-workers, Telephone Etiquettes,Understand the importance of professionalbehaviour at the work place, Empathy, Importance of the first impression
Listening-Listening to audio and video speech of business people

UNIT V	**PROFESSIONAL ETHICS**	9 **Hrs**

Working Environment –Cultural issues at the workplace, caste, religion, language issues class, regionalism, religion and poverty: the different identities of IndianEmployees and employers and how to include everyone
Professional Ethics - Truthfulness and confidentiality, Autonomy and informed consent, Beneficence, Nonmaleficence, Justice.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

- **Comprehend the right utilization of tense in the sentence**
- **Make an introduction of English in different Business roads.**
- **Apply relational abilities to be a decent pioneer.**
- **Apply Creative deduction for communicating their inventive thoughts.**
- **Get an all encompassing vision and development to turn into an incorporated character.**

TEXT BOOK:

1.Ms.MeenakshiRaman,Prakashsingh: *BusinessCommunication*, Published by Oxford Higher Education/Oxford University Press, 2012ISBN 10: 019807705X / ISBN 13: 9780198077053.

Reference(s)

1. Business Communication Today by Bovee, Thill, Raina
2. APAART: Speak Well 1 (English Language and Communication)
3. APAART: Speak Well 2 (Soft Skills)
4. Strategic Communication by Charles Marsh
5. English vocabulary in use Alan Mccarthy and Odell
6. Business Communication Dr. SarojHiremath

21UMA208	LINEAR ALGEBRA AND NUMERICAL TECHNIQUES	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- Understand the basic concepts of matrices and their Eigen values and Eigen vectors to solve the system of equations.
- 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.
- To apply the general theory of Mathematical systems involving addition and scalar multiplication of vectors has applications in all Engineering field

To apply the concept of Inner product space in orthogonalization.

UNIT I	MATRICES	9 Hrs
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	**MATRIX DECOMPOSITION**	9 **Hrs**
Positive definite matrix -Gauss Elimination method - Gauss Jordan method - LU decomposition - Singular value decomposition		
UNIT III	**NUMERICAL SOLUTIONS AND INTERPOLATION TECHNIQUES**	9 **Hrs**
Newton – Raphson method – Gauss Seidel method – Eigen values of a matrix by Power method – Lagrange's interpolation – Newton's divided difference interpolation – Newton's forward and backward difference interpolation.		
UNIT IV	**VECTOR SPACES**	9 **Hrs**
Linear dependence of vectors, basis, dimension, linear transformations (maps), range and kernel of a linear map, rank and nullity inverse of a linear transformation rank nullity theorem		
UNIT V	**INNER PRODUCT SPACE**	9 **Hrs**
Inner product space, Norm of a vector matrix vector, Orthogonally of vectors - Projections - Gram-Schmidt orthogonalization – QR decomposition.		
		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
- Apply the various numerical techniques in solving the system of linear equations including LU and singular value decomposition. (CO2) AP – K3

- Apply numerical techniques to solve linear and nonlinear equations, interpolation and error approximation in various intervals in Engineering problems. (CO3) AP – K3
- Apply the knowledge of structures and principles of vector space to solve engineering problems.(CO4) AP – K3
- Apply the knowledge of inner product and determine orthogonality on vector spaces and QR decomposition.(CO5) AP – K3
- Explain the knowledge of properties of eigen values, basis and norm of a vector. (CO6) U-K2

TEXT BOOKS:

- VEERARAJAN.T "Engineering Mathematics" Tata McGraw Hill Publishing Company, New Delhi, 2008.
- GREWAL B.S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 42nd Edition, (2012).
- KANDASAMY.P, THILAGAVATHY.K, and GUNAVATHY.K, Numerical Methods, S.Chand & Company Ltd., New Delhi, 2rd Edition, (2012).
- DAVID, C., LAY, "Linear Algebra and its applications" 4th Edition Published by Addison Wesley / Pearson, 2011.

REFERENCE BOOKS:

- Michael. D. Greenberg, "Advanced Engineering Mathematics", Second Edition, Pearson, 2002.
- Gilbert Strang, "Introduction to linear algebra", Fifth Edition, ANE Books, 2016..
- David C. Lay, "Linear Algebra and its applications" 3rd Edition updated Pearson Education, (2005).
- RAMANA.B.V, "Higher Engineering Mathematics" Tata McGraw Hill, New Delhi, 11th Reprint (2010).

Peter, D. Lax, "Linear Algebra and its applications" 2nd Edition Wiley-Interscience Publication, (2007).

21UMA209	STATISTICAL METHODS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- The main objective of this course is to provide students with the foundations of statistical and probabilistic analysis mostly used in various applications in engineering.
- To understand the fundamental concepts of estimation methods.
- To understand the fundamental concepts of programming in R.

UNIT I	DESIGN OF EXPERIMENTS	9 **Hrs**

Completely randomized design – Randomized block design – Latin square design.

UNIT II	ESTIMATION	9 **Hrs**

Point estimation - criteria for good estimates (Un-biasedness & Consistency) - Methods of estimation including maximum likelihood estimation. Sufficient Statistic: Concept & examples - Complete sufficiency - Application in estimation

UNIT III	NON - PARAMETRIC INFERENCE	9 **Hrs**

Comparison with parametric inference - Use of order statistics - Sign test - Wilcoxon signed rank test – Mann – Whitney test - Run test - Kolmogorov-Smirnov test - Spearman's and Kendall's test.

UNIT IV	TIME SERIES ANALYSIS	9 **Hrs**

Basics of Time Series Analysis - Forecasting – Stationary – ARIMA Models: Identification - Estimation – Forecasting.

UNIT V	R PROGRAMMING	9 **Hrs**

Introduction to R - Functions - Control flow and Loops - Working with Vectors and Matrices - Reading in Data – Writing Data – Working with Data – Manipulating Data – Simulation – Linear model – Data Frame - Graphics in R.

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

COURSE OUTCOMES:

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

- Analyse a process, to find its significance using design of experiments.(CO1) A – K4
- Apply the knowledge of Statistical Inference and Estimation methods. (CO2). AP – K3
- Apply the knowledge of non-parametric hypothesis testing procedures based on inferences.(CO3) AP – K3
- Apply the knowledge of time series analysis problems to predict the trend for the moving data.(CO4) AP – K3

- Apply the knowledge of R language fundamentals and how it is used to perform data analysis, correlated datas and data visualization. (CO5). AP – K3
- Understand the knowledge of statistical and probabilistic analysis .(CO6) U-K2

TEXT BOOKS:

- R. Miller, J.E. Freund and R. Johnson, "Probability and Statistics for Engineers", Fourth Edition, Pearson, 2015.
- A. Goon, M. Gupta and B.Dasgupta, "Fundamentals of Statistics (Vol. II)", The Word Press, 1933.
- Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Second Edition, Addison-Wesley Professional, 2017.

REFERENCE BOOKS:

- A.M. Mood, F.A. Graybill & D.C. Boes, "Introduction to the Theory of Statistics - ‖ ", 3rd edition, McGraw Hill.
- D.C. Montgomery and E. Peck, "Introduction to Linear Regression Analysis", Third Edition, Wiley, 2010.
- Garrett Grolemund, "Hands-on Programming with R", Shroff Publishers & Distributors Pvt Ltd, 2018.
- N. Draper & H. Smith, "Applied Regression Analysis‖, 3rd edition, Wiley.

Chris Chatfield, "The Analysis of Time Series: An Introduction‖, 6th edition, Chapman and Hall/CRC.

21UEC225	PRINCIPLES OF ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To explain the operation of semiconductor diodes and their characteristics.
- To enable the student to understand the construction ,operation and charactristics BJT,FET and MOSFET.
- To enable the students to understand the fundamentals of digital circuits.

UNIT I	SEMICONDUCTORS	9Hrs

Conductors, Semiconductors & Insulators: electrical properties, band diagrams. Semiconductors: intrinsic & extrinsic, energy band diagram, P&N-type semiconductors, drift & diffusion carriers. Diodes and Diode Circuits: Formation of P-N junction, forward and reverse biased P-N junction, V-I characteristics, Zener breakdown, Avalanche breakdown and its reverse characteristics, Rectifier circuits: half wave, full wave, PIV, DC voltage and current, ripple factor, efficiency.

UNIT II	BIPOLAR JUNCTION TRANSISTORS	9Hrs

Formation of PNP / NPN junctions; transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics: cut-off active and saturation mode, transistor action, injection efficiency, current amplification factors for CB and CE modes

UNIT III	FIELD EFFECT TRANSISTORS	9Hrs

Concept of Field Effect Transistors (channel width modulation), Gate isolation types, JFET Structure and characteristics, MOSFET Structure and characteristics, depletion and enhancement type; CS, CG, CD configurations; CMOS: Basic Principles.

UNIT IV	DIGITAL COMBINATIONAL CIRCUITS	9Hrs

Number systems, Boolean algebra, Basic and Universal Gates, Half adder – Full Adder – Half subtractor – Full subtractor - Parallel binary adder, parallel binary Subtractor – Fast Adder - Carry Look Ahead adder , Multiplexer/Demultiplexer, code converters.

UNIT V	DIGITAL SEQUENTIAL CIRCUITS	9Hrs

Latches, Flip-flops: SR, JK, D, T, and Master-Slave, Asynchronous Ripple or serial counter, Asynchronous Up/Down counter, Synchronous counters, Synchronous Up/Down counters, shift registers and its types. T**OTAL: 45 Periods**

OURSE OUTCOMES

After completion, the student will be able to

CO 1	Describe the fundamental concept of various electronic Devices. (Understand)
CO 2	Describe the functions of the various building blocks of digital circuits.(Understand)
CO 3	Apply the concepts of semiconductor devices to design electronic circuits.(Apply)
CO 4	Apply the knowledge of logic gates to design digital circuits.(Apply)
CO 5	Analyze different logics to identify suitable logic circuits for various applications.(Analyze)
CO 6	Analyze the various parameters of diodes and transistors for suitable application.(Analyze)

TEXT BOOKS:

- Salivahanan S., Suresh kumar N. and Vallavanraj A., "Electronic Devices and Circuits",Tata McGraw Hill., 4th Edition, 2017.
- M. Morris Mano, Digital Logic & Computer Design,. Pearson Education.

REFERENCE BOOKS :

1. Robert T. Paynter, "Introducing Electronics Devices and Circuits", Pearson Education, Seventh Edition, 2010.
2. Millman J. &Halkins and Satyebranta Jit, "Electronic Devices &Circuits", Tata Mc- Graw Hill, Second Edition, 2008.
3. Mandal, "Digital Electronics Principles & Application, McGraw Hill Edu, 2013.
   D.P.Kothari,J.S.Dhillon, „Digital circuits and Design",Pearson Education, 2016

21UCB205	ALGORITHMS AND DATA STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

- To impart the knowledge on algorithm add data structures for solving a problem
- To learn various searching and sorting techniques.

UNIT I	BASIC TERMINOLOGIES & INTRODUCTION TO ALGORITHM AND DATA ORGANISATION	9

Algorithm specification- Recursion- Performance analysis- Asymptotic Notation –The Big-O-Omega and Theta notation, Programming Style, Refinement of Coding - Time-Space Trade Off, Testing-Data Abstraction.

UNIT II	LINEAR DATA STRUCTURES	9

Array- Linked-list and its types- Various Representations- singly linked lists –-doubly- linked lists- circularly linked lists- Stack- Queue – Operations & Applications of Linear Data Structures.

UNIT III	NON LINEAR DATASTRUCTURES –TREES	9

Tree ADT – tree traversals – Binary Tree ADT – expression trees – applications of trees – binary search Tree ADT–Threaded Binary Trees-AVLTrees–B-Tree-B+Tree–Heap–Applications.

UNIT IV	NON LINEAR DATA STRUCTURES – GRAPHS	9

Definition–Representation of Graph–Types of graph–Breadth-first traversal–Depth-first traversal– Topological Sort – Bi-connectivity – Euler circuits – Dijkstra's Single sourceshortest Path Problem–Minimum Spanning Trees-Applications of graphs.

UNIT V	SEARCHING,SORTING AND HASHING ON VARIOUS DATA STRUCTURES	9

Searching- Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertionsort – Shellsort–Radixsort.Hashing-Hash Functions–Separate Chaining–Open Addressing Rehashing Extendible Hashing. File:Organization(Sequential,Direct,Indexed Sequential,Hashed)and various types of accessing schemes.

.**TOTAL:45 Periods**

COURSE OUTCOMES:

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

- Understand the Fundamental concepts of data structures and Applications **[Understand]**
- Apply the concepts of Linear and non-linear data structures to solve Computational Problems**[Apply]**
- Analyze different Concepts in data structures to solve real world Problem**.[Analyze]**
- Design and develop efficient linear, non-linear, sorting, searching and hashing data structure algorithms to solve problems**[Design]**
- Evaluate the problems and find solutions using linear, non-linear applications, searching, sorting and hashing algorithms**. [Evaluate]**
- Select and apply appropriate data structures to design algorithm using modern tool [**Affective Domain**]

TEXT BOOKS:

1. Mark Allen Weiss,"Data Structures and Algorithm Analysis in C", 2nd Editin,PearsonEducation,2011.
2. Charles E.Leiserson,Thomas H.Cormen,Ronald L.Rivest,CliffordStein,Introduction toAlgorithms,Third edition HI,2010.

REFERENCE BOOKS:

1. Donald E.Knuth,The Art of Computer Programming:Volume1:Fundamental Algorithms,Donald E.Knuth,3rdedition,Pearson Education.
2. Seymour Lipschutz,―Data Structures with C‖,McGraw Hill Education,Special IndianEdition, 2014.
3. Alfred V.Aho,JohnE.Hopperoft,JeffreyD.UIlman,Data Structures and Algorithms,PearsonEducation,2002.
4. PatMorin,Open Data Structures:An Introduction(Open Paths to Enriched Learning),31sted.Edition,AU Press,2013.

21UCB206	INTRODUCTION OF ECONOMICS	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES :

- To impart the knowledge of micro economics that deals with the study of economic decision making by individuals and individual firms.
- To Acquire the knowledge of the economic behavior of firms operating in perfect and imperfect competition.
- To know the various concepts in macroeconomics that deals with the performance and behaviour of an economy.
- To study the role of money and credit creation by banks in the economic development of anation.

UNIT I	INTRODUCTION TO MICROECONOMICS	6

Principles of Demand and Supply - Supply Curves of Firms - Elasticity of Supply; Demand Curves of Households - Elasticity of Demand; Equilibrium and Comparative Statics (Shift of a Curve and Movement along the Curve)

UNIT II	WELFARE ECONOMICS	6

Consumers and Producers Surplus- Price Ceilings and Price Floors; Consumer Behaviour – Axioms of Choice-Budget Constraints and Indifference Curves; Consumers Equilibrium Effects of a Price Change, Income and Substitution Effects Derivation of a Demand Curve-Applications.

UNIT III	BOUNDLESS ECONOMICS	6

Tax and Subsidies - Inter temporal Consumption -Suppliers- Income Effect; Theory of Production - Production Function and Isoquants - Cost Minimization; Cost Curves - Total, Average and Marginal Costs - Long Run and Short Run Costs; Equilibrium of a Firm Under Perfect Competition; Monopoly
and Monopolistic Competition

UNIT IV	INTRODUCTION TO MACRO ECONOMICS	6

National Income and its Components - GNP, NNP, GDP, NDP Consumption Function; Investment; Simple Keynesian Model of Income Determination and the Keynesian Multiplier; Government Sector-Taxes and Subsidies; External Sector - Exports and Imports.

UNIT V	MONETARY POLICY	6

Money -Definitions; Demand for Money Transaction and Speculative Demand; Supply of Money - Banks Credit Creation Multiplier; Integrating Money and Commodity Markets - IS, LM Model, Monetary and Fiscal Policy - Central Bank and the Government; the Classical Paradigm - Price and Wage Rigidities - Voluntary and Involuntary Unemployment

TOTAL:30 Periods

COURSE OUTCOMES:

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

1. Understand the basic principle and concepts of micro economics for economic decision making.**(Understand)**
2. Select the appropriate microeconomic demand-supply concepts to solve the business problems.**(Apply)**
3. Analyze a strategy that measure, critique and interpret consumer_s behavior in decision making.**(Analyze)**
4. Examine the banking and central bank_s monetary policy concepts in economic development of a nation**. (Evaluate)**
5.Ability to apply the concepts of financial management for project appraisal **(Affective Domain)**

TEXT BOOKS:

1. Pindyck, Robert S and Daniel L. Rubinfeld , Microeconomics, Eighth Edition, 2015
2. Dornbusch, Fischer and Startz, Macroeconomics, Tenth Edition, Tata Mcgraw Hill, 2012.
3. Paul Anthony Samuelson, William D. Nordhaus, Economics, Nineteenth Edition, McGraw-Hill Education, 2010.

REFERENCE BOOKS:

1. Hal R, Varia, Intermediate Microeconomics: A Modern Approach, Eighth Edition Affiliated East-West Press, 2006
2. N. Gregory Mankiw, Principles of Macroeconomics, SeventhEdition, Cengage Learning, 2018.

WEB REFERENCES:

1. https://data.oecd.org/economy.htm
2. https://www.focus-economics.com
3. https://www.rbi.org.in

21UCB211	ALGORITHMS & DATA STRUCTURES LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

To implement various Data structures and Algorithms.

LIST OF EXPERIMENTS:

1. Implementation of Array – Insertion, Deletion.2.Implementation of Singly Linked List
3.Implementation of Doubly linked List
4.Implementation of Stack and its Applications
5.Implementation of Queue
6.Implementation of Circular Queue
7.Implementation of Tree Traversals
8.Implementation of Binary search tree
9 .Implementation of AVL Trees
10.Implementation of Topological sort
11.Implementation of Minimal Spanning Tree
12.Implementation of Shortest path Algorithm
13.Implementation of Bubble Sort, Insertion sort
14.Implementationof Breadth First Traversal and Depth First Traversal
15.Saving / retrieving non-linear data structure in/from a file

TOTAL:30 PERIODS

Course Outcome:

- Ability to understand a systematic approach to organizing, writing and debugging C Programs.[Apply]
- Ability to implement linear and non- linear data structure operation using C programs. [Apply]
- Ability to solve problems implementing appropriate data structure. [Apply]
- Ability to implement sorting and searching algorithms using relevant data structures. [Analysis]

SYLLABUS

21UEC226	ELECTRONICS ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVE

- To enable the students to identify the components and operation of semiconductor diodes and their characteristics.
- To enable the students to design digital logic circuits.
- To make the students to identify component for suitable application.

LIST OF EXPERIMENTS

1. Characteristics of PN Junction diode.
2. Half wave rectifier with capacitive filter.
3. Full wave rectifier with capacitive filter.
4. Characteristics of CB and CE Configuration.
5. Drain and transfer characteristics of JFET.
6. Study of logic gates.
7. Design and implementation of Adder and subtractor.
8. Design and implementation of Code Converter.
9. Design and implementation of Multiplexer and Demultiplexer.
10. Design and Implementation of Synchronous and Asynchronous counters.

TOTAL: 30 PERIODS

SEMESTER III

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UCB301	Formal Language and Automata Theory	3	1	0	4	Professional Core
R21UCB302	Computational Statistics	3	0	0	3	Professional Core
R21UCS303	Object Oriented Programming using C++(Common to CSE,IT,CSBS,CSD, CSE(AI&ML),IOT,CYBER SECURITY)	3	0	0	3	Professional Core
R21UCB304	Fundamental of Management	2	0	0	2	Professional Core
R21UCS305	Computer Organization (Common to CSE,IT,CSBS,AIDS, CSE(AI&ML), IOT,CYBER SECURITY)	3	0	0	3	Professional Core
PRACTICAL						
R21UCB307	Computational Statistics Laboratory	0	0	2	1	Professional Core
R21UCS308	Object Oriented Programming using C++(Common to CSE,IT,CSBS,CSD, CSE(AI&ML),IOT,CYBER SECURITY)	0	0	2	1	Professional Core
MANDATORY						
R21UGM231	Environmental Science (Common to ALL Branches)	2	0	0	P/F	Mandatory Course
	TOTAL	**16**	**1**	**4**	**17**	
Total No of Credits - 17						

R21UCB301	Formal Languages and Automata Theory	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

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– 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. Michael Sipser, –Introduction to the Theory and Computation‖, Cengage Learning India, 2012.

6. Peter Linz , –An introduction to formal languages and automata‖, Jones &Bartlett Learning, 2001.

21UCS303	OBJECT ORIENTED PROGRAMMING USING C++ (INTEGRATED COURSE)	L	T	P	C
		3	0	2	4

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 + 9**

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

List of Exercises

1. Write C++ programs that produce following outputs.
   A B C D E
   A B C D
   A B C
   A B
   A
2. An electricity board charges the following rates to domestic users to discourage large conceptions of energy.
   First 100 units Rs 1.50 p/unit
   From 100 to 200 units Rs 1.80 p/unit
   Beyond 200 Rs 2.50 p/unit
   All users are charged a minimum of Rs 50/-. If the total amount is more than 300 then an additional surcharge of 15% of the calculated amount is added. Write a c++ program to read the name of an user, number of units consumed and print out the Electricity bill in a neat format.
3. Write a C++ program using functions to perform matrix addition & subtraction.
4. Write a C++ program to find and print the volume of a cube using inline functions.

UNIT II CLASSES AND OBJECTS **9 + 6**

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.

List of Exercises

5. Define a class to represent a bank account. Include the following members. Data Members: Name of depositor, Account number, Type of Account, Balance amount in the account Member functions : To assign initial values, To deposit an amount, To withdraw an amount after checking the balance, To display name and balance.
6. Create a class complex with real and imaginary as data members. Also include member functions to get the values for a complex number, to add two complex number, to multiply two complex numbers, to print the complex number in a+ib format.
7. Create a class complex with real and imaginary as data members. Also include member functions to get the values for a complex number and to print the complex number in a+ib format. Also include friend functions to add two complex numbers and multiply two complex numbers.
8. Write a C++ program to count the number of objects created and destroyed for a class using stating data members and static member functions.

UNIT III POLYMORPHISM **9 + 6**

Polymorphism – Function overloading – Unary operator overloading – binary operator

overloading – Data Conversion – Overloading with Friend Functions

List of Exercises

9. Write a C++ program to find the area of a square and rectangle using function overloading.
10. Write a C++ program to swap two integers, floats, characters and two strings using function overloading concept.
11. Write a C++ program to perform complex number addition, subtraction, multiplication using operator overloading with friend functions.
12. Write a C++ program to perform complex number addition, subtraction, multiplication using operator overloading with member functions.
13. Write a C++ program to perform matrix addition, subtraction, multiplication using operator overloading with friend functions.
14. Write a C++ program to perform matrix addition, subtraction, multiplication using operator overloading with member functions.
15. Write a C++ program to overload all arithmetic assignment operator (+=, -=, *=, /=) for the complex number class using friend functions and member functions.

UNIT IV	INHERITANCE AND VIRTUAL FUNCTIONS	9 + 6

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

List of Exercises

16. Imagine a publishing company that market s both book and audio-cassette versions of its work. Create a class publication that stores the title and price. From this class derive two classes book and tape; book includes one more property: page numbers and tape contains its length in minutes (float). Each of these classes must have getdata ( ) functions and putdata ( ) functions to input/output its data. Write a main function to test the book and tape classes.
17. Create three classes Student, Test and Result classes. The student class contains student relevant information. Test class contains marks for five subjects. The result class contains Total and average of the marks obtained in five subjects. Inherit the properties of Student and Test class details in Result class through multilevel inheritance.
18. Create three classes Student, Test and Result classes. The student class contains student relevant information. Test class contains marks for five subjects. The result class contains Total and average of the marks obtained in five subjects. Inherit the properties of Student and Test class details in Result class through multiple inheritance.
19. Create a base class Shape with relevant data members and member functions to get data and print the area. Create two more classes Rectangle and Triangle which inherit Shape class. Make the print data function as virtual function in base class. Write a C++ main ( ) function to check this.

UNIT V	TEMPLATES, EXCEPTION HANDLING AND FILES	9 + 3

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

List of Exercises

20. Write a C++ program to represent a stack data structure using class template.
21. Write a function template for finding the minimum value contained in an array.
22. Write C++ programs handle multiple catch block, default catch block and re-throwing exceptions for your own problem situation.
23. Create a user defined manipulator for displaying the details of employees in a neat table format. (Hint: Employee details can be maintained as array of structures).

24. Write a C++ program to perform Sorting of File contents.

Total Periods : 75 Hours

COURSE OUTCOMES:

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

CO1: Explain the concepts of object oriented programming principles and its benefits. **(Understand)**

CO2: Apply the object orientation to solve real world problems.**(Apply)**

CO3: Analyze the complex engineering problems and reach the conclusion using the object oriented programming standards. **(Analyze)**

CO4: Design object oriented programming solutions for real world problems that meet the specified needs with appropriate consideration **(Create)**

CO5: Apply appropriate techniques and modern IT tools with an understanding of the limitations in object oriented programming. **(Modern Tool Usage)**

CO6: Work individually or in teams and communicate effectively to solve real world problems using object oriented programming principles. **(Affective domain)**

TEXT BOOKS :

1. K.R.Venugopal, Rajkumar Buyya, 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.

R21UCB304	FUNDAMENTALS OF MANAGEMENT	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES :

- To impart knowledge on concepts of Management Theories, Functions and Design
- To afford knowledge on problem-solving strategies and critical thinking skills in real time situations
- To develop skills on managerial ethics and leadership

UNIT I	MANAGEMENT THEORIES	6 Hrs

Concept and Foundations of Management, Evolution of Management Thoughts [Pre-Scientific Management Era (before 1880), Classical management Era (1880-1930), Neo-classical Management Era (1930-1950), Modern Management era (1950-on word).

UNIT II	FUNCTIONS OF MANAGEMENT & ORGANIZATION BEHAVIOR	6 Hrs

Planning, Organizing, Staffing, Directing, Controlling- Classical, Neoclassical and Contingency approaches to organizational design

UNIT III	ORGANIZATIONAL DESIGN	6 Hrs

Organizational theoryand design - Principles of Organizational Design – Factors affecting Organizational Design – Organizational structure - Measuring Organizational Effectiveness (Case Study)

UNIT IV	MANAGERIAL ETHICS	6 Hrs

Ethics and Business, Ethics of Marketing & advertising, Ethics of Finance & Accounting, Decision – making frameworks, Business and Social Responsibility, Corporate Social Responsibility

UNIT V	LEADERSHIP	6 Hrs

Concept, Nature, Importance, Attributes of a leader, developing leaders across the organization, Leadership Grid .

TOTAL:30 Periods

COURSE OUTCOMES:

After learning the contents of this course, the student would be able to,

- CO1 - Understand the circumstances that lead to management evolution and how it will affectfuture managers [Understand]
- CO2 - Explain how organizations adapt to an uncertain environment and identify techniques managers use to influence and control the internal environment. [Apply]
- CO3 - Identify and evaluate social responsibility and ethical issues involved in business situations and logically articulate own position on such issues. [Apply]
- CO4 - Analyze and evaluate the influence of historical forces on the current practice of management [Analyze]
- CO5 - Develop the process of management's four functions: planning, organizing, leading, and controlling [Create]
- CO6 - Evaluate the various management functional activities of an original business. [Evaluate]

TEXT BOOKS:

1. Management Fundamentals, Robert N Lussier, 5e, Cengage Learning, 2013.
2. Fundamentals of Management, Stephen P. Robbins, Pearson Education, 2009.

REFERENCES:

1. Essentials of Management, Koontz Kleihrich, Tata McGraw Hill.
2. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012

21UCS305	COMPUTER ORGANIZATION	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 practicebased on legal and ethical principles. (Affective domain)

TEXT BOOKS:

1. Carl Hamacher, ZvonkoVranesic and SafwatZaky, ‑Computer Organization‖, FifthEdition, 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.

R21UCB302	COMPUTATIONAL STATISTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Learn the fundamental concepts of computational statistics models, Multivariate Regression, Principal Component Analysis.
- Understand the fundamental concepts of Python, Clustering and Visualization in Python.

UNIT I	MULTIVARIATE NORMAL DISTRIBUTION	9

Multivariate Normal Distribution Functions, Conditional Distribution and its relation to regression model, Estimation of parameters.

UNIT II	MULTIPLE LINEAR REGRESSION MODEL	9

Standard multiple regression models with emphasis on detection ofcollinearity, outliers, non- normality and autocorrelation, Validation of modelassumption. Assumptions of multivariate regression models, Parameter estimation.

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UNIT III	DISCRIMINANT ANALYSIS	9

Statistical background, linear discriminant function analysis, Estimating linear discriminant functions and their properties. Multivariate Analysis of variance and covariance.

UNIT IV	PRINCIPAL COMPONENT ANALYSIS AND FACTOR ANALYSIS	9

Principal components, algorithms for conducting principal component analysis, deciding on how many principal components to retain, H- plot. Factor analysis model, extracting common factors, determining number of factors, Transformation of factors analysis solutions, Factor scores.

UNIT V	CLUSTER ANALYSIS	9

Introduction, types of clustering, correlations and distances, clustering by partitioning methods, hierarchical clustering, overlapping clustering, K- means Clustering- Profiling and Interpreting Clusters.

TOTAL: 45 Periods

COURSE OUTCOMES:

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

1. Understand the introductory concepts of python and Visualization of python.[**Understand**]

2. Applythe Principal component techniques to reduce data and to interpret.[**Apply**
3. Analyze means and variances of the individual variables in a multivariate set and also the correlations between those variables.[**Analyze**]

4. Apply the Factor Analysis techniques to reduce data and to interpret.[**Apply]**
5. To find Discriminants rules to optimally assign new objects to the labelled classes.[**Evaluate**]

6. characterizing the techniques of clustering methods for massive amounts of data.[**Affective Domain**]

TEXT BOOKS:

1. Richard A. Johnson and Dean W. Wichem, "Applied Multivariate StatisticalAnalysis", 6th Edition, Pearson, 2013.
2. T.W. Anderson, "An Introduction to Multivariate Statistical Analysis", 3rd Edition, Wiley, 2003.
3. Mark Lutz, "Learning Python", 5th Edition, O'Reilly, 2013.

REFERENCE BOOKS:

1. J.D. Jobson, ‐Applied Multivariate Data Analysis‖, Volume I: Regression andExperimental Design, Springer, 1991.
2. J.D. Jobson, ‐Applied Multivariate Data Analysis‖, Volume II: Categoricaland Multivariate Methods, 1st edition Springer, 1992.
3. H. Kris, ‐Statistical Tests for Multivariate Analysis‖, Springer – Verlag, Heidelberg.
4. Tim Hall and J-P Stacey, ‐Python 3 for Absolute Beginners‖, Apress, 2009.
5. Magnus Lie Hetland, ‐Beginning Python: From Novice to Professional‖, 2nd edition, 2008.

WEB REFERENCES:

1. https://www.youtube.com/watch?v=YgExEVji7xs
2. https://onlinecourses.swayam2.ac.in/ugc19_ma05
3. https://freevideolectures.com/course/3089/applied-multivariate- analysis

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/110/105/110105060/
2. https://www.digimat.in/nptel/courses/video/111104024/L02.html
3. http://nptel.ac.in/courses/111104024/

R21UCB307	COMPUTATIONAL STATISTICSLABORATORY USING PYTHON	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

1. Write simple programs using Python statements, expressions and flow controls
2. Write programs using functions and numeric types
3. Write program using sequences, class definition and constructors
4. Implement file handling operations
5. Practice prediction concept
6. Test the performance analysis of regression analysis
7. Implementation of Principal Component Analysis for finding Important texts in a Corpus
8. Practice factor analysis
9. Clustering of images and text documents
10. Plot a graph using matplotlib package
11. Visualize various graph types

Total :30 periods

SEMESTER IV

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UEN401	Business Communication and Value Science – III	2	0	0	2	Humanities and Social Science
R21UCB401	Database Management Systems	3	0	0	3	Professional Core
R21UCB402	Software Design with UML	3	0	0	3	Professional Core
R21UCB403	Operating System	3	0	0	3	Professional Core
R21UCB404	Design and Analysis of Algorithm	3	0	0	3	Professional Core
R21UCB405	Introduction To Innovation, IP Management And Entrepreneurship	3	0	0	3	Professional Core
R21UCB406	Operations Research	3	0	0	3	Basic Science
PRACTICAL						
R21UCB407	Database Management Systems Laboratory	0	0	2	1	Professional Core
R21UCB408	Software Design with UML Laboratory	0	0	2	1	Professional Core
R21UCB409	Operating System Laboratory	0	0	2	1	Professional Core
MANDATORY						
R21UGM431	Gender Equality (Common to ALL Branches)	1	0	0	P/F	Mandatory Course
	TOTAL	**21**	**0**	**6**	**23**	
Total No of Credits - 23						

R21UCB401	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

- To impart the knowledge in Relational Database Management Systems.
- To inculcate knowledge 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 advanced databases.

UNIT I	INTRODUCTION TO DATABASES	9

Purpose of Database System – Views of data – Database System Architecture– Entity-Relationship model – ER Diagrams – Enhanced ER Model – ER to Relational Mapping

UNIT II	RELATIONAL DATABASES AND SQL	9

Introduction to relational databases – Relational Model – Keys – Relational Algebra-.SQL fundamentals – Advanced SQL – Embedded SQL.

UNIT III	NORMALIZATION	9

Introduction - Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce-Codd Normal Form. Multi-valued dependencies and Fourth normal form, Fifth normal form.

UNIT IV	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 V	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.

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. Pramod J.Sadalage, Martin Fowler –NoSQL A Brief Guide to the emerging World of Polyglot Persistence Distilled‖, Pearson Education Inc, 2013

REFERENCE BOOKS:

1. Ramez Elmasri and Shamkant B.Navathe, –Fundamentals of Database Systems‖, Fifth Edition, Pearson Education, 2008.
2. Raghu Ramakrishnan, –Database Management Systems‖, Fourth Edition, Tata McGraw Hill, 2010.
3. Atul Kahate, –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.

R21UCB402	SOFTWARE DESIGN WITH UML	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

UNIT I	UNIFIED PROCESS AND USE CASE DIAGRAMS	9

Introduction to OOAD with OO Basics — Unified Process — UML diagrams — Use Case –Case study — the Next Gen POS system, Inception -Use case Modelling — Relating Use cases — include, extend and generalization — When to use Use-cases

UNIT II	STATIC UML DIAGRAMS	9

Class Diagram—- Elaboration — Domain Model — Finding conceptual classes and description classes — Associations — Attributes — Domain model refinement — Finding conceptual class Hierarchies — Aggregation and Composition — Relationship between sequence diagrams and use cases — When to use Class Diagrams

UNIT III	DYNAMIC AND IMPLEMENTATION UML DIAGRAMS	9

Dynamic Diagrams — UML interaction diagrams — System sequence diagram — Collaboration diagram — When to use Communication Diagrams — State machine diagram and Modelling –When to use State Diagrams — Activity diagram — When to use activity diagrams Implementation Diagrams — UML package diagram — When to use package diagrams — Component and Deployment Diagrams — When to use Component and Deployment diagrams

UNIT IV	DESIGN PATTERNS	9

GRASP: Designing objects with responsibilities — Creator — Information expert — Low Coupling — High Cohesion — Controller Design Patterns — creational — factory method — structural — Bridge — Adapter — behavioural — Strategy — observer –Applying GoF design patterns — Mapping design to code

UNIT V	TESTING	9

Object Oriented Methodologies — Software Quality Assurance — Impact of object orientation on Testing — Develop Test Cases and Test Plans

COURSE OUTCOMES:

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

- Understand the basic concepts of software process models and its tools.
- Apply object oriented design concepts to solve the complex engineering problems using various tools.
- Analyze the object oriented technologies in software development process using real world scenarios.
- Design the Object Oriented Methodologies with UML diagrams.
- Create a model for various real time applications using UML diagrams & techniques to solve the complex engineering problems.
- Work individually or in teams and demonstrate the solutions from UML diagrams using modern tools.

TEXT BOOKS:

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

REFERENCES:

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

R21UCB403	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

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

UNIT I	INTRODUCTION AND PROCESS CONCEPTS	9

Introduction: Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.
Process: Processes - Process Concept - Operations on Processes - Inter-process Communication.

UNIT II	CONCURRENCY AND SCHEDULING	9

Concurrency: Principles of Concurrency - Mutual Exclusion, Semaphores, Monitors, Readers/Writers problem.
Scheduling : CPU Scheduling - Scheduling criteria - Scheduling algorithms: Threads - Multithread Models – Threading issues.

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	INPUT/OUTPUT AND FILE SYSTEMS	9

I/O : I/O management and disk scheduling – I/O devices, organization of I/O functions; OS design issues, I/O buffering, disk scheduling, Disk cache.
File Systems: File management – Organization, Directories, File sharing, and Record blocking, secondary storage management.

UNIT V	VIRTUAL MACHINES AND MOBILE OS	9

Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components;
Mobile OS - iOS and Android.

Total : 45 periods

COURSE OUTCOMES:

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

- Ability to realize concepts of operating system structures, services and functionalities
- Ability to Apply Various Process Scheduling Algorithms, Disk Scheduling algorithms, Page replacement algorithms and Deadlock detection and avoidance techniques for providing Operating System functionalities
- Ability to Analyze various process management concepts (including scheduling, synchronization and deadlocks), Memory Management strategies and Design considerations of file system.
- Ability to Demonstrate the concepts of Operating system like System calls, Scheduling, Synchronization, Page replacement and Disk Scheduling algorithms using any Programming

Language and present the same along with the report

- Ability to evaluate the Multiprogramming, Synchronization and Virtual Memory Concepts
- Ability to Demonstrate the algorithms used for CPU scheduling, Deadlock using OS sim and shows the concepts of cloud using Virtualization tools

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, ‐Operating System Concepts‖, 10th Edition, John Wiley and Sons Inc., 2018.
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi.

REFERENCES:

1. Ramaz Elmasri, A. Gil Carrick, David Levine, ― Operating Systems – A Spiral Approach‖, Tata McGraw Hill Edition, 2010.
2. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.
3. Achyut S.Godbole, Atul Kahate, ‐Operating Systems‖, McGraw Hill Education, 2016.

R21UCB405	Introduction To Innovation, IP Management and Entrepreneurship	L	T	P	C
		3	0	0	3

Course Objectives

- The successful completion of the course will help students gain knowledge on: How to identify and discover market needs
- How to manage an innovation program
- How to create, protect, assetize and commercialize intellectual property
- Opportunities and challenges for entrepreneurs

UNIT I	Innovation	9

A primer on Innovation, IP Rights and Entrepreneurship, Types of Innovation (incremental, disruptive, etc.), Lifecycle of Innovation (idea, literature survey, PoT, PoC, etc.)

UNIT II	Challenges in Innovation	9

Challenges in Innovation (time, cost, data, infrastructure, etc.), co-innovation and open innovation (academia, start-ups and corporates), Technology innovation - case study - jile - A scalable agile devops products, curefit - A platform to stay healthy.

UNIT III	Intellectual Property Right	9

Types of IPR (patents, copyrights, trademarks, GI, etc.), Lifecycle of IP (creation, protection, assetization, monetization), Balancing IP risks & rewards (Right Access and Right Use of Open Source and 3rd party products, technology transfer & licensing), IP valuation (methods, examples, limitations).

UNIT IV	Entrepreneurship	9

Opportunity identification in technology entrepreneurship (customer pain points, competitive context), Market research, segmentation & sizing, Product positioning & pricing, go-to-market strategy, Innovation assessment (examples, patentability analysis)

UNIT V	Entrepreneurship - Social Innovation	9

Startup business models (fund raising, market segments, channels, etc.), Innovation, Incubation & Entrepreneurship in Corporate Context Technology-driven Social Innovation & Entrepreneurship, Manage innovation, IP and Entrepreneurship Programs- Processes, Governance and Tools.

TOTAL:45

COURSE OUTCOMES:

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

- Understand the concept of life cycle and types of innovation.[Understand]
- Apply the analytical techniques in business transactions that would help in effective business. [Apply]
- Analyze the challenges of Innovations. [Analyze]

- Estimate the Startup business models. [Estimate]
- Create a business plan to ensure a success of a startup. [Create]
- Work collaboratively in teams and present in groups as well as individually. [Work collaboratively]
- Analyze the requirements of the technology-driven social innovation

Text Bok:

1. Robert D.Hidrich, Mathew J.Manimala Micheal P.Peters Dean A.Shepherd.

2. Joe Tidd, John Bessant. Managing Innovation: Integrating Technological, Market and

Organizational Change.

Reference(s) :

1. Richard Razgaitis, Valuation and Dealmaking of Technology-Based Intellectual Property Principles, Methods and Tools, Wiley, 2009
2. Clayton M.Christensen, Innovator"s Dilemma: When New Technologies Cause Great Firms to Fail (Management of Innovation and Change), Harvard Business Review Press, 2013
3. Case Study Materials: To be distributed for class discussion.

R21UCB404	Design and Analysis of Algorithm	L	T	P	C
		3	0	0	3

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 - Divide and conquer methodology – Binary search –Binary tree traversal algorithm, Graph traversals - Breadth first search and Depth first search, Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting

UNIT III	DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE	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	TRACTABLE AND INTRACTABLE PROBLEMS	9

Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook‘s theorem, Standard NP-complete problems and Reduction techniques. Total: 45 Periods

COURSE OUTCOMES:

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

- CO1- Understand the concept of Notation of Algorithm that apply in various methodologies like brute force divide and Conquer, Greedy Techniques **[Understand]**
- CO2- Apply various Methodology based algorithm and different types of searching sorting techniques for providing Betterment solution for the problems. **[Apply]**
- CO3-Analyze various methodology based algorithm for enhancing the efficiency of the problem **[Analyze]**

- CO4-Analyze different set of problem and to Design a solution using algorithm design methodology **[Design]**
- CO5-Evaluate running time, efficiency of the problem using different set of algorithm **[Evaluate]**
- CO6- Demonstrate the algorithms with analyzed solution based on time complexity , efficiency and also shows the concepts of difference between different methodology **[Affective Domain]**

TEXT BOOKS

1. Anany Levitin, "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.Fayez Gebali," 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.

R21UCB406	OPERATIONS RESEARCH	L	T	P	C
		3	0	0	3

PRE-REQUISITE:

COURSE OBJECTIVES :

The student should be made to:

- Solve linear programming problem and solve using graphical method.
- Solve LPP using simplex method
- Solve transportation, assignment problems
- To provide knowledge and training in using optimization techniques under limited resourcesfor the engineering and business problems

UNIT I	LINEAR MODELS	9

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

UNIT II	TRANSPORTATION MODELS AND NETWORK MODELS	9

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

UNIT III	INVENTORY MODELS	9

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventorymodels – Multi product models – Inventory control models in practice.

UNIT IV	QUEUEING MODELS	9

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V	DECISION MODELS	9

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

TOTAL :45 Periods

COURSE OUTCOMES:

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

- Ability to understand linear programming problem and solve using graphical method.[**Understand**]
- Abilityto apply simplex methods to solve LPP Problem. **[Apply]**
- Abilityto Analyze and solve transportation, assignment problems [**Analyze]**
- Abilityto Develop skills To solve project management problems **[Design]**
- Abilityto Evaluate scheduling problems. **[Evaluate]**
- Abilityto solve real world Problem using Modern R Tool**[Modern Tool]**

TEXT BOOK:

1. Hillier and Libeberman, –Operations Research‖, Holden Day, 2005 2. Taha H.A., –OperationsResearch‖, Sixth Edition, Prentice Hall of India, 2003.

REFERENCE BOOKS:

1. Bazara M.J., Jarvis and Sherali H., –Linear Programming and Network Flows‖, John Wiley, 2009.
2. Budnick F.S., –Principles of Operations Research for Management‖, Richard D Irwin, 1990.
3. Philip D.T. and Ravindran A., –Operations Research‖, John Wiley, 1992.
4. Shennoy G.V. and Srivastava U.K., –Operation Research for Management‖, Wiley Eastern, 1994.
5. Tulsian and Pasdey V., –Quantitative Techniques‖, Pearson Asia, 2002.

R21UCB407	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS:

1. E-R Diagram
2. Creation of A Database For TV Company
3. Working with queries on TV database
4. Working with queries on municipality database
5. Normalization
6. Implementation of Join and Nested Queries AND Set operators
7. Implementation of virtual tables using Views
8. Practice of Procedural extensions (Procedure, Function, Cursors, Triggers)
9. Implementation of Exceptions and Triggers
10. Developing Applications

Total Hours:30

R21UCB408	SOFTWARE DESIGN WITH UML LABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

Prepare the following documents for any one of the experiments and develop the software usingsoftware engineering methodology

1. Identify a software system that needs to be developed.
2. Document the Software Requirements Specification (SRS) for the identified system.
3. Identify use cases and develop the Use Case model.
4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram fromthat.
5. Using the identified scenarios, find the interaction between objects and represent them usingUML Sequence and Collaboration Diagrams
6. Draw relevant State Chart and Activity Diagrams for the same system.
7. Implement the system as per the detailed design
8. Test the software system for all the scenarios identified as per the usecase diagram
9. Improve the reusability and maintainability of the software system by applying appropriate designpatterns.
10. Implement the modified system and test it for various scenarios

R21UCB409	OPERATING SYSTEM LABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

1. Shell Programming, Program to illustrate various methods for process and Process Synchronization
2. Program to illustrate various methods for thread handling, scheduling algorithms.
3. Bankers Algorithm for Deadlock Avoidance
4. Page Replacement Algorithms, File Allocation Strategies
5. Jcrypt tool,Fault Tolerance, High Availability concepts using Cloudsim.

SEMESTER V

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UEN501	Business Communication and Value Science – IV	2	0	0	2	Humanities and Social Science
R21UCB501	Software Engineering	3	0	0	3	Professional Core
R21UCB502	Compiler Design	3	0	0	3	Professional Core
R21UCB503	Data Communication and Networking	3	0	0	3	Professional Core
R21UCB504	Marketing Research and Management	3	0	0	3	Professional Core
	Professional Elective I	3	0	0	3	Professional Elective
	Open Elective I	3	0	0	3	Open Elective
R21UGS531	Reasoning and Aptitude(Common to CSE,ECE,IT,CSBS,AIDS,CSD, CSE(AI&ML),IOT,CYBER SECURITY)	1	0	0	1	Basic Science
PRACTICAL						
R21UCB507	Creative Thinking and Innovation	0	0	2	1	Project Work
R21UCB508	Software Engineering Laboratory	0	0	2	1	Professional Core
R21UGS532	Soft Skills Laboratory(Common to CSE,ECE,IT,CSBS,AIDS,CSD, CSE(AI&ML),IOT,CYBER SECURITY)	0	0	2	1	Humanities and Social Science
	TOTAL	**20**	**0**	**6**	**24**	
Total No of Credits – 23						

R21UCB501	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Introduce the phases in a software project
- To Explain the concepts of requirements engineering and Analysis Modeling
- To Explain the major considerations for enterprise integration ,deployment , Testing and Maintenance

UNIT I	SOFTWARE PROCESS	9

Introduction to Software Engineering, Software Process, Prescriptive Process Models and Specialized Process Models – Agile Software Development- 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 QUALITY	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 – Software Quality - Internal and external qualities; process and product quality; principles to achieve software quality;

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

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

Understand the basic concepts of software engineering principles. [Understand]

Ability to apply Software Engineering Design Techniques and practices for developing Software. [Apply]

Ability to analyze the various requirements, design and Testing Techniques to select the appropriate techniques for the software system. [Analyze]

Ability to Design Models for different phases of software development to solve real world problems. [Design]

Ability to Evaluate Projects by Estimating cost and time required for developing the SoftwareProduct. [Evaluate]

Demonstrate diagraming, requirement phases, test scenarios using suitable tools. [Moderntool]

TEXT BOOKS:

1. Roger Pressman.S, ‐Software Engineering Practitioner‘sApproach‖,McGrawHillInternational Edition,7thEdition,2010.
2. Ian Sommerville, ‐Software Engineering‖, Pearson Education Asia 9thedition,2011

REFERENCE BOOKS:

1. RajibMall, ‖FundamentalsofSoftwareEngineering‖,PHI Learning Private Limited,3rdEd
2. PankajJalote, ‖Software Engineering, A Precise Approach Fundamentals of Software Engineering‖,Wiley India, 2010.
3. Stephen R.Schach, ‖Software Engineering‖, Tata McGraw-Hill Publishing Company Limited,2007.

R21UCB502	COMPILER DESIGN	L	T	P	C
		3	0	0	3

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	LEXICAL ANALYSIS	9

Phases of compilation and overview - Lexical Analysis (scanner): Regular languages – Finite Automata - Regular expressions - Relating regular expressions and finite automata - Scanner generator (lex, flex).

UNIT II	SYNTAX ANALYSIS	9

Need and Role of the Parser-Context Free Grammars –Top Down Parsing -General Strategies-Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item-Construction of SLR Parsing Table -Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC.

UNIT III	INTERMEDIATE CODE GENERATION	9

Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expression.

UNIT IV	CODE OPTIMIZATION	9

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

UNIT V	RUN TIME ENVIRONMENTS AND CODE GENERATOR	9

Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management – Issues in Code Generation – Design of a simple Code Generator.

TOTAL: 45 Periods

COURSE OUTCOMES:

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

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

TEXT BOOKS:

1. Nandhini Prasad - Principles of Compiler Design ,Cengage Pvt Ltd cThird Edition,2017
2. Adesh K.Pandey - Compiler of Design , S.K.Kataria and sons,2011

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

R21UCB503	DATA COMMUNICATION AND NETWORKING	L	T	P	C
		3	0	0	3

COURSEOBJECTIVES:

The student should be made to:

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

UNIT I	INTRODUCTION AND PHYSICAL LAYER	9

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

UNIT II	DATA-LINK LAYER & MEDIA ACCESS	9

Introduction –Link-Layer Addressing–DLC Services–Data-Link Layer Protocols–HDLC – PPP-MediaAccessControl-WiredLANs:Ethernet-WirelessLANs–Introduction– IEEE802.11,Bluetooth–Connecting Devices.

UNIT III	NETWORK LAYER	9

Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets - Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols –Multicasting Basics–IPV6Addressing–IPV6Protocol.

UNIT IV	TRANSPORT LAYER	9

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

UNIT V	APPLICATION LAYER	9

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

TOTAL:45Periods

COURSE OUTCOMES:

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

- Understand the basic layers and its functions in computer networks.**[Understand]**
- Applythe concepts of all layers to solve problems in Network.**[Apply]**
- Analyze algorithms in different layers to solve problem that occur in real world. **[Analyze]**
- Design protocols for various functions in network.**[Design]**
- Evaluate the performance of a network. **[Evaluate]**
- Select and apply appropriate concept to design algorithm using Modern toolNS2.**[Modern tool]**

TEXTBOOK:

1. BehrouzA.Forouzan,Data Communications and Networking, Fifth Edition TMH,2017.

REFERENCESBOOKS:

1. LarryL.Peterson,BruceS.Davie,ComputerNetworks:ASystemsApproach,FifthEdition,MorganKaufmannPublishersInc., 2021.
2. WilliamStallings,DataandComputerCommunications,TenthEdition,PearsonEducation,
3. NaderF.Mir,Computer and Communication Networks,Second Edition,Prentice Hall,2014.

R21UCB504	MARKETING RESEARCH AND MANAGEMENT	L	T	P	C
		2	0	0	2

Course objectives :

- To inculcate the students to analyze markets and design customer driven strategies and will be able to communicate the decisions towards business development with superior customer value.

UNIT I	Introduction Marketing	6 Hrs

Introduction: Importance - Scope of Marketing - Core Marketing Concepts - Marketing Environment -Marketing Strategies & Plans. Market Research (MR): Definition of MR - MIS - MR Process - MR Online - MR & Ethics -International MR.

UNIT II	Analyzing Marketing Opportunities, Customer Value And Marketing Mix	6 Hrs

Market Analysis and Decision Making: Consumer Decision Making - Creating Customer Value - Analyzing Consumer Markets - Consumer Behaviour - Cultural - Social & Personal Factors. Marketing Mix: Developing Products & Brands - Product Levels - Classifying Products - Product Range - Line & Mix - PLC - New Product Development.

UNIT III	Designing a Customer Driven Strategy	6 Hrs

Market Segmentation: Segmentation of Consumer Market - Business Market - Requirement for Effective Segmentation - Market Targeting - Evaluating Market Segmentation - Selecting Target Market Segmentation. Positioning: Positioning Maps - Positioning Strategy

UNIT IV	Distribution Decisions, Promotion	6 Hrs

Distribution Decisions: Marketing Channels - Channel Intermediates and Functions - Channel Structure - Channel for Consumer Products - Business and Industrial Products - Alternative Channel -Channel Strategy Decisions.Promotion: The Promotional Mix - Advertising - Public Relations - Sales Promotion – Personal Selling.

UNIT V	Pricing Theory and Practices	6 Hrs

Pricing: Importance of Price - Cost Determinant of Price - Mark-up Pricing - Profit Maximization Pricing - Break Even Pricing - Pricing Strategy - Ethics of Pricing Strategy - Product Line Pricing.

TOTAL :30 Periods

COURSE OUTCOMES:

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

- Understand the concept of marketing, marketing environment and prepare a marketing plan **[Understand]**
- Apply the concepts of consumer decision making and STP(segmentation, targeting, positioning) strategies to gain competitive advantage**[Apply]**
- Analyze the distribution and promotion strategies of firm **[Analyze]**
- Evaluate product and pricing decisions in marketing**[Evaluate]**
- Determine the most effective action to be taken in specific situations [**Affective domain]**

TEXT BOOK:

1. Philip Kortler and kevin lane keller, Marketing Management, PHI 15th Edition, 2017

REFERENCE BOOKS:

1. Rajan saxena, marketing management, Mcgrawhil, 6th edition, 2020.
2. Lamb, hair, sharma, Mc Daniel- marketing- An Innovative approach to learning and teaching- A south Asian perspective, Cengage learning -2016

R21UCB507	CREATIVE THINKING AND INNOVATIONS	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 lifeand 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.

Total Hours: 30 Periods

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 andprovide 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)

R21UCB508	SOFTWARE ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

Prepare the following documents for any one of the experiments and develop the software usingsoftware engineering methodology.

- Problem Analysis and Project Planning Thorough study of the problem
- Identify project scope, Objectives, infrastructure
- Software Requirement Analysis Describe the individual Phases/ modules of the project, Identify deliverables.
- Data Modeling Use work products – data dictionary, use case diagrams and activity diagrams, build and test class diagrams, sequence diagrams and add interface to class diagrams.
- Software Development and Debugging
- Software Testing Prepare test plan, perform validation testing, coverage analysis, memory leaks, develop test case hierarchy, Site check and site monitor
- Understand a given business scenario and identify product backlog, user stories and sprint tasks.

1. Course Registration System
2. Quiz System
3. Online ticket reservation system
4. Remote computer monitoring
5. Student marks analyzing system
6. Expert system to prescribe the medicines for the given symptoms
7. ATM system
8. Platform assignment system for the trains in a railway station
9. Stock maintenance.

Total Hours: 30

SEMESTER VI

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UCB601	Business Strategy	2	0	0	2	Professional Core
R21UCB602	Information Security	2	0	0	2	Professional Core
R21UCB603	Artificial Intelligence Techniques	3	0	0	3	Professional Core
	Professional Elective II	3	0	0	3	Professional Elective
	Professional Elective III	3	0	0	3	Professional Elective
	Open Elective II	3	0	0	3	Open Elective
PRACTICAL						
R21UGS633	Interpersonal Skills Development Laboratory(Common to CSE,IT,EEE,AGRI,CSBS ,AIDS,CSD, AI&ML,IOT,CYBER SECURITY)	0	0	3	1.5	Humanities and Social Science
R21UCB607	Product Development Project	0	0	8	4	Project Work
R21UCB608	Information Security Laboratory	0	0	2	1	Professional Core
R21UCB609	Artificial Intelligence Techniques Laboratory	0	0	3	1.5	Professional Core
MANDATORY						
R21UGM631	Indian Constitution(Common to all Branches)	1	0	0	P/F	Mandatory Course
	TOTAL	**18**	**0**	**16**	**24**	
Total No of Credits - 24						

R21UCB601	BUSINESS STRATEGY	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES :

- To expose students to various perspectives and concepts in the field of Strategic Management
- The course would enable the students to understand the principles of strategy formulation,implementation and control in organizations.
- To help students develop skills for applying these concepts to the solution of business problems

UNIT I	INTRODUCTION TO STRATEGIC MANAGEMENT	6 Hrs

Importance of Strategic Management - Vision and Objectives - Schools of thought in Strategic Management -Strategy Content, Process, and Practice - Fit Concept and Configuration Perspective in Strategic Management

UNIT II	INTERNAL ENVIRONMENT OF FIRM	6 Hrs

Recognizing a Firm's Intellectual Assets - Core Competence as the Root of Competitive Advantage - Sources of Sustained Competitive Advantage - Business Processes and Capabilities-based Approach to Strategy

UNIT III	EXTERNAL ENVIRONMENTS OF FIRM	6 Hrs

Competitive Strategy - Five Forces of Industry Attractiveness that Shape Strategy - The concept of StrategicGroups, and Industry Life Cycle - Generic Strategies - Generic Strategies and the Value Chain

UNIT IV	CORPORATE STRATEGY, AND GROWTH STRATEGIES	6 Hrs

The Motive for Diversification - Related and Unrelated Diversification - Business Portfolio Analysis -Expansion, Integration and Diversification - Strategic Alliances, Joint Ventures, and Mergers & Acquisitions

UNIT V	STRATEGY IMPLEMENTATION	6 Hrs

Structure and Systems - The 7S Framework - Strategic Control and Corporate Governance

Total: 30 Hours

COURSE OUTCOMES:

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

- Understand the basic concepts and principles of strategic management. [**Understand]**
- Apply different strategic approaches to managing a business successfully in a global context.
  [Apply]
- Analyze the internal and external environment of business**. [Analyze]**
- Develop and prepare organizational strategies that will be effective for the current businessenvironment**. [Design]**
- Evaluate the different strategical approaches and Corporate strategies and Growth strategies. **[Evaluate]**
- Ability to solve the real world Business oriented problems and make an effective presentation as team. **[Affective Domain]**

TEXT BOOKS

1. Robert M. Grant. Contemporary Strategic Analysis, Blackwell, 10th Edition, 2012.

REFERENCE BOOKS

1. M.E. Porter, Competitive Strategy, 1980. M.E. Porter,
2. Competitive Advantage, 1985 Richard Rumelt (2011).
3. Good Strategy Bad Strategy: The Difference and Why It Matters.
4. Exploring Corporate Strategy, Gerry Johnson, Kevan Scholes, Richard Whittington, 2009, PearsonEd Ltd, United Kingdom, 2nd Ed.
5. Crafting and Executing Strategy Arthur A Thompson Jr, Strickland A.J., John E. Gamble and Arun K.Jain, McGraw Hill Education Private Limited, New Delhi.
6. Strategic Management Michael Hitt, Ireland, Hoskission, 2010, Cengage Learning, NewDelhi.
7. Strategic Management – Concepts and Cases, Fred R. David, 2010, PHI Learning, New Delhi.
8. Business Policy and Strategic Management (Text and Cases) , Subba Rao, P 2010,

R21UCB602	INFORMATION SECURITY	L	T	P	C
		2	0	0	2

COURSEOBJECTIVES:

- This course focuses on the models, tools, and techniques for enforcement of security with some emphasis on the use of cryptography. Students will learn security from multiple perspectives.

UNIT I	OVERVIEW OF SECURITY PARAMETERS	6Hrs

Overview: Confidentiality, integrity and availability- Security violation and threats- Security policy and procedure-Assumptions and Trust-Security Assurance, Implementation and Operational Issues- Security Life Cycle.

UNIT II	ACCESS CONTROL MODELS AND SECURITY POLICIES	6Hrs

Access Control Models: Discretionary, mandatory, roll-based and task-based models, unified models, access control algebra, temporal and spatio-temporal models. Security Policies Confidentiality policies, integrity policies, hybrid policies ,non-interference and policy composition, international standards.

UNIT III	SYSTEMS DESIGN	6Hrs

Systems design: Design principles, representing identity, control of access and information flow, confinement problem. Assurance: Building systems with assurance, formal methods, evaluating systems.

UNIT IV	LOGIC BASED SYSTEM	6Hrs

Malicious logic, vulnerability analysis, auditing, intrusion detection. Applications: Network security, operating system security, user security, program security. Special Topics: Data privacy, introduction to digital forensics, enterprise security specification.

UNIT V	OPERATING SYSTEMS SECURITY AND DATABASE SECURITY	6Hrs

Operating Systems Security: Security Architecture, Analysis of Security in Linux/Windows. Database Security: Security Architecture, Enterprise security, Database auditing.

Total:30Peroids

LIST OF EXPERIMENTS

1. Analysis of security in Unix/Linux
2. Administration of users, password policies, privileges and roles
3. Perform encryption, decryption using any one substitution techniques
4. Performencryptionanddecryptionusinganyonetranspositiontechniques
5. Implement the SIGNATURE SCHEME - Digital Signature Standard.
6. Demonstrate intrusion detection system(ids)using any tool eg.Snort or any others/w.
7. Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool

COURSE OUTCOMES:

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

- Understand the CIA triad of Confidentiality, Integrity and Availability. [**Understand]**
- Appreciate the difficulties that arise when valuable information needs to be shared.[**Apply]**
- Analyze what information is appreciating the value of information to modern organization.**[Analyze]**
- Develop basic understanding of security ,cryptography,system attacks and defenses against them.**[Design]**
- Evaluate the five leading-edge resources that have up-to-date information on information security**.[Evaluate]**
- Ability to solve the real world problems using modern tool-Wire shark**[Modern tool]**

TEXT BOOKS:

1. MarkStamp - Information Security ,Wiley publisher,,2018
2. Micheal Workman - Information Security,Jones & Bartlett Publisher,Second Edition-2021

REFERENCE BOOKS:

1. MickiKrause,HaroldF.Tipton,—HandbookofInformationSecurityManagement ",Vol1-3CRCPressLLC,2004.
2. Security Engineering, Ross Anderson.
3. Computer Security:Art and Science,M.Bishop,Pearson Education.
4. Information Security: PrinciplesandPractice,M.Stamp.
5. Security in Computing,C.P.Pfleeger,S.L.Pfleeger,J.Margulies.
6. Secure ProgrammingHOWTO,DavidWheeler.
7. Browser Security Handbook,MichaelZalewski.
8. Handbook of Database Security,M.Gertz,S.Jajodia.

WEB REFERENCES:

1. http://faculty.kfupm.edu.sa/COE/marwan/richfiles/misc/Network-security-essentials- 4theditionwilliam-stallings.pdf
2. http://files.gu.edu.ge:8008/.../Principles%20of%20Information%20Security.
3. https://www.mooc-list.com/course/information-security-and-risk-management- context-coursera
4. https://www.coursera.org/learn/cyber-security-domain/lecture/FLyKS/information-securitygovernance-and-risk-management

R21UCB603	ARTIFICIAL INTELLIGENCE TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

UNIT I	INTRODUCTION TO ARTIFICIAL INTELLIGENCE PROBLEM SOLVING, PROBLEM SPACE	6Hrs

Problems of AI- AI technique,-Tic - Tac - Toe problem-Intelligent Agents- Agents & environment-nature of environment- structure of agents- goal based agents- utility based agents- learning agents. Defining the problem as state space search- production system- problem characteristics- issues in the design of search programs

UNIT II	SEARCH TECHNIQUES	5Hrs

Problem solving agents- searching for solutions- uniform search strategies: breadth first search,-depth first search- depth limited search- bidirectional search-comparinguniform search strategies. Heuristic search strategies Greedy best-first search- A* search-AO* search- memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search- simulated annealing search- local beam search.

UNIT III	CONSTRAINT SATISFACTION PROBLEMS	7Hrs

Local search for constraint satisfaction problems- Adversarial search- Games, optimal decisions & strategies in games- the minimax search procedure- alpha-beta pruning- additional refinements- iterative deepening. Expert Systems: Representing and using domain knowledge, expert system shells, and knowledge acquisition.

UNIT IV	KNOWLEDGE REPRESENTATION	6Hrs

Knowledge representation issues- representation & mapping- approaches to knowledge representation. Using predicate logic- representing simple fact in logic- representing instant & ISA relationship- computable functions & predicates- resolution, natural deduction. Representing knowledge using rules- Procedural verses declarative knowledge- logic programming- forward verses backward reasoning- matching- control knowledge.

UNIT V	LEARNING PLANNING AND MACHINE	6Hrs

Basic plan generation systems - Strips -Advanced plan generation systems – K strips -Strategic Explanations -Why, Why not and how explanations. Learning- Machine learning, adaptive Learning, reinforcement learning.

Total:30Hours

COURSE OUTCOMES:

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

- Understand the concept of agents, environments, search strategies, reasoning, logic and probabilities. [Understand]
- Abilityto applyknowledge of agent architecture, searching and reasoning techniques for different applications. [Apply]
- Ability to analyze procedural and declarative knowledge by applying agent-based rules.
- Abilityto design a reasoning system for a given requirement. [Design]
- Evaluate the search algorithms and Use appropriate algorithms for any AI problem.
- [Evaluate]
- Abilityto conduct practical experiments for demonstrating agents, searching and inferencing using Modern tool. [Modern tool]

TEXT BOOKS:

1. Norvig and Rusell - Artificial Intelligence,Pearson India ,FourthEdition,2022
2. .Bratko,—Prolog:ProgrammingforArtificialIntelligence‖,Fourthedit ion,Addison-WesleyEducationalPublishersInc., 2011.

REFERENCE BOOKS:

1. M.Tim Jones,—Artificial Intelligence: A Systems Approach (Computer Science)‖,Jones andBartlett Publishers,Inc.;First Edition,2008
2. Nils J.Nilsson,—The Quest for Artificial Intelligence‖,CambridgeUniversity Press,2009.
3. William F.Clocksin and Christopher S.Mellish,‖Programming inProlog: Using the ISO Standard‖, Fifth Edition, Springer,2003.
4. GerhardWeiss,—MultiAgentSystems‖,SecondEdition,MITPress,2013.
5. DavidL.PooleandAlanK.Mackworth,—ArtificialIntelligence:Foundations of Computational Agents‖, Cambridge University Press,2010.

R21UCB607	PRODUCT DEVELOPMENT PROJECT	L	T	P	C
		0	0	8	4

COURSE OBJECTIVES:

- To develop a product for a specific problem right from its identification and literature review till the successful solution of the same
- To train the students in preparing project reports
- To prepare the students to face reviews and viva voice examination

PROJECT DESCRIPTION

- Eight periods per week shall be allotted in the timetable and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, and computer analysis of field work as assigned by the guide and also to presenting periodical seminars on the progress made in the project.
- The aim of the product development project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, are search investigation,computer or management project or a design problem.
- The progress of the project is evaluated based on a minimum of three reviews.

COURSE OUTCOMES:

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

- Understand the problem definition.[**Understand**]
- Applytheir views in terms of preparing reports and presentation skills.[**Apply]**
- IdentifyandsolveproblemspertainingtoComputerScienceandBusinessSystems. [**Analyze]**
- Develop IT based solution for real world problems.**[Design]**
- Investigate the independent learning for effective implementation of the project. **[Investigate]**
- Build the project as a Team or as an individual using Modern tool.**[Moderntool]**

R21UCB608	INFORMATION SECURITY LABORATORY	L	T	P	C
		0	0	2	1

COURSEOBJECTIVES:

- This course focuses on the models, tools, and techniques for enforcement of security with some emphasis on the use of cryptography. Students will learn security from multiple perspectives.

LIST OF EXPERIMENTS

1. Analysis of security in Unix/Linux
2. Administration of users, password policies, privileges and roles
3. Perform encryption, decryption using any one substitution techniques
4. Performencryptionanddecryptionusinganyonetranspositiontechniques
5. Implement the SIGNATURE SCHEME - Digital Signature Standard.
6. Demonstrate intrusion detection system(ids)using any tool eg.Snort or anyothers/w.
7. Automated Attack and Penetration Tools Exploring N-Stalker,a Vulnerability Assessment Tool

R21UCB609	ARTIFICIAL INTELLIGENCE LABORATORY	L	T	P	C
		0	0	3	1.5

COURSEOBJECTIVES:

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

LIST OF EXPERIMENTS

1. Write a Program to Implement Breadth First Search using Python
2. Write a Program to Implement Depth First Search using Python
3. Write a Program to Implement Tic-Tac-Toe game using Python.
4. Write a Program to Implement 8-Puzzle problem using Python
5. Write a Program to Implement Water-Jug problem using Python
6. Write a Program to Implement Travelling Salesman Problem using Python.
7. Write a Program to Implement Tower of Hanoi using Python.
8. Write a Program to Implement Monkey Banana Problem using Python
9. Write a Program to Implement Missionaries-Cannibals Problems using Python
10. Write a Program to Implement N-Queens Problem using Python

SEMESTER VII

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
R21UCB701	Human Resource Management	2	0	0	2	Professional Core
R21UCB702	Usability Design of Software Applications	2	0	0	2	Professional Core
R21UCB703	IT Workshop	2	0	0	2	Professional Core
	Professional Elective IV	3	0	0	3	Professional Elective
	Professional Elective V	3	0	0	3	Professional Elective
	Open Elective III	3	0	0	3	Open Elective
PRACTICAL						
R21UCB707	Usability Design of Software Applications Laboratory	0	0	2	1	Professional Core
R21UCB708	IT Workshop Laboratory	0	0	2	1	Professional Core
MANDATORY						
R21UGM731	Sports and Social Development (Common to all Branches)	-	-	-	P/F	Mandatory Course
R21UGM732	Skill Development (Common to all Branches)	-	-	-	P/F	Mandatory Course
	TOTAL	**15**	**0**	**4**	**17**	
Total No of Credits - 17						

R21UCB701	HUMAN RESOURCE MANAGEMENT	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES :

- To provide knowledge about management issues related to staffing, training, performance, compensation, human factors consideration and compliance with human resource requirements.
- To gain knowledge needed for success as a human resources professional.
- To develop the skills needed for a successful HR manager
- To implement the concepts learned in the workplace.

UNIT I	PERSPECTIVES IN HUMAN RESOURCE MANAGEMENT	9 Hrs

Evolution of human resource management-The importance of the human capital-Role of human resource manager-Challenges for human resource managers-trends in Human resource-Computer applications in human resource management-Human resource accounting

UNIT II	HUMAN RESOURCE PLANNING AND RECRUITMENT	9 Hrs

Importance of Human Resource Planning-Forecasting human resource requirement-matching supply and demand-- Internal and External sources-Organizational Attraction-Recruitment, Selection, Induction and Socialization- Theories, Methods and Process

UNIT III	TRAINING AND DEVELOPMENT	9 Hrs

Types of training methods-purpose-benefits-resistance. Executive development programme-Common practices-Benefits-Self Development-Knowledge management

UNIT IV	EMPLOYEE ENGAGEMENT	9 Hrs

Compensation plan-Reward-Motivation-Application of theories of motivation -Career managementMentoring-Development of mentor-Protege relationships- Job Satisfaction, Employee Engagement, Organizational Citizenship Behaviour-Theories, Models

UNIT V	PERFORMANCE EVALUATION AND CONTROL	9 Hrs

Method of performance evaluation-Feedback-Industry practices. Promotion,Demotion,Transfer and Separation-Implication of job change.The control process-Importance-Methods-Requirement of effective control systems grievances-causes-implications-Redressel methods.

TOTAL: 45 Periods

COURSE OUTCOMES:

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

- Understand the knowledge on the various aspects of HRM[**Understand**]
- Develop the skills needed for a successful HR manager[**Apply**]
- Gain knowledge needed for success as a human resources professional**.[Analysis]**
- Evaluate the concepts learned in the workplace.[**Evaluate**]
- Aware of the emerging concepts in the field of HRM [**Affective Domain**]

Text Book(s)

1. Human Resource Management, 8th Edition, K. Aswathappa, Tata McGraw Hill, 2017

Reference(s)

1. Dessler Human Resource Management, Pearson Education Limited, 14th Edition, 2015.
2. Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy. Managing Human Resource. PHI Learning. 2012

3. Bernadin , Human Resource Management ,Tata Mcgraw Hill ,8th edition 2012.
4. Wayne Cascio, Managing Human Resource, McGraw Hill, 2007.
5. Ivancevich, Human Resource Management, McGraw Hill 2012.

R21UCB702	USABILITY DESIGN OF SOFTWARE APPLICATIONS	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES :

- Acquire Knowledge of quantitative user design and evaluating product assignments
- Independently plan, perform and make a report about both an expert evaluation and an evaluation of assignment and research.
- Describe the relation between design review and evaluation of projects, especially the relation between usability and design

UNIT I	INTRODUCTION TO USER CENTRED DESIGN	6 Hrs

Aspects of User Centred Design - Product Appreciation Assignment - Evaluating the product from user centred design aspects such as functionality - ease of use - ergonomics - aesthetics.

UNIT II	HEURISTIC EVALUATION	6 Hrs

Heuristic Evaluation-10 Heuristic Principles-Examples-Heuristic Evaluation-Group Assignment initiation -Website and App- Evaluation for key tasks of the app or website for heuristic principlesseverity - recommendations

UNIT III	GROUP ASSIGNMENT PRESENTATIONS AND REVIEWS	6 Hrs

Discovery -Define-Design-Implement-Design Prototype -Usability Testing.

UNIT IV	UX RESEARCH	6 Hrs

Understanding users -their goals -context of use-environment of use-Research Techniques-Contextual Enquiry-User Interviews -Competitive Analysis for UX

UNIT V	SCENARIOS AND PERSONA TECHNIQUE	6 Hrs

Presentation of Personas for the group project-Design Thinking Technique -Discovery and brainstorming-Concept Development-Task flow detailing for the Project-Prototyping TechniquesPaper-Electronic -Prototyping Tools

TOTAL: 30 Periods

COURSE OUTCOMES:

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

- Understand the user-centered design process to evaluate the different Assignments[**Understand**]
- Apply heuristic evaluation techniques to evaluate the website and application[**Apply**]
- Analysis the UX research techniques for software application[**Analysis**]
- To perform and make a report about both an expert evaluation and an evaluation of assignment and research.[**Evaluate**]
- Create the personal technique for different projects[**Create**]
- Generate ideas for developing and testing innovation through an assignment presentation.[**Affective Domain**]

Reference(s)

1. Jenny Preece, Helen Sharp and Yvonne Rogers,Interaction Design: Beyond Human-Computer Interaction, 4th Edition, , 2015
2. About Face,4th Edition, Alan Cooper and Robert Reimann,Wiley,2014
3. Elizabeth Goodman, Mike Kuniavsky, Andrea Moed,Observing the User Experience, Second Edition,A Practitioner"s Guide to User Research,2012
4. Jesse James Garrett,The Elements of User Experience User-Centered Design for the Web and Beyond,2nd Edition,New Riders2021
5. Jonny Schneider,Understanding Design Thinking, Lean, and Agile, 2017

21UCB703	IT WORKSHOP	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES :

- Understand the basic working principles of MATLAB.
- Understand the workspace and miscellaneous commands of MATLAB.
- Analysing matrix, array and basic mathematical functions
- Applying the basic plotting done using MATLAB
- Apply the different programming logics which help to complete different plotting structures.

UNIT I	MATLAB	6 Hrs

History - basic features - strengths and weaknesses - good programming practices and plan your code. Creating MATLAB variables - overwriting variable - error messages - making corrections - controlling the hierarchy of operations or precedence - controlling the appearance of floating point number

UNIT II	WORKSPACE AND MISCELLANEOUS COMMANDS	6 Hrs

Managing the workspace - keeping track of your work session - entering multiple statements per line - miscellaneous commands

UNIT III	MATRIX, ARRAY AND BASIC MATHEMATICAL FUNCTIONS	6 Hrs

Matrix generation, entering a vector, entering a matrix - matrix indexing, colon operator - linear spacing - creating a sub-matrix - dimension, matrix operations and functions matrix generators - special matrices- array and array operations - solving linear equations- other mathematical functions.

UNIT IV	INTRODUCTION TO PROGRAMMING	6 Hrs

M-File Scripts, script side-effects, M-File functions, anatomy of a M-File function, input and output arguments, input to a script file, output commands

UNIT V	Debugging M-files	6 Hrs

Debugging process, preparing for debugging, setting breakpoints, running with breakpoints, examining values, correcting and ending debugging, correcting an M-file **TOTAL: 45 Periods**

COURSE OUTCOMES:

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

- Understand the basic principles of MATLAB operations[**Understand**]
- Apply formalized arguments based on conditional looping statements**.[Apply]**
- Analysis the working session and multiple statements per line in MATLAB.[**Analysis**]
- Evaluate the concepts of sub matrix and its operation.[**Evaluate**]
- Apply the language of graphs and trees to the real world problems.[**Apply**]

Reference(s)

1. Digital Image Processing using MATLAB. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Pearson Education, Inc., 2004.

2. MATLAB: A Practical Introduction to Programming and Problem Solving. Stormy Attaway, Butterworth-Heinemann, 2017.

R21UCB707	USABILITY DESIGN OF SOFTWARE APPLICATIONS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVE:

- To understand the appreciation of user research, solution conceptualization and validation as interwoven activities in the design and development lifecycle.
- To familiarize the facets of User Experience (UX) Design, particularly as applied to the digital artefacts. To implement complex mobile/web applications.

LIST OF EXPERIMENTS

1. Product Appreciation Assignment – Evaluating the product from User Centred Design aspects such as functionality, ease of use, ergonomics, and aesthetics.
2. Heuristic Evaluation: Group Assignment initiation (Website and App) Evaluation for key tasks of the app or website for heuristic principles, severity, recommendations.
3. Students will identify a project in the given domain (Healthcare, E-Commerce, Online Learning Platforms, Gaming, Point-of-Sale, Smart Things) and its related website or mobile app to redesign. They will take this redesign project through the design lifecycle: Discovery Define Design Implement (Design Prototype) Usability Testing The below design methods and techniques will be imparted w.r.t. the group project selected by the students.
4. Presentation of Persona for the group project
5. Task flow detailing for the project
6. Project Prototyping Iteration 1
7. Project Prototyping Iteration 2
8. Final Product Demo(Mobile or Web Application)

Course Outcome:

On completion of the course, the students will be able to,

- Understand the fundamentals and importance of User-Centred design.[Understand]
- Perform design evaluation by applying the heuristic principles. [Design]
- Develop an application focusing on the design aspects. [Apply]
- Do research on understanding user requirement. [Apply]
- Perform iterative product development using prototyping technique.[Apply]

R21UCB708	IT WORKSHOP LABORATORY	L	T	P	C
		0	0	2	1

COURSEOBJECTIVES:

- To introduce the students with the basic features of MATLAB for problem solving.
- To introduce the students about the Mathematical functions like matrix generation and Plotting with multiple data sets, line styles and colors.
- To introduce the students about the Array operations and solving Linear equations in MATLAB.
- To introduce the students about the control flow and operators using if-end structures and loops.

LIST OF EXPERIMENTS

1. Programs using mathematical, relational expressions and the operators.
2. Vectors and Matrices: Programs using array operations and matrix operations (such as matrix multiplication).
3. Programs on input and output of values.
4. Selection Statements: Experiments on if statements, with else and elseif clauses and switch statements.
5. Loop Statements and Vectorizing Code: Programs based on the concepts of counted (for) and conditional (while) loops.
6. Programs based on scripts and user-defined functions.
7. Programs on Built-in text manipulation functions and conversion between string and number types.
8. Programs based on two main data structures: cell arrays and structures.
9. Programs based on Data Transfer
10. Programs based on Advanced Functions.
11. Introduction to Object-Oriented Programming and Graphics.
12. Programs based on Advanced Plotting Techniques.
13. Programs based on sound files and image processing.

14 Programs based on Advanced Mathematics.

Course Outcome:

On completion of the course, the students will be able to

- Write fundamental programs in MATLAB, creating variables and mathematical functions.
- Understand how to program matrix operations, array operations and how to solve the system of linear equations.
- Program the fundamentals concepts of basic Plotting consisting of simple and multiple data sets in one plot. Understand how to program M-file scripts, M- file functions, Input –output Arguments and program control flow operators, loops, flow structures.
- Use the debugging process and debugging M-files.

SEMESTER VIII

Course Code	Course Title	L	T	P	C	Type of Course
THEORY						
	Professional Elective VI	3	0	0	3	Professional Elective
	Open Elective IV	3	0	0	3	Open Elective
PRACTICAL						
R21UCB801	Project Work	0	0	16	8	Project Work
MANDATORY						
R21UGM831	Professional Ethics and Human Values (Common to all Branches)	2	0	0	P/F	Mandatory Course
	TOTAL	**8**	**0**	**16**	**14**	
Total No of Credits - 14						

TOTAL CREDITS – 162

R21UCB801	PROJECT WORK	L	T	P	C
		0	0	16	8

COURSE OBJECTIVES:

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

PROJECT DESCRIPTION

- Sixteen periods per week shall be allotted in the timetable and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, and computer analysis of field work as assigned by the guide and also to presenting periodical seminars on the progress made in the project.
- The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.
- The progress of the project is evaluated based on a minimum of three reviews.

COURSE OUTCOMES:

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

- Understand the problem definition. [**Understand**]
- Apply their views in terms of preparing reports and presentation skills. [**Apply]**
- Identify and solve problems pertaining to Computer Science and Business Systems. [**Analyze]**
- Develop IT based solution for real world problems. **[Design]**
- Investigate the independent learning for effective implementation of the project. **[Investigate]**
- Build the project as a Team or as an individual using Modern tool. **[Modern tool]**

21UCB972	STRATEGIC MANAGEMENT AND LEADERSHIP	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

- To learn the major initiatives taken by a company's top management on behalf of corporate, involving resources and performance in external environments. It entails specifying the organization's mission, vision and objectives, and to equip with skills required to manage business and non-business organizations at senior levels. The course adopts a functional approach to management developing policies and plan to understand the analysis and implementation of strategic management in strategic business units

UNIT I	STRATEGY AND PROCESS	6 Hrs

Conceptual framework for strategic management, the Concept of Strategy and the Strategy Formation Process – Stakeholders in business – Vision, Mission and Purpose – Business definition, Objectives and Goals - Corporate Governance and Social responsibility-case study.

UNIT II	COMPETITIVE ADVANTAGE	6 Hrs

External Environment - Porter‘s Five Forces Model-Strategic Groups Competitive Changes during Industry Evolution-Globalisation and Industry Structure - National Context and Competitive advantage Resources-Capabilities and competencies–core competencies-Low cost and differentiation Generic Building Blocks of Competitive Advantage- Distinctive Competencies- Resources and Capabilities durability of competitive Advantage- Avoiding failures and sustaining competitive advantage-Case study.

UNIT III	STRATEGIES	6 Hrs

The generic strategic alternatives – Stability, Expansion, Retrenchment and Combination strategies - Business level strategy- Strategy in the Global Environment-Corporate Strategy- Vertical IntegrationDiversification and Strategic Alliances- Building and Restructuring the corporation-Strategic analysis and choice – Managing Growth - Environmental Threat and Opportunity Profile (ETOP) - Organizational Capability Profile - Strategic Advantage Profile - Corporate Portfolio Analysis - SWOT Analysis - GAP Analysis - Mc Kinsey's 7s Framework - GE 9 Cell Model – Distinctive competitiveness - Selection of matrix - Balance Score Card-case study

UNIT IV	STRATEGY IMPLEMENTATION & EVALUATION	6 Hrs

The implementation process, Resource allocation, Designing organisational structure-Designing Strategic Control Systems- Matching structure and control to strategy-Implementing Strategic changePolitics-Power and Conflict-Techniques of strategic evaluation & control-case study.

UNIT V	OTHER STRATEGIC ISSUES	6 Hrs

Managing Technology and Innovation - Strategic issues for Non Profit organisations. New Business Models and strategies for Internet Economy-case study Challenges in Strategic Management: Introduction, Strategic Management as an Organisational Force, Dealing with Strategic Management in Various Situations, Strategic Management Implications and Challenges

Recent Trends in Strategic Management: Introduction, Strategic Thinking, Organisational Culture and its Significance, Organisational Development and Change, Change Management, Strategic management in a new globalised economy

Total: 30 Peroids

COURSE OUTCOMES:

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

- Ability to understand the Strategic management process and social responsibility o business organizations
- In-depth understanding about the need for developing competitive advantage fo organizations
- Provides insights into various corporate and business level strategies
- Facilitates to identify the various control systems required for organizational strateg implementation process
- Enhances the cognitive knowledge about various strategic issues and development o new business models

TEXT BOOKS:

1. Strategic Management and Competitive Advantage | Pearson | Sixth Edition |2012
2. Strategic Management: Concepts, Competitiveness & Globalization | Cengage | Tweleth edition |2014

REFERENCE BOOKS:

1. Hill. Strategic Management: An Integrated approach, 2009 Edition Wiley (2012).
2. John A.Parnell. Strategic Management, Theory and practice Biztantra (2012).
3. Azhar Kazmi, Strategic Management and Business Policy, 3rd Edition, Tata McGraw Hill, 2008
4. AdriauH Aberberg and Alison Rieple, Strategic Management Theory & Application, Oxford University Press, 2008.
5. Lawerence G. Hrebiniak, Making strategy work, Pearson, 2 nd edition, 2013.
6. Gupta, Gollakota and Srinivasan, Business Policy and Strategic Management – Concepts and Application, Prentice Hall of India, 2005.
7. Dr.Dharma Bir Singh, Strategic Management & Business Policy, KoGent Learning Solutions Inc., Wiley, 2012.
8. John Pearce, Richard Robinson and Amitha Mittal, Strategic Management, McGraw Hill, 12th Edition, 2012
9. Lafley AG and Roger L Martin, Playing to Win : Strategy really works, Harvard Business Review Press

21UCB973	SOCIAL MEDIA MARKETING ANALYITCS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

1. To understand, design and implement online marketing tools.
2. Translate some of the key marketing and business models
3. Review the history of social media marketing
4. Explain the key social media marketing activities needed for competitive success

UNIT I	SOCIAL MEDIA MARKETING	9 Hrs

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 II	DIGITAL TRANSFORMATION	9 Hrs

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Changing your strategy based on analysis- Recent trends in Digital marketing.

UNIT III	COMMUNITY BUILDING AND MANAGEMENT	9 Hrs

History and Evolution of Social Media-Understanding Science of Social Media –Goals for using Social Media- Social Media Audience and Influencers - Digital PR- Promoting Social Media PagesLinking Social Media Accounts-The Viral Impact of Social Media

UNIT IV	SOCIAL MEDIA POLICIES AND MEASUREMENTS	9 Hrs

Social Media Policies-Etiquette, Privacy- ethical problems posed by emerging social media technologies - The Basics of Tracking Social Media

UNIT V	MARKETING RESEARCH & TRENDS IN MARKET	9 Hrs

Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post-performance on FB. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis.

Total: 45 Peroids

COURSE OUTCOMES:

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

- Ability to understand the Strategic management process and social responsibility of business organizations
- In-depth understanding about the need for developing competitive advantage for organizations
- Provides insights into various corporate and business level strategies
- Facilitates to identify the various control systems required for organizational strategy implementation process
- Enhances the cognitive knowledge about various strategic issues and development of new business models

REFERENCES:

1. K. M. Shrivastava, Social Media in Business and Governance, Sterling Publishers
Private Limited, 2013
2. Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014
3. Bittu Kumar, Social Networking, V & S Publishers, 2013
4. Avinash Kaushik, Web Analytics - An Hour a Day, Wiley Publishing, 2007
5. ric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress, 2004
6. TakeshiMoriguchi, Web Analytics Consultant Official Textbook, 7th Edition, 2016

21UCB974	MARKETING MANAGEMENT STRATEGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

The student should be made to:

1. To understand, design and implement online marketing tools.
2. Translate some of the key marketing and business models
3. Review the history of social media marketing
4. Explain the key social media marketing activities needed for competitive success

UNIT I	SOCIAL MEDIA MARKETING	9 Hrs

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 II	DIGITAL TRANSFORMATION	9 Hrs

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Changing your strategy based on analysis- Recent trends in Digital marketing.

UNIT III	COMMUNITY BUILDING AND MANAGEMENT	9 Hrs

History and Evolution of Social Media-Understanding Science of Social Media –Goals for using Social Media- Social Media Audience and Influencers - Digital PR- Promoting Social Media PagesLinking Social Media Accounts-The Viral Impact of Social Media

UNIT IV	SOCIAL MEDIA POLICIES AND MEASUREMENTS	9 Hrs

Social Media Policies-Etiquette, Privacy- ethical problems posed by emerging social media technologies - The Basics of Tracking Social Media

UNIT V	MARKETING RESEARCH & TRENDS IN MARKET	9 Hrs

Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post-performance on FB. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis.

Total: 45 Peroids

COURSE OUTCOMES:

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

- Ability to understand the Strategic management process and social responsibility of business organizations
- In-depth understanding about the need for developing competitive advantage for organizations
- Provides insights into various corporate and business level strategies
- Facilitates to identify the various control systems required for organizational strategy implementation process
- Enhances the cognitive knowledge about various strategic issues and development of new business models

REFERENCES:

1. K. M. Shrivastava, Social Media in Business and Governance, Sterling Publishers
Private Limited, 2013
2. Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014
3. Bittu Kumar, Social Networking, V & S Publishers, 2013
4. Avinash Kaushik, Web Analytics - An Hour a Day, Wiley Publishing, 2007
5. ric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress, 2004
6. TakeshiMoriguchi, Web Analytics Consultant Official Textbook, 7th Edition, 2016

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Department of Computer Science and Business Systems

Verticals

Verticals-

Professional Elective Courses

PROFESSIONALELECTIVECOURSES: VERTICALS

Vertical I Data Science	**Vertical II Cloud Computing and Datacentre Technologies**	**Vertical III Emerging Technologies**	**Vertical IV Artificial Intelligence and Machine Learning**	**Vertical V Marketing and Management**	**Vertical VI Digital Marketing**	**Vertical VII Digital Technologies**
21CSV101-Exploratory Data Analysis	21CSV301-Cloud Computing	21CSV501-Augmented Reality/Virtual Reality	21ITV701 Knowledge Engineering	21CBV401-Human Resource Management for Entrepreneurs	21CDV408-Marketing Research and Marketing Management	21CBV701-GUI Design and Applications
21CSV102-Recommender Systems	21CSV302-Virtualization	21CSV602-Robot Process Automation	21CSV702- Soft Computing	21CSV102-Recommender Systems	21CBV601-Advanced social, text and media analytics	21CBV702-Application Development
21ITV103- Neural Networks and Deep Learning	21CSV203-Cloud Essentials	21ITV103- Neural Networks and Deep Learning	21ITV103-Neural Networks and Deep Learning	21CBV404-Supply Chain Management	21CBV602-Conversational Systems	21CBV703-Problem Solving and Python Programming
21CSV104- Text and Speech Analysis	21ITV304-Data Ware housing	21CSV604- Cyber security	21CSV104- Text and Speech Analysis	21CDV408-Marketing and Social Media Web Analytics	21CBV603-Social Media Marketing	21CBV704-Programming in JAVA
21ITV105-Business Analytics	21ITV305-Storage Technologies	21CSV605-Quantum Computing	21CSV705-Optimization Techniques	21CDV407-Social Data Mining	21CBV604 -Web analytics and Search Engine Optimization	21CBV705- PERN Stack Development
21ITV106- Image and Video Analytics	21CSV306-Software Defined Networks	21ITV406- Crypto currency and Block chain Technologies	21ITV706 - Game Theory	21CBV403-Financial Management	21CBV605-Digital Marketing Analytics	21CBV706-MERN stack web Development
21CSV107-Computer Vision	21ITV307-Stream Processing	21ITV507-Game Development	21ITV707-Cognitive Science	21CSV505-Digital Marketing	21CSV102-Recommender Systems	21CBV707-Data Wrangling
21ITV108- Big Data Analytics	21ITV308-Security and Privacy in Cloud	21ITV608-3D Printing and Design	21CSV708-Ethics and AI	21CDV408-Marketing Research and Marketing Management	21CBV606-Capstone Project	21CBV708-Software Testing Methodologies

21CSV 101	EXPLORATORY DATA ANALYSIS	L	T	P	C
		3	0	0	3

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 **Hrs**

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 forEDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques.

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UNIT II	EDA USING PYTHON	9 **Hrs**

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 **Hrs**

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

UNIT IV	BIVARIATE ANALYSIS	9 **Hrs**

Relationships between Two Variables - Percentage Tables - Analysing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines

UNIT V	MULTIVARIATE AND TIME SERIES ANALYSIS	9 **Hrs**

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:

At the end of this course, the students 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. Suresh Kumar Mukhiya, Usman Ahmed, “Hands-On Exploratory Data Analysis with Python”, Packt Publishing, 2020. (Unit 1)
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", First Edition, O Reilly, 2017. (Unit 2)
3. Catherine Marsh, Jane Elliott, “Exploring Data: An Introduction to Data Analysis for SocialScientists”, Wiley Publications, 2nd Edition, 2008. (Unit 3,4,5)

REFERENCES:

1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
2. Claus O. Wilke, “Fundamentals of Data Visualization”, O’reilly publications, 2019.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, “Interactive Data Visualization: Foundations, Techniques, and Applications”, 2nd Edition, CRC press, 2015.

21CSV 102	RECOMMENDER SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

UNIT I	INTRODUCTION	9 **Hrs**

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 Recommender systems

UNIT II	CONTENT-BASED RECOMMENDATION SYSTEMS	9 **Hrs**

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

Suggested Activities:

- Assignment on content-based recommendation systems
- Assignment of learning user profiles

Suggested Evaluation Methods:

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

UNIT III	COLLABORATIVE FILTERING	9 **Hrs**

A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF, components of neighborhood methods (rating normalization, similarity weight computation,and neighborhood selection

Suggested Activities:

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

Suggested Evaluation Methods:

- Quiz on collaborative filtering
- Seminar on security measures of recommender systems

UNIT IV	ATTACK-RESISTANT RECOMMENDER SYSTEMS	9 **Hrs**

Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack – Group attack – Strategies for robust recommender design - Robust recommendation algorithms

Suggested Activities:

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

Suggested Evaluation Methods:

- Quiz on attacks on recommender systems
- Seminar on preventing attacks using the CAPTCHAs

UNIT V	EVALUATING RECOMMENDER SYSTEMS	9 **Hrs**

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – 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

COURSE OUTCOMES:

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

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

TEXTBOOKS:

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2019.
2.Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich ,

Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.

3.Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Sytems Handbook, 1sted, Springer (2011),

4.Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 2020.

21ITV103	NEURAL NETWORKS AND DEEP LEARNING	L	T	P	C
		3	0	0	3

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 traindeep neural networks for various tasks.

To apply autoencoders and generative models for suitable applications

UNIT I	INTRODUCTION	9 **Hrs**

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.

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UNIT II	ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS	9 **Hrs**

Training Algorithms for Pattern Association-Autoassociative Memory Network-Heteroassociative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Autoassociative 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 NEURAL NETWORKS	9 **Hrs**

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 – Neuroscientific Basis – Applications: Computer Vision, Image Generation, Image Compression

UNIT IV	DEEP FEEDFORWARD NETWORKS	9 **Hrs**

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

UNIT V	RECURRENT NEURAL NETWORKS	9 **Hrs**

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

TOTAL: 45 Periods

COURSE OUTCOMES:

At the end of this course, the students 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 deep learning and use them to build and train deep neural networks for various tasks.
- Apply autoencoders and generative models for suitable applications.

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2019.
2. Francois Chollet, "Deep Learning with Python", Second Edition, Manning Publications,2021.

REFERENCES:

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", Oreilly,2018.
2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.
3. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 1st Edition, 2018.
4. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
5. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
6. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017.
7. S Rajasekaran, G A Vijayalakshmi Pai, "Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications", PHI Learning, 2017.
8. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017
9. James A Freeman, David M S Kapura, "Neural Networks Algorithms, Applications, andProgramming Techniques", Addison Wesley, 2003.

21CSV104	TEXT AND SPEECH ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

UNIT I	NATURAL LANGUAGE BASICS	9 **Hrs**

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 **Hrs**

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model – Overview of Deep Learning models – RNN – Transformers – Overview of Textsummarization 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 **Hrs**

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 **Hrs**

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 **Hrs**

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

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TOTAL: 45 Periods

COURSE OUTCOMES:

On completion of the course, the students 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 translationExplain 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

TEXTBOOK

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

REFERENCES:

1. Dipanjan Sarkar, “Text Analytics with Python: A Practical Real-World approach to GainingActionable 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.

21UIT105	BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

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 **Hrs**

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 **Hrs**

.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 **Hrs**

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 **Hrs**

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 employeesfor a year.

UNIT V	MARKETING & SALES ANALYTICS	9 **Hrs**

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:

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

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, 2019
3. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2019
4. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
5. Mahadevan B, "Operations Management -Theory and Practice",3rd Edition, Pearson Education,2018.

21UIT106	IMAGE AND VIDEO ANALYTICS	L	T	P	C
		3	0	0	3

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 **Hrs**

Computer Vision – Image representation and image analysis tasks - Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image datarepresentation - Traditional and Hierarchical image data structures

UNIT II	IMAGE PRE-PROCESSING	9 **Hrs**

Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models - Edges in multi-speralct images - Local pre-processing in the frequency domain - Line detection by local pre-processing operators - Image restoration

UNIT III	OBJECT DETECTION USING MACHINE LEARNING	9 **Hrs**

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 **Hrs**

Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition-DeepFace solution by Facebook-FaceNet for Face Recognition- Implementation using FaceNet-Gesture Recognition.

UNIT V	VIDEO ANALYTICS	9 **Hrs**

Video Processing — use cases of video analytics-Vanishing Gradient and exploding gradient problem-RestNet architecture-RestNet and skip connections-Inception Network-GoogleNet architecture-Improvement in Inception v2-Video analytics-RestNet and Inception v3.

TOTAL: 45 Periods

COURSE OUTCOMES:

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

- Understand the basics of image processing techniques for computer vision and videoanalysis.

- 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 BOOKS:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing, Analysis, and Machine Vision”, 4nd edition, Thomson Learning, 2013.
2. Vaibhav Verdhan,(2021, Computer Vision Using Deep Learning Neural NetworkArchitectures with Python and Keras,Apress 2021(UNIT-III,IV and V)

REFERENCES

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

21UCSV107	COMPUTER VISION	L	T	P	C
		3	0	0	3

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

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 **Hrs**

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

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

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 **Hrs**

Shape from X - Active rangefinding - Surface representations - Point-based representations- Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos

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

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:

At the end of this course, the students 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 BOOKS:

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

REFERENCES:

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2009
3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

21UITV108	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

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 **Hrs**

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 **Hrs**

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 **Hrs**

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 – outputformats.

UNIT IV	BASICS OF HADOOP	9 **Hrs**

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 **Hrs**

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 – HiveQLqueries

TOTAL: 45 Periods

COURSE OUTCOMES:

After the completion of this course, students 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 BOOKS:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
3. Sadalage, Pramod J. “NoSQL distilled”, 2013

REFERENCES:

1. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
2. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
3. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
4. Alan Gates, "Programming Pig", O'Reilley, 2011.

21CSV301	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

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 **Hrs**

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 **Hrs**

.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 andI/O devices

UNIT III	VIRTUALIZATION INFRASTRUCTURE AND DOCKER	9 **Hrs**

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 **Hrs**

Google App Engine — Amazon AWS — Microsoft Azure; Cloud Software Environments — Eucalyptus — OpenStack

UNIT V	CLOUD SECURITY	9 **Hrs**

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:

- 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 BOOKS

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, “Distributed and Cloud Computing, FromParallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.
2. James Turnbull, “The Docker Book”, O’Reilly Publishers, 2014.
3. Krutz, R. L., Vines, R. D, “Cloud security. A Comprehensive Guide to Secure Cloud Computing”, Wiley Publishing, 2010.

REFERENCES

1. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, “Cloud Security and Privacy: an enterprise perspective on risks and compliance”, O’Reilly Media, Inc., 2009.

21CSV302	VIRTUALIZATION	**L**	**T**	**P**	**C**
		3	0	0	3

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 **Hrs**

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 **Hrs**

. 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 **Hrs**

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

UNIT IV	STORAGE VIRTUALIZATION	9 **Hrs**

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

UNIT V	VIRTUALIZATION TOOLS	9 **Hrs**

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

TOTAL: 45 Periods

COURSE OUTCOMES:

- Analyse 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 BOOKS

1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
3. David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and MicrosoftPlatform 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, 2009.

21CSV203	CLOUD ESSENTIALS	L	T	P	C
		3	0	0	3

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 cloudservices
- Select appropriate structures for designing, deploying and running cloud-based services ina business environment
- Illustrate the benefits and drive the adoption of cloud-based services to solve real worldproblems

UNIT I	CLOUD SERVICE MANAGEMENT FUNDAMENTALS	9 **Hrs**

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 **Hrs**

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 **Hrs**

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 **Hrs**

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 **Hrs**

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:

- 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 BOOKS

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by Enamul Haque, Enel Publications
2. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini,Zaigham Mohammad 2013
3. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour

REFERENCES

1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi

21ITV304	DATA WAREHOUSING	L	T	P	C
		3	0	0	3

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 **Hrs**

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 **Hrs**

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 **Hrs**

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 **Hrs**

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 **Hrs**

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:

At the end of the course the students should 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 BOOKS

1. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", TataMcGraw – Hill Edition, Thirteenth Reprint 2008.
2. Ralph Kimball, "The Data Warehouse Toolkit: The Complete Guide to DimensionalModeling", Third edition, 2013.

REFERENCES

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, 2009.

21ITV305	STORAGE TECHNOLOGIES	L	T	P	C
		3	0	0	3

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 **Hrs**

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 **Hrs**

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and scale- out storageArchitecture

UNIT III	STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION	9 **Hrs**

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 **Hrs**

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration,Disaster Recovery as a Service(DRaaS)**.**

UNIT V	SECURING STORAGE INFRASTRUCTURE	9 **Hrs**

Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance, Storageinfrastructure management functions, Storage infrastructure management processes.
TOTAL: 45 Periods

COURSE OUTCOMES:

- Demonstrate the fundamentals of information storage management and various models ofCloud 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

TEXTBOOKS

1. EMC Corporation, Information Storage and Management, Wiley, India
2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017
3. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein ,Storage Networks Explained, Second Edition, Wiley, 2009

21CSV306	SOFTWARE DEFINED NETWORKS	L	T	P	C
		3	0	0	3

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 **Hrs**

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 **Hrs**

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 **Hrs**

SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering –Measurement and Monitoring – Security – Data Center Networking

UNIT IV	NETWORK FUNCTION VIRTUALIZATION	9 **Hrs**

Network Virtualization - Virtual LANs – OpenFlow VLAN Support - NFV Concepts – Benefits andRequirements – Reference Architecture

UNIT V	NFV FUNCTIONALITY	9 **Hrs**

NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFVUse 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 NFV4\

TEXTBOOKS:

1. William Stallings, “Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud”,Pearson Education, 1st Edition, 2015.

REFERENCES:

1. Ken Gray, Thomas D. Nadeau, “Network Function Virtualization”, Morgan Kauffman, 2019.
2. Thomas D Nadeau, Ken Gray, “SDN: Software Defined Networks”, O’Reilly Media, 2013.
3. Fei Hu, “Network Innovation through OpenFlow and SDN: Principles and Design”, 1st Edition, CRC Press, 2014.
4. Paul Goransson, Chuck Black Timothy Culver, “Software Defined Networks: A Comprehensive Approach”, 2nd Edition, Morgan Kaufmann Press, 2019.
5. Oswald Coker, Siamak Azodolmolky, “Software-Defined Networking with OpenFlow”, 2nd Edition, O’Reilly Media, 2017.

21ITV307	STREAM PROCESSING	L	T	P	C
		3	0	0	3

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 abusiness environment
- Illustrate the benefits and drive the adoption of real-time data services to solve real worldproblems
-

UNIT I	FOUNDATIONS OF DATA SYSTEMS	9 **Hrs**

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 **Hrs**

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 **Hrs**

Relational Model, Document Model, Key-Value Pairs, NoSQL, Object-Relational Mismatch, Many- to-One and Many-to-Many Relationships, Network data models, Schema Flexibility, Structured Query Language, Data Locality for Queries, Declarative Queries, Graph Data models, Cypher Query Language, Graph Queries in SQL, The Semantic Web, CODASYL, SPARQL

UNIT IV	EVENT PROCESSING WITH APACHE KAFKA	9 **Hrs**

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 **Hrs**

Structured Streaming, Basic Concepts, Handling Event-time and Late Data, Fault-tolerant Semantics, Exactly-once Semantics, Creating Streaming Datasets, Schema Inference, Partitioningof Streaming datasets, Operations on Streaming Data, Selection, Aggregation, Projection, Watermarking, Window operations, Types of Time windows, Join Operations, Deduplication

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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 BOOKS

1. Streaming Systems: The What, Where, When and How of Large-Scale Data Processing by Tyler Akidau, Slava Chemyak, 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

REFERENCES

1. https://spark.apache.org/docs/latest/streaming-programming-guide.html
2. Kafka.apache.org

21ITV308	SECURITY AND PRIVACY IN CLOUD	L	T	P	C
		3	0	0	3

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 **Hrs**

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Non-repudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II	SECURITY DESIGN AND ARCHITECTURE FOR CLOUD	9 **Hrs**

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 **Hrs**

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, IdentityFederation - 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 **Hrs**

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 **Hrs**

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:

- 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.

TOTAL:45 PERIODS

TEXTBOOKS

1. Raj Kumar Buyya , James Broberg, andrzejGoscinski, “Cloud Computing:‖, Wiley 2013
2. Dave shackleford, “Virtualization Security‖, SYBEX a wiley Brand 2013.
3. Mather, Kumaraswamy and Latif, “Cloud Security and Privacy‖, OREILLY 2011

REFERENCES

1. Mark C. Chu-Carroll “Code in the Cloud‖,CRC Press, 2011
2. Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya, Christian Vechhiola, S. ThamaraiSelvi

21UCV501	AUGMENTED REALITY/VIRTUAL REALITY	L	T	P	C
		3	0	0	3

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 thedevelopment 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 **Hrs**

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 ofVirtual 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 **Hrs**

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – KinematicsModeling – Transformation Matrices – Object Position – Transformation Invariants – ObjectHierarchies — Viewing the 3D World — Physical Modeling — Collision Detection — Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – ModelManagement

UNIT III	VR PROGRAMMING	9 **Hrs**

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of WorldToolKit and Java 3D

UNIT IV	APPLICATIONS	9 **Hrs**

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 ApplicationsEmerging 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 **Hrs**

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation-Navigation-Wearable devices

	TOTAL: 45 Periods

COURSE OUTCOMES:

On completion of the course, the students 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

TEXTBOOKS:

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", AddisonWesley, 2019
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

21CSV602	ROBOTIC PROCESS AUTOMATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts of Robotic Process Automation.
- To expose to the key RPA design and development strategies and methodologies.
- To learn the fundamental RPA logic and structure.
- To explore the Exception Handling, Debugging and Logging operations in RPA.
- To learn to deploy and Maintain the software bot.

UNIT I	INTRODUCTION TO ROBOTIC PROCESS AUTOMATION	9 **Hrs**

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 **Hrs**

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 **Hrs**

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 **Hrs**

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 **Hrs**

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:

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

- Enunciate the key distinctions between RPA and existing automation techniquesand platforms.
- Use UiPath to design control flows and work flows for the target process
- Implement recording, web scraping andprocess mining by automation
- Use UIPath Studio to detect, and handle exceptions in automation processes
- Implement and use Orchestrator for creation, monitoring, scheduling, and controlling of automated bots and processes.

TEXT BOOKS:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, 2018.
2. Tom Taulli , "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress publications, 2020.

REFERENCES:

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018
3. A Gerardus Blokdyk, "Robotic Process Automation Rpa A Complete Guide ", 2020

21CSV605	QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

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

UNIT I	QUANTUM COMPUTING BASIC CONCEPTS	9 **Hrs**

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 **Hrs**

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

UNIT III	QUANTUM ALGORITHMS	9 **Hrs**

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 **Hrs**

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

UNIT V	QUANTUM CRYPTOGRAPHY	9 **Hrs**

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

TOTAL: 45 Periods

COURSE OUTCOMES:

On completion of the course, the students 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.
- Understand the quantum operations such as noise and error–correction.

TEXTBOOKS:

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

REFERENCES

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

21ITV406	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of Blockchain
- To learn Different protocols and consensus algorithms in Blockchain
- To learn the Blockchain implementation frameworks
- To understand the Blockchain Applications
- To experiment the Hyperledger Fabric, Ethereum networks

UNIT I	INTRODUCTION TO BLOCKCHAIN	9 **Hrs**

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree

UNIT II	BITCOIN AND CRYPTOCURRENCY	9 **Hrs**

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 **Hrs**

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, 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 **Hrs**

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

UNIT V	BLOCKCHAIN APPLICATIONS	9 **Hrs**

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:

- 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 BOOKS

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. 2.Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly, 2014.

REFERENCES:

1. Daniel Drescher, “Blockchain Basics”, First Edition, Apress, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2019.
3. Melanie Swan, “Blockchain: Blueprint for a New Economy”, O’Reilly, 2015
4. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Blockchain”, Packt Publishing
5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198192, 2020.

21ITV507	GAME DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of a game engine.
- To survey the gaming development environment and tool kits.
- To learn and develop simple games using Pygame environment

UNIT I	3D GRAPHICS FOR GAME DESIGN	9 **Hrs**

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 **Hrs**

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 **Hrs**

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 **Hrs**

Pygame Game development – Unity – Unity Scripts –Mobile Gaming, Game Studio, Unity Single player and Multi-Player games.

UNIT V	GAME DEVELOPMENT USING PYGAME	9 **Hrs**

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:

- 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.

REFERENCES

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 toProfessional”, Apress,2007.
3. Paul Craven, “Python Arcade games”, Apress Publishers,2019.
4. David H. Eberly, “3D Game Engine Design: A Practical Approach to Real-Time ComputerGraphics”, Second Edition, CRC Press,2009.
5. Jung Hyun Han, “3D Graphics for Game Programming”, Chapman and Hall/CRC, 2011.

21ITV608	3D PRINTING AND DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To discuss on basics of 3D printing
  To explain the principles of 3D printing technique
- To explain and illustrate inkjet technology
- To explain and illustrate laser technology
- To discuss the applications of 3D printing

UNIT I	INTRODUCTION	9 **Hrs**

Introduction; Design considerations – Material, Size, Resolution, Process; Modelling and viewing - 3D; Scanning; Model preparation – Digital; Slicing; Software; File formats

UNIT II	PRINCIPLE	9 **Hrs**

Processes — Extrusion, Wire, Granular, Lamination, Photopolymerisation; Materials - Paper, Plastics, Metals, Ceramics, Glass, Wood, Fiber, Sand, Biological Tissues, Hydrogels, Graphene; Material Selection - Processes, applications, limitations

UNIT III	INKJET TECHNOLOGY	9 **Hrs**

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 basedfabrication — Colourjet

UNIT IV	LASER TECHNOLOGY	9 **Hrs**

Light Sources – Types, Characteristics; Optics – Deflection, Modulation; Material feeding and flowLiquid, powder; Printing machines — Types, Working Principle, Build Platform, Print bedMovement, Support structures

UNIT V	INDUSTRIAL APPLICATIONS	9 **Hrs**

Product Models, manufacturing – Printed electronics, Biopolymers, Packaging, Healthcare, Food, Medical, Biotechnology, Displays; Future trends

TOTAL: 45 Periods

COURSE OUTCOMES:

At the end of this course, the students 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

inkjettechnique

- 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.

REFERENCES:

1. Chua, C.K., Leong K.F. and Lim C.S., Rapid prototyping: Principles and applications, second edition, World Scientific Publishers, 2010
2. Ibrahim Zeid, Mastering CAD CAM Tata McGraw-Hill Publishing Co., 2007
3. Joan Horvath, Mastering 3D Printing, APress, 2014

21ITV701	KNOWLEDGE ENGINEERING	**L**	**T**	**P**	**C**
		3	0	0	3

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 **Hrs**

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 **Hrs**

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 **Hrs**

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 **Hrs**

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 **Hrs**

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:

At the end of this course, the students 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 BOOKS:

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2019. (Unit 1 – Chapter 1 / Unit 2 – Chapter 3,4 / Unit 3 – Chapter 5, 9 / Unit4 - 7 , Unit 5 — Chapter 8, 9)

REFERENCES:

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,200

21CSV702	SOFT COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on humanexperience.
- To provide the mathematical background for carrying out the optimization associated withneural network learning
- To learn various evolutionary Algorithms.
- To become familiar with neural networks that can learn from available examples andgeneralize to form appropriate rules for inference systems.
- To introduce case studies utilizing the above and illustrate the Intelligent behavior ofprograms based on soft computing

UNIT I	INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC	9 **Hrs**

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 **Hrs**

Supervised Learning Neural Networks – Perceptrons - Backpropagation -Multilayer Perceptrons – Unsupervised Learning Neural Networks – Kohonen Self-Organizing Networks

UNIT III	GENETIC ALGORITHMS	9 **Hrs**

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 **Hrs**

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 **Hrs**

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:

- Understand the fundamentals of fuzzy logic operators and inference mechanisms
- Understand neural network architecture for AI applications such as classification andclustering
- 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 BOOKS:

1. SaJANG, J.-S. R., SUN, C.-T., & MIZUTANI, E. (1997). Neuro-fuzzy and soft computing: Acomputational 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

REFERENCES

1. roj Kaushik and Sunita Tiwari, Soft Computing-Fundamentals Techniques and Applications, 1st Edition, McGraw Hill, 2018.
2. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.
3. Samir Roy, Udit Chakraborthy, Introduction to Soft Computing, Neuro Fuzzy and GeneticAlgorithms, Pearson Education, 2013.
4. S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Third Edition, Wiley India PvtLtd, 2019.
5. R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence - PC Tools", AP Professional, Boston, 1999

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21CSV705	OPTIMIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

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 **Hrs**

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 **Hrs**

Integer programming: Branch and bound method- Transportation and Assignment problems - Traveling salesman problem

UNIT III	PROJECT SCHEDULING	9 **Hrs**

Project network -Diagram representation – Floats - Critical path method (CPM) – PERT- Cost considerations in PERT and CPM

UNIT IV	CLASSICAL OPTIMIZATION THEORY	9 **Hrs**

Unconstrained problems – necessary and sufficient conditions - Newton-Raphson method, Constrained problems – equality constraints – inequality constraints - Kuhn-Tucker conditions

UNIT V	QUEUING MODELS	9 **Hrs**

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:

On successful completion of this course, the student will 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.

REFERENCES:

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.

21ITV706	GAME THEORY	L	T	P	C
		3	0	0	3

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 41odeIIing applications.
- To draw the connections between game theory, computer science, and economics, especially emphasizing the computational issues.
- To introduce contemporary topics in the intersection of game theory, computer science, and economics.
- To apply game theory in searching, auctioning and trading.

UNIT I	INTRODUCTION	9 **Hrs**

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 **Hrs**

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 **Hrs**

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 **Hrs**

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 **Hrs**

Aggregating Preferences — Social Choice — Formal Model — Voting — Existence of social functions — Ranking systems — Protocols for Strategic Agents: Mechanism Design — Mechanismdesign with unrestricted preferences
TOTAL: 45 Periods

COURSE OUTCOMES:

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

- Discuss the notion of a strategic game and equilibria and identify the characteristics ofmain 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.
- 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.

21UIT707	COGNITIVE SCIENCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To know the theoretical background of cognition.
- To understand the link between cognition and computational intelligence.
- To explore probabilistic programming language.
- To study the computational inference models of cognition.
- To study the computational learning models **of cognition**.

UNIT I	PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE	9 **Hrs**

Philosophy: Mental-physical Relation – From Materialism to Mental Science – Logic and theSciences 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 **Hrs**

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 **Hrs**

WebPPL Language – Syntax – Using Javascript Libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Coroutines: Functions that receive continuations –Enumeration

UNIT IV	INFERENCE MODELS OF COGNITION	9 **Hrs**

Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence – Data Analysis – Algorithms for Inference

UNIT V	LEARNING MODELS OF COGNITION	9 **Hrs**

Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models– Learning (Deep) Continuous Functions – Mixture Models

TOTAL: 45 Periods

COURSE OUTCOMES:

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

- Understand the underlying theory behind cognition.
- Connect to the cognition elements computationally.
- Implement mathematical functions through WebPPL.
- Develop applications using cognitive inference model.
- Develop applications using cognitive learning model.

TEXT BOOK:

1. Vijay V Raghavan,Venkat N.Gudivada, VenuGovindaraju, C.R. Rao, Cognitive Computing:Theory and Applications: (Handbook of Statistics 35), Elsevier publications, 2019
2. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big DataAnalytics, Wiley Publications, 2015
3. Robert A. Wilson, Frank C. Keil, "The MIT Encyclopedia of the Cognitive Sciences",TheMIT Press, 1999.
4. Jose Luis Bermúdez, Cognitive Science -An Introduction to the Science of the Mind,Cambridge University Press 2020

REFERENCES:

1. Noah D. Goodman, Andreas Stuhlmuller, "The Design and Implementation of ProbabilisticProgramming Languages", Electronic version of book, https://dippl.org/.
2. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, "ProbabilisticModels of Cognition", Second Edition, 2019, https://probmods.org/.

21CSV708	ETHICS AND AI	L	T	P	C
		3	0	0	3

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 **Hrs**

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 **Hrs**

International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles , Warfare and weaponization

UNIT III	AI STANDARDS AND REGULATION	9 **Hrs**

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: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS	9 **Hrs**

Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility-Roboethics Taxonomy.

UNIT V	AI AND ETHICS- CHALLENGES AND OPPORTUNITIES	9 **Hrs**

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:

On completion of the course, the students 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 andSemi-Autonomous Systems
- Understand the concepts of Roboethics and Morality with professional responsibilities.
- Learn about the societal issues in AI with National and International Strategies on AI

TEXT BOOKS:

1. y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield ,"The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 934.452 — March 2020
2. Patrick Lin, Keith Abney, George A Bekey," Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press-January 2014.

REFERENCES**:**

1. Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations,Theory, and Algorithms) by Paula Boddington, November 2017
2. Mark Coeckelbergh," AI Ethics", The MIT Press Essential Knowledge series, April 2020
3. Web link:
4. https://sci-hub.mksa.top/10.1007/978-3-540-30301-5_95
5. https://www.scu.edu/ethics/all-about-ethics/artificial-intelligence-and-ethics-sixteen- challenges-and-opportunities/
6. https://www.weforum.org/agenda/2019/10/top-10-ethical-issues-in-artificial-intelligence/ 7. https://sci-hub.mksa.top/10.1159/000492428

21CBV401	**HUMAN RESOURCE MANAGEMENT FOR ENTREPRENEURS**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES :

- To introduce the basic concepts, structure and functions of human resource management for entrepreneurs.
- To create an awareness of the roles, functions and functioning of human resource department.
- To understand the methods and techniques followed by Human Resource Management practitioners.

UNIT I	INTRODUCTION TO HRM	9 **Hrs**

Concept, Definition, Objectives- Nature and Scope of HRM - Evolution of HRM - HR Manager Roles- Skills - Personnel Management Vs. HRM - Human Resource Policies - HR Accounting - HR Audit - Challenges in HRM.

UNIT II	HUMAN RESOURCE PLANNING	9 **Hrs**

HR Planning - Definition - Factors- Tools - Methods and Techniques - Job analysis- Job rotationJob Description - Career Planning - Succession Planning - HRIS - Computer Applications in HR - Recent Trends

UNIT III	RECRUITMENT AND SELECTION	9 **Hrs**

Sources of recruitment- Internal Vs. External - Domestic Vs. Global Sources -eRecruitment - Selection Process- Selection techniques -eSelection- Interview Types- Employee Engagement.

UNIT IV	TRAINING AND EMPLOYEE DEVELOPMENT	9 **Hrs**

Types of Training - On-The-Job, Off-The-Job - Training Needs Analysis – Induction andSocialisation Process - Employee Compensation - Wages and Salary Administration – Health and Social Security Measures- Green HRM Practices

UNIT V	CONTROLLING HUMAN RESOURCES	9 **Hrs**

Performance Appraisal – Types - Methods - Collective Bargaining - Grievances Redressal Methods – Employee Discipline – Promotion – Demotion - Transfer – Dismissal - Retrenchment - Union Management Relationship - Recent Trends

TOTAL: 45 Periods

COURSE OUTCOMES:

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

- To understand the Evolution of HRM and Challenges faced by HR Managers
- To learn about the HR Planning Methods and practices.
- To acquaint about the Recruitment and Selection Techniques followed in Industries.
- To known about the methods of Training and Employee Development
- To comprehend the techniques of controlling human resources in organisations.

Text Book(s)

1. Gary Dessler and Biju Varkkey, Human Resource Management, 14e , Pearson, 2015.
2. Mathis and Jackson, Human Resource Management, Cengage Learning 15e, 2017.
3. David A. Decenzo, Stephen.P.Robbins, and Susan L. Verhulst, Human Resource Management, Wiley, International Student Edition, 11th Edition, 2014
4. R. Wayne Mondy, Human Resource Management, Pearson , 2015.
5. Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy. Managing Human Resource. PHI Learning. 2012
6. John M. Ivancevich, Human Resource Management,12e, McGraw Hill Irwin,2013.
7. K. Aswathappa, Sadhna Dash , Human Resource Management - Text and Cases , 9th Edition,

McGraw Hill, 2021.
8. Uday Kumar Haldar, Juthika Sarkar. Human Resource management. Oxford.

21CBV404	**SUPPLY CHAIN MANAGEMENT**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES :

- To understand the importance of supply chain management
- To learn decisions in supply chain management for gaining competitive advantage
- To design supply chain networks to enhance supply chain performance
- To plan demand based on inventory and supply
- To understanding the role of logistics in supply chain performance

UNIT I	INTRODUCTION	9 **Hrs**

Supply Chain – Fundamentals, Evolution, Role in Economy, Importance, Decision Phases, Enablers & Drivers of Supply Chain Performance; Supply chain strategy; Supply Chain Performance Measures.

UNIT II	SUPPLY CHAIN NETWORK	9 **Hrs**

Distribution Network Design – Role in supply chain, Influencing factors, design options, online sales and distribution network, Distribution Strategies; Network Design in supply chain – Role, influencing factors, framework for network design, Impact of uncertainty on Network Design.

UNIT III	PLANNING DEMAND, INVENTORY AND SUPPLY	9 **Hrs**

Managing supply chain cycle inventory and safety inventory - Uncertainty in the supply chain ,Analyzing impact of supply chain redesign on the inventory, Risk Pooling, Managing inventory for short life-cycle products, multiple item -multiple location inventory management; Pricing and Revenue Management.

UNIT IV	LOGISTICS	9 **Hrs**

Transportation – Role, Modes and their characteristics, infrastructure and policies, transport documentation, design options, trade-offs in transportation design, intermodal transportation. Logistics outsourcing – catalysts, benefits, value proposition. 3PL, 4PL, 5PL, 6PL; International Logistics -objectives, importance in global economy, Characteristics of global supply chains, Incoterms.

UNIT V	SUPPLY CHAIN INNOVATIONS	9 **Hrs**

Supply Chain Integration, SC process restructuring, IT in Supply Chain; Agile Supply Chains, Legible supply chain, Green Supply Chain, Reverse Supply chain; Supply chain technology trends – AI, Advanced analytics, Internet of Things, Intelligent things, conversational systems, robotic process automation, immersive technologies, Block chain.

TOTAL: 45 Periods

COURSE OUTCOMES:

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

- Understanding of supply chain fundamentals
- Ability to design supply chain networks to enhance supply chain performance
- Ability to plan demand based on inventory and supply
- Understanding the role of logistics in supply chain performance
- Awareness of innovations for sustainable supply chains

Text Book(s)

1. Chopra, Sunil, Meindl, Peter and Kalra, D. V.; Supply Chain Management: Strategy, Planning and Operation; Pearson Education, 2015.
2. Altekar, Rahul V.; Supply Chain Management: Concepts and Cases; PHI Learning, 2005.

Reference(s)

1. Sunil Chopra, Peter Meindl and DharamVirKalra, Supply Chain Management-Strategy Planning and Operation, Pearson Education, Sixth Edition, 2016.
2. Janat Shah, Supply Chain Management – Text and Cases, Pearson Education, 2009
3. Ballou Ronald H, Business Logistics and Supply Chain Management, Pearson Education, 5thEdition, 2007. 152
4. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, Designing and Managing the SupplyChain: Concepts, Strategies, and Cases, Tata McGraw-Hill, 2005.
5. Pierre David, International Logistics, Biztantra, 2011.

21CDV407	SOCIAL DATA MINING	L	T	P	C
		3	0	0	3

COURSE DESIGNATION :

PRE-REQUISTIES:

COURSE OBJECTIVES :

- To collect user-generated information from social media platforms.
- To extract valuable data from consumers for identifying patterns and trends
- To arrive business conclusions.
- To study easier detection of spammers and bots
- To study the role social media data in research .

UNIT I DATA MINING FOUNDATIONS	**6**
Introduction – Data mining functionalities – Classification of Data mining systems – Preprocessing - Association Rules and Sequential Patterns – Supervised Learning – Unsupervised Learning – Partially Supervised Learning – Association Rule Mining – Classification – Clustering.	
UNIT II ANALYZING THE SOCIAL WEB	**6**
Introduction - Nodes, Edges, and Network Measures - Network Structure and Measures - Network Visualization - Social Information Filtering - Social Media in the Public Sector- Privacy	
UNIT III MINING THE SOCIAL WEB	**6**
Mining Twitter – Mining Facebook – Mining LinkedIn – Mining Google+ - Mining GitHub – Mining Mailboxes	
UNIT IV COMMUNITIES AND INTERACTIONS	**6**
Community Analysis – Detection – Evolution – Evaluation – Information Diffusion in social media – Herd behavior – Information Cascades – Diffusion of Innovations - Epidemics	
UNIT V APPLICATIONS	**6**
Influence and Homophily – Recommendation in Social Media - Classical Recommendation Algorithms – Recommendation using Social Context – Evaluating Recommendations – Behavior Analytics- Individual and Collective Behavior	

COURSE OUTCOMES:

CO1: Students will study to collect user-generated information from social media platforms.

CO2: Extract valuable data from consumers for identifying patterns and trends

CO3: Perform social media monitoring and arrive business conclusions for application.

CO4: Detection of spammers and bots in social media platform.

CO5: Exploring the research perspective of social media data. 3. Creating blockchain applications in metaverse, by creating virtual assets, smart Contracts for exchange of assets using utility tokens and NFTs.

CO6: Create any Metaverse based application by picking one usecase.

- COURSE OUTCOMES:
- CO1:Students will understand the History of Metaverse.
- CO2:Learn the role of Metaverse to connect the real world and blockchain.
- CO3:Working with advanced development of blockchain in the future.
- CO4:Exploring the open ecosystem of smart properties and assets.
- CO5:Integrating futuristic technologies such as blockchain, cryptocurrency, DAO, AR/VR

TEXT BOOKS

1. Jiawei Han and Micheline Kamber, ―Data Mining Concepts and Techniques‖, Third Edition, Elsevier, 2012.

2. Bing Liu, “Web Data Mining-Exploring Hyperlinks, Contents, and Usage Data”, Springer, Second Edition, 2011.

REFERENCES:

1. Reza Zafarani, Mohammad Ali Abbasi and Huan Liu, “Social Media Mining - An Introduction”, Cambridge University Press, 2014.

2. Matthew A.Russell, “Mining the social web”, 2nd edition- O'Reilly Media, 2013.

3. Jennifer Golbeck, Analyzing the social web, Morgan Kaufmann, 2013.

4. Social Media Data Mining and Analytics Paperback ,by Gabor Szabo , Gungor Polatkan , P. Oscar Boykin , Antonios Chalkiopoulos ,Wiely Publisher 2018 5. Advanced Data Mining Tools and Methods for Social Computing ,Sourav De, Sandip Dey, Siddhartha Bhattacharyya, Surbhi Bhatia,Elsiever,2022

21CDV408	MARKETING AND SOCIAL MEDIA WEB ANALYTICS	L	T	P	C
		3	0	0	3

COURSE DESIGNATION :

PRE-REQUISTIES:

COURSE OBJECTIVES :

- To showcase the opportunities that exist today to leverage the power of the web and social media

UNIT I **MARKETING ANALYTICS**	9
Marketing Budget and Marketing Performance Measure, Marketing - Geographical Mapping, Data Exploration, Market Basket Analysis	
UNIT II **COMMUNITY BUILDING AND MANAGEMENT**	9
History and Evolution of Social Media-Understanding Science of Social Media –Goals for using Social Media- Social Media Audience and Influencers - Digital PR- Promoting Social Media Pages- Linking Social Media Accounts-The Viral Impact of Social Media.	
UNIT III **SOCIAL MEDIA POLICIES AND MEASUREMENTS**	9
Social Media Policies-Etiquette, Privacy- ethical problems posed by emerging social media technologies - The Basics of Tracking Social Media.	
UNIT IV **WEB ANALYTICS**	9
Data Collection, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Proposals & Reports, Web Data Analysis.	
UNIT V **SEARCH ANALYTICS**	9
45 PERIODS	
Search engine optimization (SEO), user engagement, user-generated content, web traffic analysis, online security, online ethics, data visualization.	
Course Outcomes *At the end of the course the student will be able to* The Learners will understand social media, web and social media analytics and their potential impact.	
REFERENCE BOOKS: 1. K. M. Shrivastava, Social Media in Business and Governance, Sterling Publishers Private Limited, 2013 2. Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014 3. Bittu Kumar, Social Networking, V & S Publishers, 2013 4. Avinash Kaushik, Web Analytics - An Hour a Day, Wiley Publishing, 2007	

5. Ric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress 2004
6. Takeshi Moriguchi, Web Analytics Consultant Official Textbook, 7th Edition, 2016

21CBV403	**FINANCIAL MANAGEMENT**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES :

- Understand the fundamental concepts of financial management
- Understand valuation of securities.
- Analyse operating and financial leverages.
- Comprehend and apply the concepts of capital budgeting.
- Understand cash management.

UNIT I	INTRODUCTION	9 **Hrs**

Introduction: Introduction to Financial Management - Goals of the firm - Financial Environments. Time Value of Money: Simple and Compound Interest Rates, Amortization, Computing more that once a year, Annuity Factor.

UNIT II	VALUATION OF SECURITIES	9 **Hrs**

Valuation of Securities: Bond Valuation, Preferred Stock Valuation, Common Stock Valuation, Concept of Yield and YTM. Risk & Return: Defining Risk and Return, Using Probability Distributions to Measure Risk, Attitudes Toward Risk, Risk and Return in a Portfolio Context, Diversification, The Capital Asset Pricing Model (CAPM).

UNIT III	OPERATING & FINANCIAL LEVERAGE	9 **Hrs**

Operating & Financial Leverage: Operating Leverage, Financial Leverage, Total Leverage, Indifference Analysis in leverage study. Cost of Capital: Concept, Computation of Specific Cost of Capital for Equity - Preference – Debt, Weighted Average Cost of Capital – Factors affecting Cost of Capital 4L.

UNIT IV	CAPITAL BUDGETING	9 **Hrs**

Capital Budgeting: The Capital Budgeting Concept & Process - An Overview, Generating Investment Project Proposals, Estimating Project, After Tax Incremental Operating Cash Flows, Capital Budgeting Techniques, Project Evaluation and Selection - Alternative Methods. Working Capital Management: Overview, Working Capital Issues, Financing Current Assets (Short Term and Long Term- Mix), Combining Liability Structures and Current Asset Decisions, Estimation of Working Capital.

UNIT V	CASH MANAGEMENT	9 **Hrs**

Cash Management: Motives for Holding cash, Speeding Up Cash Receipts, Slowing Down Cash Payouts, Electronic Commerce, Outsourcing, Cash Balances to maintain, Factoring. Accounts Receivable Management: Credit & Collection Policies, Analyzing the Credit Applicant, Credit References, Selecting optimum Credit period. **TOTAL: 45 Periods**

COURSE OUTCOMES:

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

- Understand the fundamental concepts of financial management
- Apply valuation of securities and calculate the risk & return in portfolio management.
- Build a Chabot for any application and deploy it
- Analyse the cost structure of a company using operating and financial leverages.
- Develop capital budgets and to estimate working capital. CO5: Apply cash management in business

Text Book(s)

1. Chandra, Prasanna - Financial Management - Theory & Practice, Tata McGraw Hill, 2007.
2. Srivastava, Misra: Financial Management, OUP, 2011.
3. Van Horne and Wachowicz : Fundamentals of Financial Management, Prentice Hall/ Pearson Education.
4. Financial Management: Theory & Practice: by Brigham and Ernhardt, 14th edition, Cengage, 2015.
5. M.Y. Khan and P.K.Jain Financial management, Text, Problems and cases Tata McGraw Hill, 6th edition, 2011.
6. M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd., 10th edition, 2012.

21CSV505	DIGITAL MARKETING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- The primary objective of this module is to examine and explore the role and importance ofdigital marketing in today's rapidly changing business environment.
  It also focuses on how digital marketing can be utilized by organizations and howits effectiveness can be measured

UNIT I	INTRODUCTION TO ONLINE MARKET	9 **Hrs**

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing

UNIT II	SEARCH ENGINE OPTIMISATION	9 **Hrs**

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 **Hrs**

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 **Hrs**

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	DIGITAL TRANSFORMATION	9 **Hrs**

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:

- To examine and explore the role and importance of digital marketing in today'srapidly changing business environment..
- To focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.
- To know the key elements of a digital marketing strategy.

- To study how the effectiveness of a digital marketing campaign can be measured
- To demonstrate advanced practical skills in common digital marketing tools such as SEO,SEM, Social media and Blogs.

TEXT BOOKS

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education;
2. First edition (July 2017);ISBN-10: 933258737X;ISBN-13: 978-9332587373.
3. Digital Marketing by Vandana Ahuja ;Publisher: Oxford University Press (April 2015). ISBN-10: 0199455449
4. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition (April 2017); ISBN10: 9788129599938;ISBN 13: 9788129599938;ASIN: 8129599930.
5. Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited..
6. Barker, Barker, Bormann and Neher(2017), Social Media Marketing: A Strategic Approach, 2E South-Western ,Cengage Learning.
7. Pulizzi,J Beginner's Guide to Digital Marketing , Mcgraw Hill Education

21CBV408	Marketing Research and MarketingManagement	L	T	P	C
		3	0	0	3

COURSE DESIGNATION :

PRE-REQUISTIES:

COURSE OBJECTIVES:

- To understand the changing business environment and the fundamental premise underlying market driven strategies.
- To identify the indicators of management thoughts and practices.
- To analyze the nature of consumer buying behaviour
- To understanding the marketing research
- To new trends in the arena of marketing

UNIT I INTRODUCTION	6

Defining Marketing − Core concepts in Marketing – Evolution of Marketing − Marketing Planning Process − Scanning Business environment: Internal and External − Value chain − Core Competencies – PESTEL − SWOT Analysis − Marketing interface with other functional areas – 147 Production, Finance, Human Relations Management, Information System − Marketing in global environment – International Marketing − Rural Marketing − Prospects and Challenges

UNIT II MARKETING STRATEGY	6

Marketing strategy formulations – Key Drivers of Marketing Strategies - Strategies for Industrial Marketing – Consumer Marketing − Services marketing – Competition Analysis − Analysis of consumer and industrial markets − Influence of Economic and Behavioral Factors − Strategic Marketing Mix components.

UNIT III MARKETING MIX DECISIONS	6

Product planning and development – Product life cycle – New product Development and Management – Defining Market Segmentation – Targeting and Positioning − Brand Positioning and Differentiation – Channel Management – Managing Integrated Marketing Channels − Managing Retailing, Wholesaling and Logistics − Advertising and Sales Promotions – Pricing Objectives, Policies and Methods.

UNIT IV BUYER BEHAVIOUR	6

Understanding Industrial and Consumer Buyer Behaviour − Influencing factors – Buyer Behaviour Models – Online buyer behaviour − Building and measuring customer satisfaction – Customer relationships management – Customer acquisition, Retaining, Defection − Creating Long Term Loyalty Relationships. Do case studies on understanding consumer Decision-making Styles in India - Domestic Vs Foreign brand clothing.

UNIT V MARKETING RESEARCH & TRENDS IN MARKET	6

Marketing Information System – Marketing Research Process – Concepts and applications: Product – Advertising – Promotion – Consumer Behaviour – Retail research – Customer driven organizations - Cause related marketing − Ethics in marketing – Online marketing trends - social media and digital marketing. Do an analysis on Amazon in India.

COURSE OUTCOMES:

CO1: Applied knowledge of contemporary marketing theories to the demands of business and management practice

CO2: Enhanced knowledge of marketing strategies for consumer and industrial marketing

CO3 : Deep understanding of choice of marketing mix elements and managing integrated marketing channels

CO4: Ability to analyze the nature of consumer buying behaviour

CO5: Understanding of the marketing research and new trends in the arena of marketing

TEXT BOOKS

1. Philip. T. Kotler and Kevin Lane Keller, Marketing Management, Prentice Hall India, 15th Edition, 2017 2. KS Chandrasekar, “Marketing management-Text and Cases”, Tata McGraw Hill Education, 2012

REFERENCES

1. Lamb, Hair, Sharma, Mc Daniel– Marketing – An Innovative approach to learning and teaching- A south Asian perspective, Cengage Learning, 2012.

2. Paul Baines, Chris Fill, Kelly Page, Marketing, Asian edition, Oxford University Press,5 th edition, 2019

3. Ramasamy, V.S, Namakumari, S, Marketing Management: Global Perspective Indian Context, Macmillan Education, New Delhi, 6 th edition, 2018.

4. A. NAG, Marketing successfully- A Professional Perspective, Macmillan 2008.

5. Micheal R.Czinkota, Masaaki Kotabe, Marketing Management, Vikas Thomson Learning, 2nd edition 2006

21CBV601	ADVANCED SOCIAL, TEXT AND MEDIA ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basic issues and types of social, text and media mining
- Familiarize the learners with the concept of social, text and media analytics and understand its significance
- Familiarize the learners with the tools of social, text and media analytics.
- Enable the learners to develop skills required for analyzing the effectiveness of social, text and media for business purposes
- To know the applications in real time systems

UNIT I	INTRODUCTION TO SOCIAL MEDIA ANALYSIS	9 **Hrs**

Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas. Network fundamentals and models: The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization.

UNIT II	OVERVIEW OF TEXT MINING	9 **Hrs**

Overview of text mining- Definition- General Architecture– Algorithms– Core Operations – Preprocessing–Types of Problems- basics of document classification- information retrieval clustering and organizing documents- information extraction- prediction and evaluation.

UNIT III	TEXT MINING FOR INFORMATION RETRIEVAL AND INFORMATION EXTRACTION	9 **Hrs**

Information retrieval and text mining- keyword search- nearest-neighbor methods- similarity- web based document search- matching- inverted lists- evaluation. Information extraction- Architecture - Co-reference - Named Entity and Relation Extraction-. Text Summarization Techniques - Topic Representation - Influence of Context - Indicator Representations – Pattern Extraction - Apriori Algorithm – FP Tree algorithm.

UNIT IV	WEB ANALYTICS TOOLS	9 **Hrs**

Click stream analysis, A/B testing, online surveys, Web crawling and Indexing. Natural Language Processing Techniques for Micro-text Analysis. Do a case study on Google analytics

UNIT V	CONTROLLING HUMAN RESOURCES	9 **Hrs**

Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post- performance on FB. Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis. Case study : Identify Consumer Preferences and Market Positioning of a New Product.

TOTAL: 45 Periods

Text Book(s)

1.Matthew Ganis, Avinash Kohirkar , Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media, Pearson, 2016.
2. Jim Sterne, Social Media Metrics: How to Measure and Optimize Your Marketing Investment, Wiley, 2010.
3. Oliver Blanchard ,Social Media ROI: Managing and Measuring Social Media Efforts in

Your Organization (Que Biz-Tech), 2019
4. Sholom Weiss, Nitin Indurkhya, Tong Zhang, Fred Damerau “The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data”, Springer, paperback 2010
5. Ronen Feldman, James Sanger -“ The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data”, Springer, paperback 2010.
6. Tracy L. Tuten, Michael R. Solomon, Social Media Marketing , Sage, 2016.

21CBV602	CONVERSATIONAL SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

- Enable attendees to acquire knowledge on chatbots and its terminologies
- Work with ML Concepts and different algorithms to build custom ML Model
- Better understand on Conversational experiences and provide better customer experiences

UNIT I	FUNDAMENTALS OF CONVERSATIONAL SYSTEMS	9 Hrs

Introduction: Overview, Case studies, Explanation about different modes of engagement for a human being, History and impact of AI. Underlying technologies: Natural Language Processing, Artificial Intelligence and Machine Learning, NLG, Speech-To-Text, Text-To-Speech, Computer Vision etc. Introduction to Top players in Market – Google, MS, Amazon &Market trends. Messaging Platforms (Facebook, WhatsApp) and Smart speakers – Alexa, Google Home and other new channels. Ethical and Legal Considerations in AI Overview..

UNIT II	FOUNDATIONAL BLOCKS FOR PROGRAMMING AND NATURAL LANGUAGE PROCESSING	9 Hrs

Introduction: Brief history, Basic Concepts, Phases of NLP, Application of chat bots etc. General chatbot architecture, Basic concepts in chatbots: Intents, Entities, Utterances, Variables and Slots, Fulfillment. Lexical Knowledge Networks (WordNet, Verbnet, PropBank, etc). Lexical Analysis, Part-of-Speech Tagging, Parsing/Syntactic analysis, Semantic Analysis, Word Sense Disambiguation. Information Extraction, Sentiment Analysis.

UNIT III	BUILDING A CHAT BOT / CONVERSATIONAL AI SYSTEMS	9 Hrs

Fundamentals of Conversational Systems (NLU, DM and NLG) - Chatbot framework & Architecture, Conversational Flow & Design, Intent Classification (ML and DL based techniques), Dialogue Management Strategies, Natural Language Generation. UX design, APIs and SDKs, Usage of Conversational Design Tools. Introduction to popular chatbot frameworks – Google Dialog flow, Microsoft Bot Framework, Amazon Lex, RASA Channels: Facebook Messenger, Google Home, Alexa, WhatsApp, Custom Apps. Overview of CE Testing techniques, A/B Testing, Introduction to Testing Frameworks - Botium /Mocha ,Chai. Security & Compliance – Data Management, Storage, GDPR, PCI.

UNIT IV	ROLE OF ML/AI IN CONVERSATIONAL TECHNOLOGIES AND CONTACT CENTERS	9 Hrs

Brief Understanding on how Conversational Systems uses ML technologies in ASR, NLP, Advanced Dialog management, Language Translation, Emotion/Sentiment Analysis, Information extraction ,etc. to effectively converse, Introduction to Contact centers – Impact & Terminologies. Case studies & Trends, How does a Virtual Agent/Assistant fit in here?

UNIT V	CONVERSATIONAL ANALYTICS AND FUTURE	9 Hrs

Conversation Analytics : The need of it - Introduction to Conversational Metrics - Summary, Robots and Sensory Applications overview - XR Technologies in Conversational Systems , XRCommerce - What to expect next? – Future technologies and market innovations overview. **TOTAL: 45 Periods**

COURSE OUTCOMES:

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

- Familiarize in the NLTK tool kit and the pre-processing techniques of natural language processing.
- Familiarize with the basic technologies required for building a conversational system.
- Build a Chabot for any application and deploy it
- Involve AI in building conversational system and build advanced systems that can be cognitively inclined towards human behaviour.
- Build a real time working conversational system for social domain that can intelligently process inputs and generate relevant replies.

Text Book(s)

1. Michael McTear, “Conversational AI: Dialogue Systems, Conversational Agents, and Chatbots”, Second Edition, Moran and Claypool Publishers, 2020.
2. Cathy Pearl, “Designing Voice User Interfaces: Principles of Conversational Experiences”, O’REILLY, 2016.

21CBV603	SOCIAL MEDIA MARKETING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The student should be made to:

1. To understand, design and implement online marketing tools.
2. Translate some of the key marketing and business models
3. Review the history of social media marketing
4. Explain the key social media marketing activities needed for competitive success

UNIT I	SOCIAL MEDIA MARKETING	9 **Hrs**

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 II	DIGITAL TRANSFORMATION	9 **Hrs**

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

UNIT III	COMMUNITY BUILDING AND MANAGEMENT	9 **Hrs**

History and Evolution of Social Media-Understanding Science of Social Media –Goals for using Social Media- Social Media Audience and Influencers - Digital PR- Promoting Social Media PagesLinking Social Media Accounts-The Viral Impact of Social Media

UNIT IV	SOCIAL MEDIA POLICIES AND MEASUREMENTS	9 **Hrs**

Social Media Policies-Etiquette, Privacy- ethical problems posed by emerging social media technologies - The Basics of Tracking Social Media

UNIT V	MARKETING RESEARCH & TRENDS IN MARKET	9 **Hrs**

Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post- performance on FB. Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis. Case study : Identify Consumer Preferences and Market Positioning of a New Product.

Relationship - Recent Trends **TOTAL: 45 Periods**

COURSE OUTCOMES:

COURSE OUTCOMES:

Summarize the Social media marketing environment [Understand]

- Analyse the Dynamics of online selling and related metrics [Understand]
- Evaluate the managerial implication in community building and management. [Analyze]
- Demonstrate social media polices and measurements.[Analyze]
- Develop the Advertising Online and Social Media Marketing strategies [Apply]

Text Book(s)

REFERENCES:

1. K. M. Shrivastava, Social Media in Business and Governance, Sterling Publishers Private Limited, 2013
2. Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014
3. Bittu Kumar, Social Networking, V & S Publishers, 2013
4. Avinash Kaushik, Web Analytics - An Hour a Day, Wiley Publishing, 2007
5. ric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress, 2004
6. TakeshiMoriguchi, Web Analytics Consultant Official Textbook, 7th Edition, 2016

R21CBV604	WEB ANALYTICS AND SEARCH ENGINE OPTIMIZATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The student should be made to:

- To understand, design and implement web analytics
- Familiarize the learners with the concept of search engine optimization and understand its significance
- Familiarize the learners with the tools of web analytics
- Enable the learners to develop skills required for analyzing the effectiveness of web analytics and search engine optimization for business purposes

UNIT I	WEB ANALYTICS	9 Hrs

Web Analytics - Present and Future, Data Collection - Importance and Options, Overview of qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Web Analytics Fundamentals, Concepts, Proposals & Reports, Web Data Analysis

UNIT II	DIGITAL TRANSFORMATION	9 Hrs

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends and analytics in Digital marketing.

UNIT III	SEARCH ENGINE OPTIMIZATION	9 Hrs

Search engine optimization (SEO), non-linear media consumption, user engagement, user generated content web traffic analysis, navigation, usability, eye tracking, online security, online ethics, content management system, data visualization, RSS feeds, Mobile platforms, User centered design, Understanding search behaviors Relationship - Recent Trends

UNIT IV	CONTROLLING HUMAN RESOURCES	9 Hrs

Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post-performance on FB. Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis. Case study : Identify Consumer Preferences and Market Positioning of a New Product

UNIT V	WEB ANALYTICS TOOLS	9 Hrs

Click stream analysis, A/B testing, online surveys, Web crawling and Indexing. Natural Language Processing Techniques for Micro-text Analysis. Do a case study on Google analytics

TOTAL: 45 Periods

COURSE OUTCOMES:

- Summarize the importance of web analytics [Understand]
- Analyze channel distribution and analytics [Analyze]
- Demonstrate Search Engine Optimization [Analyze]
- Analyze the page audience. Reach and Engagement analysis.[Analyze]
- Develop Click stream analysis web crawling and indexing [Apply].

Text Book(s)

1. Matthew Ganis, Avinash Kohirkar , Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media, Pearson, 2016.
2. Jim Sterne, Social Media Metrics: How to Measure and Optimize Your Marketing Investment, Wiley, 2010.
3. Oliver Blanchard ,Social Media ROI: Managing and Measuring Social Media Efforts in Your Organization (Que Biz-Tech), 2019
4. Avinash Kaushik, Web Analytics - An Hour a Day, Wiley Publishing, 2007

5. ric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress, 2004
6. TakeshiMoriguchi, Web Analytics Consultant Official Textbook, 7th Edition, 2016

21CBV605	DIGITAL MARKETING ANALYTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The student should be made to:

- To understand, design and implement online marketing tools.
- Translate some of the key marketing and business models
- Review the history of digital marketing
- Explain the key digital marketing activities needed for competitive success

UNIT I	INTRODUCTION TO ONLINE MARKET	9 **Hrs**

Online Market space- Digital Marketing Strategy- Components -Opportunities for building BrandWebsite - Planning and Creation- Content Marketing.

UNIT II	E-COMMERCE AND DIGITAL MARKETING METRICS	9 **Hrs**

E-Commerce - Multi-channel retailing, Fulfilment, Comparison shopping engines, e-marketplaces and third-party shopping websites, e-commerce website; Metrics and Analytics – Introduction, Analytics presentation and use.

UNIT III	MARKETING ANALYTICS	9 **Hrs**

Introduction to Marketing Analytics-Marketing Budget and Marketing Performance Measure, Marketing Metrics and its application- Financial Implications of various Marketing Strategies- Geographical Mapping, Data Exploration, Market Basket Analysis

UNIT IV	WEB ANALYTICS	9 **Hrs**

Web Analytics - Present and Future, Data Collection - Importance and Options, Overview of qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Web Analytics Fundamentals, Concepts, Proposals & Reports, Web Data Analysis.

UNIT V	SEARCH ANALYTICS	9 **Hrs**

Search engine optimization (SEO), non-linear media consumption, user engagement, usergenerated content, web traffic analysis, navigation, usability, eye tracking, online security, online ethics, content management system, data visualization, RSS feeds, Mobile platforms, User centered design, Understanding search behaviors Relationship - Recent Trends **TOTAL: 45 Periods**

COURSE OUTCOMES:

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

- Summarize the Digital Marketing Environment [Understand]
- Analyse the Dynamics of online selling and related metrics [Understand]
- Evaluate the managerial implication in Website Development. [Analyze]
- Demonstrate the Search Engine Optimization and Email Marketing.[Analyze]
- Develop the Advertising Online and Social Media Marketing strategies [Apply].

REFERENCES:

1. K. M. Shrivastava, Social Media in Business and Governance, Sterling Publishers Private Limited, 2013
2. Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014
3. Bittu Kumar, Social Networking, V & S Publishers, 2013
4. Avinash Kaushik, Web Analytics - An Hour a Day, Wiley Publishing, 2007
5. ric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress, 2004
6. TakeshiMoriguchi, Web Analytics Consultant Official Textbook, 7th Edition, 2016

21CBV701	GUI Design and Applications	L	T	P	C
		3	0	0	3

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 6	9 **Hrs**

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy

UNIT II	FOUNDATIONS OF DESIGN 6	9 **Hrs**

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides

UNIT III	FOUNDATIONS OF DESIGN 6	9 **Hrs**

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 6	9 **Hrs**

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 6	9 **Hrs**

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

CO1:Build UI for user Applications
CO2:Evaluate UX design of any product or application
CO3:Demonstrate UX Skills in product development
CO4:Implement Sketching principles
CO5:Create Wireframe and Prototype

TEXT BOOKS

1. Joel Marsh, “UX for Beginners”, O’Reilly , 2022
2. Jon Yablonski, “Laws of UX using Psychology to Design Better Product & Services” O’Reilly 2021 REFERENCES
1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, “Designing Interface” 3 rd Edition , O’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.

21CBV702	APPLICATION DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

- To Understand HTML and CSS fundamentals, UNIX CLI for web servers.
- To Learn AJAX for asynchronous data exchange with servers.
- To Understand decision-making and loop structures in PHP.
- To apply version control using Git and GitHub for collaborative development.
- To explore data persistence using Spring JDBC.

UNIT I	Web Development Basics	9 **Hrs**

Web development Basics - HTML & Web servers Shell - UNIX CLI Version control - Git &Github HTML, CSS

UNIT II	Frontend Development	9 **Hrs**

JavaScript basics OOPS Aspects of JavaScript Memory usage and Functions in JS AJAX for data exchange with server jQuery Framework jQuery events, UI components etc. JSON data format.

UNIT III	Introduction to PHP	9 **Hrs**

Evaluation of Php, Basic Syntax, Defining variable and constant, Php Data type, Operator and Expression. Decisions and loop.

UNIT IV	Function, Array and Files in PHP	9 **Hrs**

Functions, Recursive functions, Array Anatomy of an Array, Creating index based and Associative array, Accessing array. Handling Html Form with Php Capturing Form, Data Dealing with Multi-value filed, and Generating File uploaded form, redirecting a form after submission.

UNIT V	Databases & Deployment	9 **Hrs**

Relational schemas and normalization Structured Query Language (SQL) Data persistence using Spring JDBC Agile development principles and deploying application in Cloud **TOTAL: 45 Periods**

COURSE OUTCOMES:

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

CO1: Attain proficiency in web development basics, version control, and UNIX CLI operations.

CO2: Master frontend development with JavaScript, AJAX, jQuery, and JSON data manipulation.

CO3: Acquire foundational knowledge in PHP programming for web development.

CO4: Demonstrate expertise in PHP functions, arrays, and form handling techniques.

CO5: Develop a comprehensive understanding of databases, SQL, and deployment strategies for web applications.

TEXT BOOKS:

1. Web Design with HTML, CSS, JavaScript and JQuery Set Book by Jon Duckett Professional JavaScript for Web Developers Book by Nicholas C. Zakas
2. Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by Step Guide to Creating Dynamic Websites by Robin Nixon

REFERENCE BOOKS:

1. Full-Stack JavaScript Development by Eric Bush.
2. Mastering Full Stack React Web Development Paperback – April 28, 2017 by TomaszDyl, Kamil Przeorski, Maciej Czarnecki

21CBV703	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, and dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I	COMPUTATIONAL THINKING AND PROBLEM SOLVING	9 **Hrs**

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, and guess an integer number in a range, Towers of Hanoi.

UNIT II	DATA TYPES, EXPRESSIONS, STATEMENTS	9 **Hrs**

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III	CONTROL FLOW, FUNCTIONS, STRINGS	9 **Hrs**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

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

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V	FILES, MODULES, PACKAGES	9 **Hrs**

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

TOTAL: 45 Periods

COURSE OUTCOMES:

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

CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs using conditionals and looping for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries etc.
CO6: Read and write data from/to files in Python programs.

TEXT BOOKS:

1. Allen B. Downey, “Think Python: How to Think like a Computer Scientist”, 2nd Edition, O’Reilly Publishers, 2016.
2. Karl Beecher, “Computational Thinking: A Beginner's Guide to Problem Solving and programming”, 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers and Data Scientists”, 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data‘‘, Third Edition, MIT Press, 2021
4. Eric Matthes, “Python Crash Course, A Hands - on Project Based Introduction to Programming”, 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-Graw Hill, 2018

SYLLABUS – R-2021

21CBV704	PROGRAMMING IN JAVA	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES :

The student should be made to:

- To teach principles of object oriented programming paradigm including abstraction, encapsulation, inheritance and polymorphism.
- To impart fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
- To inculcate concepts of inheritance to create new classes from existing one & Design the classes needed given a problem specification;
- To familiarize the concepts of packages and interfaces.
- To facilitate students in handling exceptions.
- To demonstrate the concept of event handling used in GUI.

UNIT I	JAVA BASICS	6

Review of Object oriented concepts, History of Java, Java buzzwords, JVM architecture, Data types, Variables, Scope and life time of variables, arrays, operators, control statements, type conversion and casting, simple java program, constructors, methods, Static block, Static Data, Static Method String and String Buffer Classes, Using Java API Document.:

UNIT II	INHERITANCE AND POLYMORPHISM	6

Basic concepts, Types of inheritance, Member access rules, Usage of this and Super key word, Method Overloading, Method overriding, Abstract classes, Dynamic method dispatch, Usage of final keyword.

UNIT III	PACKAGES AND INTERFACES	6

Defining package, Access protection, importing packages, Defining and Implementing interfaces, and Extending interfaces. I / O STREAMS: Concepts of streams, Stream classes- Byte and Character stream, Reading console Input and Writing Console output, File Handling.

UNIT IV	EXCEPTION HANDLING	6

Exception types, Usage of Try, Catch, Throw, Throws and Finally keywords, Built-in Exceptions, Creating own Exception classes. MULTI THREADING: Concepts of Thread, Thread life cycle, creating threads using Thread class and Runnable interface, Synchronization, Thread priorities, Inter Thread communication.

UNIT V	AWT CONTROLS	6

The AWT class hierarchy, user interface components- Labels, Button, Text Components, Check Box, Check Box Group, Choice, List Box, Panels – Scroll Pane, Menu, Scroll Bar. Working with Frame class, Colour, Fonts and layout managers. EVENT HANDLING: Events, Event sources, Event Listeners, Event Delegation Model (EDM), Handling Mouse and Keyboard Events, Adapter classes, Inner classes. **TOTAL:30 Periods**

Java Lab Experiments:

1) a. Write a Java program that prints all real solutions to the quadratic equation ax2+ bx + c = 0. Read in a, b, c and use the quadratic formula. If the discriminate b2-4ac is negative, display a message stating that there are no real solutions.

b. Write a java program to check whether a given string is palindrome.

2) Design a class to represent a bank account. Which include contains account number, name of the depositor, type of the account, balance amount in the account. Use constructors to assign initial values, to Deposit an amount, to Withdraw amount after checking balance, to display name and

balance. .(Hint: constructor overloading).

3) Create a class called Calculation with methods for addition and subtraction. Create another class My_Calculation with a method for multiplication. The My_Calculation class must inherit Calculation class so that objects of My_Calculation class can do addition, subtraction, and multiplication operations.

4) To create an abstract class named shape that contains two integers and an empty method named printArea.Provide three classes named Rectangle ,Triangle and Circle subclass that each one of the classes extends the Class Shape .Each one of the classes contains only the method printArea() that prints the area of Shape.

5) Interface.- Define an Interface Bicycle with abstract methods ChangeCadence(), changeGear(), SpeedUp(), and applyBreakes(). Define a class ACMEBicycle that implements Bicycle Interface in addition to its own method implementation.

6). Write a java program to copy the contents of one file into another file.

7) Create a BankDemo application in which user can withdraw and deposit amount. If the user withdraws more than the balance, the user should be given a warning of insufficient funds to withdraw.

8) Simulate multithreading by creating a child thread of main thread.

9) Create a frame with file and Edit menus. File menu should contain menu items, open, save and Exit. Edit menu should contain cut, copy, paste.

10) Simulate Login Screen of authentication in an application.

Total: 30 Periods

COURSE OUTCOMES:

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

- Understand the concept in Object Oriented Programming [**Understand]**
- Apply the concepts to solve Complex Problem. **[Apply]**
- Analyze the necessity for Object Oriented Programming paradigm over structured programming and become familiar with the fundamental concepts in OOP like encapsulation, Inheritance and Polymorphism [**Analyze]**
- Analyze the use of exception handling mechanisms and multithreaded model to solve real world problems. [**Analyze]**
- Design a Java applications with I/O packages, string classes, Collections and generics concepts. [**Design]**
- Work individually or in teams and demonstrate the solutions to the given exercises through presentation **[Affective Domain]**

TEXT BOOKS:

1. Herbert schildt (2010), The complete reference, 7th edition, Tata Mc graw Hill, New Delhi

REFERENCE BOOKS:

1. T.Budd(2009),An Introduction to Object Oriented Programming, 3rd edition, PearsonEducation, India.
2. J. Nino, F. A. Hosch (2002), An Introduction to programming and OO design using Java, John Wiley & sons, New Jersey.
3. Y. Daniel Liang (2010), Introduction to Java programming, 7th edition, Pearson education, India.

21CBV705	PERN STACK DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

- Learn to build a full-stack web application using the PERN stack (PostgreSQL, Express, React, and Node.js) through this beginner-friendly tutorial course.
- By the end of the course, you will be able to create a PostgreSQL database, set up server connections, build routes with PostgreSQL queries, develop a Restful API, and create client-side components using React.
- The course follows a hands-on approach with practical demonstrations and coding sessions.
- This course is intended for beginners looking to learn how to integrate PostgreSQL, Express, React, and Node.js to develop full-stack web applications.

UNIT I	Introduction to React	9 **Hrs**
Understanding basics of react app, Understanding JSX ,React Lifecycle, States , Class components vs functions components ,Event handling, define Props , Building a basic Forms using React.		
UNIT II	**REACT JS**	9 **Hrs**
Introduction to React React Router and Single Page Applications React Forms, Flow Architecture and Introduction to Redux More Redux and Client-Server Communication		
UNIT III	**PostgreSQL**	9 **Hrs**
PostgreSQL (Object-Relational Database) Why use PostgreSQL? - Free and open source.- Available in multiple languages - Highly extensible.- Protects data integrity.- Builds fault-tolerant environments. - Robust access-control system		
UNIT IV	**EXPRESS**	9 **Hrs**
Introduction to Express- Implementing Express in Node.js – Configuring routes – Using Request and Response objects		
UNIT V	**NODE JS**	9 **Hrs**
Basics of Node JS – Installation – Working with Node packages – Using Node package manager – Creating a simple Node.js application – Using Events – Listeners –Timers – Callbacks – Handling Data I/O – Implementing HTTP services in Node.js		

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to develop a website using PERN.

CO1: Gain a solid understanding of the individual technologies of the PERN stack: React.js, Express.js, PostgreSQL, and Node.js.

CO2: Learning and practises to integrate the Express.js for server-side development, React.js for building user interfaces, and Node.js for server-side runtime.

CO3: Develop proficiency in building dynamic and responsive user interfaces using React.js

CO4: Develop a web application framework for building robust APIs and server-side applications

CO5: Work on a comprehensive, real-world project that encompasses the entire PERN stack, from database design to front-end development and deployment.

TEXT BOOKS:

1. Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB. Copyright © 2015 BYAZAT MARDAN

REFERENCES

1. Chris Northwood, 'The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', Apress; 1st edition, 2018

2. Kirupa Chinnathambi, 'Learning React: A Hands-On Guide to Building Web Applications Using React and Redux', Addison-Wesley Professional, 2nd edition, 2018

21CBV706	MERN STACK	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

- To understand the various components of full stack development
- To learn Node.js features and applications
- To develop applications with MongoDB
- To understand the role of Express in web applications
- To develop simple web applications with React

UNIT I	BASICS OF MERN STACK	9 **Hrs**

Understanding the Basic Web Development Framework – User – Browser – Webserver – Backend Services – MVC Architecture – Understanding the different stacks –The role of Express – Angular – Node – Mongo DB – React

UNIT II	NODE JS	9 **Hrs**

Basics of Node JS – Installation – Working with Node packages – Using Node package manager – Creating a simple Node.js application – Using Events – Listeners –Timers – Callbacks – Handling Data I/O – Implementing HTTP services in Node.js

UNIT III	MONGO DB	9 **Hrs**

Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts –Access control – Administering databases – Managing collections – Connecting to MongoDB from Node.js – simple applications

UNIT IV	EXPRESS	9 **Hrs**

Introduction to Express- Implementing Express in Node.js – Configuring routes – Using Request and Response objects Express.js: Simplifying Server-Side Development

UNIT V	REACT	9 **Hrs**

MERN STACK – Basic React applications – React Components – React State – Express REST APIs – Modularization and Webpack – Routing with React Router – Server-side rendering

TOTAL: 45 Periods

COURSE OUTCOMES:

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

CO1: Understand the various stacks available for web application development

CO2: Use Node.js for application development

CO3: Develop applications with MongoDB

CO4: Use the features of Express

CO5: Develop React applications

TEXT BOOKS

1. Brad Dayley, Brendan Dayley, Caleb Dayley, 'Node.js, MongoDB ', Addison-Wesley, Second Edition, 2018

2. Vasan Subramanian, 'Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node', Second Edition, Apress, 2019.

REFERENCES

1. Chris Northwood, ‘The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer’, Apress; 1st edition, 2018
2. Kirupa Chinnathambi, ‘Learning React: A Hands-On Guide to Building Web Applications Using React and Redux’, Addison-Wesley Professional, 2nd edition, 2018

21CBV707	Data Wrangling	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

- To understand the data science fundamentals and process.
- To learn to describe the data for the data science process.
- To learn to describe the relationship between data.
- To utilize the Python libraries for Data Wrangling.
- To present and interpret data using visualization libraries in Python

UNIT I	INTRODUCTION	9 **Hrs**

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing – Basic Statistical descriptions of Data

UNIT II	DESCRIBING DATA	9 **Hrs**

Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores

UNIT III	DESCRIBING RELATIONSHIPS	9 **Hrs**

Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations –regression towards the mean

UNIT IV	PYTHON LIBRARIES FOR DATA WRANGLING	9 **Hrs**

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

UNIT V	DATA VISUALIZATION	9 **Hrs**

Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

TOTAL: 45 Periods

COURSE OUTCOMES:

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

CO1: Define the data science process
CO2: Understand different types of data description for data science process
CO3: Gain knowledge on relationships between data
CO4: Use the Python Libraries for Data Wrangling
CO5: Apply visualization Libraries in Python to interpret and explore data

TEXT BOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016. (Unit I)
2. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017. (Units II and III)
3. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016. (Units IV and V)

REFERENCES:

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

21CBV708	Software Testing Methodologies	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES :

- The objective of a **Software Testing Methodologies** course is to teach students the principles and strategies for generating system test cases, and to understand the essential characteristics of tools used for test automation
- The course also aims to expose students to various software testing issues and solutions in software unit test, integration and system testing

UNIT I	INTRODUCTION	9 **Hrs**

The need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing –Compatibility testing – Testing the documentation – Website testing.

UNIT II	TEST CASE DESIGN STRATEGIES	9 **Hrs**

Test case Design Strategies – Using Black Box Approach to Test Case Design – Boundary Value Analysis – Equivalence Class Partitioning – State based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing - Random Testing – Requirements based testing – Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Additional White box testing approaches- Evaluating Test Adequacy Criteria.

UNIT III	LEVELS OF TESTING	9 **Hrs**

The need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing –Compatibility testing – Testing the documentation – Website testing.

UNIT IV	TEST MANAGEMENT	9 **Hrs**

People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group- The Structure of Testing Group- .The Technical Training Program.

UNIT V	TEST AUTOMATION	9 **Hrs**

Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.

TOTAL: 45 Periods

COURSE OUTCOMES:

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

- Design test cases suitable for a software development for different domains.
- Identify suitable tests to be carried out.
- Prepare test planning based on the document.

- Document test plans and test cases designed.
- Use automatic testing tools.
- Develop and validate a test plan.

TEXT BOOKS:

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

REFERENCES:

1. Ilene Burnstein, ―Practical Software Testing‖, Springer International Edition, 2003.
2. Edward Kit,‖ Software Testing in the Real World – Improving the Process‖, Pearson Education, 1995.
3. Boris Beizer,‖ Software Testing Techniques‖ – 2nd Edition, Van Nostrand Reinhold, New York, 1990.
4. Aditya P. Mathur, ―Foundations of Software Testing _ Fundamental Algorithms and Techniques‖, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.