DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

CURRICULUM

&

SYLLABI

(Semesters: I to VIII)

Regulation-2022

Programme: B.E. COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

2022 Regulations

(2022 Batch onwards)

Curriculum for Semesters I to VIII

SEMESTER I

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
Theory Cum Practical Courses									
1.	22HS101	English for Communication	3	0	2	5	4	60 / 40	HS
2.	22CH101	Engineering Chemistry	3	0	2	5	4	60 / 40	BS
3.	22CS101	Problem Solving Techniques I	3	0	2	5	4	60 / 40	ES
4.	22ES101	Innovation and Design Thinking	1	0	2	3	2	0 / 100	ES
Theory Courses									
5.	22MA101	Matrices and Calculus	3	1	0	4	4	60 / 40	BS
6.	22AC101	Heritage of Tamil	1	0	0	1	1	0 / 100	AC
7.	22EEC101	Aptitude and Soft Skills	1	0	0	1	1	0 / 100	EEC
8.	22EE102	Basics of Electrical and Electronics Engineering	3	0	0	3	3	60 / 40	ES
Mandatory Course									
9.		Student Induction Programme							MC

SEMESTER II

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
Theory Cum Practical Courses									
1.	22CS201	Problem Solving Techniques II	3	0	2	5	4	60 / 40	ES
2.	22PH101	Engineering Physics	3	0	2	5	4	60 / 40	BS
3.	22CS202	Digital Principles & System Design	3	0	2	5	4	60 / 40	ES
Theory Courses									
4.	22MA201	Numerical Methods	3	1	0	4	4	60 / 40	BS
5.	22AC201	Tamils and Technology	1	0	0	1	1	0 / 100	AC
6.	22EEC201	Aptitude and Soft Skills II	1	0	0	1	1	0 / 100	EEC
7.	22HS203	Universal Human Values	2	0	0	2	2	0 / 100	HS
Practical Course									
8.	22ES201	Engineering Practice Laboratory	0	0	4	4	2	40 / 60	ES
9.	22CS203	Computer Hardware & Networking	0	0	4	4	2	40 / 60	PC

SEMESTER III

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
Theory Cum Practical Courses									
1.	22ML301	Data Structures and Algorithms	3	0	2	5	4	60/40	PC
2.	22CS302	Problem Solving Techniques III	3	0	2	5	4	60/40	ES
3.	22CS303	Foundations of Data Science	3	0	2	5	4	60/40	PC

Theory Courses									
4.	22MA302	Discrete Mathematics	3	1	0	4	4	60/40	BS
5.	22CS304	Software Engineering	3	0	0	3	3	60/40	PC
6.	22CS305	Computer Architecture	3	0	0	3	3	60/40	PC
Practical Course									
7.	22EEC301	Industrial Training / Internship - I	0	0	0	2 Weeks	1	0/100	EEC

SEMESTER IV

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
Theory Cum Practical Courses									
1.	22CS401	Operating Systems	3	0	2	5	4	60/40	PC
2.	22ML401	Foundations of Artificial Intelligence	3	0	2	5	4	60/40	PC
3.	22CS403	Database Management Systems	3	0	2	5	4	60/40	PC
Theory Courses									
4.	22CS404	Theory of Computation	3	0	0	3	3	60/40	PC
5.	22IT402	Embedded Systems and IOT	3	0	0	3	3	60/40	ES
Elective Course									
6.		Open Elective - I					3	60/40	OE
Mandatory Course									
7.	22MC402	Innovation and Patent Development					-	0/100	MC

SEMESTER V

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
Theory Cum Practical Course									
1.	22ML501	Natural Language Processing	3	0	2	5	4	60/40	PC
2.	22AI401	Machine Learning	3	0	2	5	4	60/40	PC
Theory Courses									
3.	22CS503	Cryptography and Cyber Security	3	0	0	3	3	60/40	PC
Elective Courses									
4.		Professional Elective – I					3	60/40	PE
5.		Professional Elective – II					3	60/40	PE
6.		Open Elective - II					3	60/40	OE
Practical Course									
7.	22EEC501	Industrial Training / Internship - II	0	0	0	2 Weeks	1	0/100	EEC

SEMESTER VI

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
Theory Cum Practical Course									
1	22ML601	Object Oriented Software Engineering	3	0	2	5	4	60/40	PC
Elective Courses									
2.		Professional Elective – III					3	60/40	PE
3.		Professional Elective – IV					3	60/40	PE
4.		Open Elective - III					3	60/40	OE

5.		Open Elective - IV					3	60/40	OE
Practical Course									
6.	22EEC502	Mini Project	0	0	2	2	1	0/100	EEC
Mandatory Course									
7.	22MC602	Environmental Science					-	0/100	MC

SEMESTER VII

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
Theory Courses									
1.	22CS701	Distributed Computing	3	0	0	3	3	60/40	PC
2.	22MG701	Principles of Management	3	0	3	3	3	60/40	HS
Elective Courses									
3.		Professional Elective – V					3	60/40	PE
4.		Open Elective-V					3	60/40	OE
5.		Open Elective-VI					3	60/40	OE
Practical Course									
6.	22EEC701	Project Work – Phase I	0	0	4	4	2	0/100	EEC

SEMESTER VIII

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
Theory Courses									
1.	22IT801	Software testing	3	0	0	3	3	60/40	PC
Elective Course									
2.		Professional Elective – VI					3	60/40	PE
Practical Course									
3.	22EEC801	Project Work – Phase II	0	0	20	20	10	60/40	EEC

Total Credits : 162

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Professional Electives

(Common to B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE and B.Tech. INFORMATION TECHNOLOGY and B.E. COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING))

Professional Elective I

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PCS01	Advanced Java Programming	2	0	2	4	3	60/40	PE
2.	22PCS02	App Development	2	0	2	4	3	60/40	PE
3.	22PCS03	Cloud Services Management	2	0	2	4	3	60/40	PE
4.	22PCS04	UI and UX Design	2	0	2	4	3	60/40	PE
5.	22PCS05	Software Testing and Automation	2	0	2	4	3	60/40	PE
6.	22PCS06	Web Application Security	2	0	2	4	3	60/40	PE
7.	22PCS07	Principles of Programming Languages	2	0	2	4	3	60/40	PE
8.	22PCS08	Web Technologies	2	0	2	4	3	60/40	PE

Professional Elective II

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PCS09	Data Analytics and Visualization	2	0	2	4	3	60/40	PE
2.	22PCS10	Exploratory Data Analysis	2	0	2	4	3	60/40	PE

3.	22PCS11	Recommender Systems	2	0	2	4	3	60/40	PE
4.	22PCS12	Neural Networks and Deep Learning	2	0	2	4	3	60/40	PE
5.	22PCS13	Text and Speech Analysis	2	0	2	4	3	60/40	PE
6.	22PCS14	Business Analytics	2	0	2	4	3	60/40	PE
7.	22PCS15	Image and Video Analytics	2	0	2	4	3	60/40	PE
8.	22PCS16	Big Data Analytics	2	0	2	4	3	60/40	PE

Professional Elective III

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PCS17	MERN full stack Development	2	0	2	4	3	60/40	PE
2.	22PCS18	Web Essentials	2	0	2	4	3	60/40	PE
3.	22PCS19	Robotic Process Automation	2	0	2	4	3	60/40	PE
4.	22PCS20	Blockchain Technologies	2	0	2	4	3	60/40	PE
5.	22PCS21	MEAN Full Stack Development	2	0	2	4	3	60/40	PE

Professional Elective IV

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PCS22	DevOps	2	0	2	4	3	60/40	PE
2.	22PCS23	Soft Computing	2	0	2	4	3	60/40	PE
3.	22PCS24	Optimization Techniques	2	0	2	4	3	60/40	PE
4.	22PCS25	Game Theory	2	0	2	4	3	60/40	PE
5.	22PCS26	Cognitive Science	2	0	2	4	3	60/40	PE
6.	22PCS27	Ethics and AI	2	0	2	4	3	60/40	PE

Professional Elective V

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PCS28	Amazon web Services	2	0	2	4	3	60/40	PE
2.	22PCS29	Cloud Computing Virtualization	2	0	2	4	3	60/40	PE
3.	22PCS30	Data Warehousing	2	0	2	4	3	60/40	PE
4.	22PCS31	Storage Technologies	2	0	2	4	3	60/40	PE
5.	22PCS32	Software defined Networks	2	0	2	4	3	60/40	PE
6.	22PCS33	Stream Processing	2	0	2	4	3	60/40	PE
7.	22PCS34	Security and Privacy in Cloud	2	0	2	4	3	60/40	PE

Professional Elective VI

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PCS35	Ethical Hacking	2	0	2	4	3	60/40	PE
2.	22PCS36	Social Network Security	2	0	2	4	3	60/40	PE
3.	22PCS37	Modern Cryptography	2	0	2	4	3	60/40	PE
4.	22PCS38	Engineering Secure Software Systems	2	0	2	4	3	60/40	PE
5.	22PCS39	Network Security	2	0	2	4	3	60/40	PE
6.	22PCS40	Cryptocurrency and Blockchain Technologies	2	0	2	4	3	60/40	PE
7.	22PCS41	Digital and Mobile Forensics	2	0	2	4	3	60/40	PE

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Verticals

Vertical I : Data Science

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PCS10	Exploratory Data Analysis	2	0	2	4	3	60/40	PE
2.	22PCS11	Recommender Systems	2	0	2	4	3	60/40	PE
3.	22PCS12	Neural Networks and Deep Learning	2	0	2	4	3	60/40	PE
4.	22PCS13	Text and Speech Analysis	2	0	2	4	3	60/40	PE
5.	22PCS14	Business Analytics	2	0	2	4	3	60/40	PE
6.	22PCS15	Image and Video Analytics	2	0	2	4	3	60/40	PE
7.	22PCS43	Computer Vision	2	0	2	4	3	60/40	PE
8.	22PCS16	Big Data Analytics	2	0	2	4	3	60/40	PE

Vertical II : Full Stack Development

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PCS08	Web Technologies	2	0	2	4	3	60/40	PE
2.	22PCS02	App Development	2	0	2	4	3	60/40	PE
3.	22PCS03	Cloud Services Management	2	0	2	4	3	60/40	PE
4.	22PCS04	UI and UX Design	2	0	2	4	3	60/40	PE
5.	22PCS05	Software Testing and Automation	2	0	2	4	3	60/40	PE
6.	22PCS06	Web Application	2	0	2	4	3	60/40	PE

		Security							
7.	22PCS22	DevOps	2	0	2	4	3	60/40	PE
8.	22PCS07	Principles of Programming Languages	3	0	0	3	3	60/40	PE

Vertical III : Cloud Computing and Data Center Technologies

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PCS44	Cloud Computing	2	0	2	4	3	60/40	PE
2.	22PCS45	Virtualization	2	0	2	4	3	60/40	PE
3.	22PCS03	Cloud Services Management	2	0	2	4	3	60/40	PE
4.	22PCS30	Data Warehousing	2	0	2	4	3	60/40	PE
5.	22PCS31	Storage Technologies	3	0	0	3	3	60/40	PE
6.	22PCS32	Software Defined Networks	2	0	2	4	3	60/40	PE
7.	22PCS33	Stream Processing	2	0	2	4	3	60/40	PE
8.	22PCS34	Security and Privacy in Cloud	2	0	2	4	3	60/40	PE

Vertical IV : Cyber Security and Data Privacy

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PCS35	Ethical Hacking	2	0	2	4	3	60/40	PE
2.	22PCS41	Digital and Mobile Forensics	2	0	2	4	3	60/40	PE
3.	22PCS36	Social Network Security	2	0	2	4	3	60/40	PE
4.	22PCS37	Modern Cryptography	2	0	2	4	3	60/40	PE

5.	22PCS38	Engineering Secure Software Systems	2	0	2	4	3	60/40	PE
6.	22PCS40	Cryptocurrency and Blockchain Technologies	2	0	2	4	3	60/40	PE
7.	22PCS39	Network Security	2	0	2	4	3	60/40	PE
8.	22PCS34	Security and Privacy in Cloud	2	0	2	4	3	60/40	PE

Vertical V : Creative Media

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PCS46	Augmented Reality/Virtual Reality	2	0	2	4	3	60/40	PE
2.	22PCS47	Multimedia and Animation	2	0	2	4	3	60/40	PE
3.	22PCS48	Video Creation and Editing	2	0	2	4	3	60/40	PE
4.	22PCS04	UI and UX Design	2	0	2	4	3	60/40	PE
5.	22PCS49	Digital marketing	2	0	2	4	3	60/40	PE
6.	22PCS52	Visual Effects	2	0	2	4	3	60/40	PE
7.	22PCS51	Game Development	2	0	2	4	3	60/40	PE
8.	22PCS50	Multimedia Data Compression and Storage	2	0	2	4	3	60/40	PE

Vertical VI : Emerging Technologies

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PCS46	Augmented Reality/Virtual Reality	2	0	2	4	3	60/40	PE
2.	22PCS19	Robotic Process Automation	2	0	2	4	3	60/40	PE
3.	22PCS12	Neural Networks and Deep Learning	2	0	2	4	3	60/40	PE
4.	22PCS53	Cyber security	2	0	2	4	3	60/40	PE
5.	22PCS54	Quantum Computing	2	0	2	4	3	60/40	PE
6.	22PCS40	Cryptocurrency and Blockchain Technologies	2	0	2	4	3	60/40	PE
7.	22PCS51	Game Development	2	0	2	4	3	60/40	PE
8.	22PCS55	3D Printing and Design	2	0	2	4	3	60/40	PE

Vertical VII : Artificial Intelligence and Machine Learning

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PCS42	Knowledge Engineering	2	0	2	4	3	60/40	PE
2.	22PCS23	Soft Computing	2	0	2	4	3	60/40	PE
3.	22PCS12	Neural Networks and Deep Learning	2	0	2	4	3	60/40	PE
4.	22PCS13	Text and Speech Analysis	2	0	2	4	3	60/40	PE
5.	22PCS24	Optimization Techniques	2	0	2	4	3	60/40	PE
6.	22PCS25	Game Theory	2	0	2	4	3	60/40	PE

7.	22PCS26	Cognitive Science	2	0	2	4	3	60/40	PE
8.	22PCS27	Ethics And AI	2	0	2	4	3	60/40	PE

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Open Electives

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22OME02	Advanced Manufacturing Technology	3	0	0	3	3	60 / 40	OE
2.	22OCS04	Cognitive Computing	3	0	0	3	3	60 / 40	OE
3.	22OCS05	Computational Finance	3	0	0	3	3	60 / 40	OE
4.	22OCS06	Computational Linguistics	3	0	0	3	3	60 / 40	OE
5.	22OBM07	Computational Neuroscience	3	0	0	3	3	60 / 40	OE
6.	22OME05	Computer Aided Design and Manufacturing	3	0	0	3	3	60 / 40	OE
7.	22OCS07	Computer Forensics and Incident Response	3	0	0	3	3	60 / 40	OE
8.	22OCS08	Computer Graphics and Multimedia	3	0	0	3	3	60 / 40	OE
9.	22OCS10	Cyber Crime and Digital Forensics	3	0	0	3	3	60 / 40	OE
10.	22OCS11	Cyber Defense and Information Assurance	3	0	0	3	3	60 / 40	OE
11.	22OCS12	Cyber-Physical Systems	3	0	0	3	3	60 / 40	OE
12.	22OEC04	Digital Signal Processing	3	0	0	3	3	60 / 40	OE

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
13.	22OAG05	Energy Conservation and Management	3	0	0	3	3	60 / 40	OE
14.	22OBT02	Food Processing and Preservation	3	0	0	3	3	60 / 40	OE
15.	22OCS16	Game Design and Development	3	0	0	3	3	60 / 40	OE
16.	22OCS17	High-Performance Computing	3	0	0	3	3	60 / 40	OE
17.	22OCS18	Human-Computer Interaction	3	0	0	3	3	60 / 40	OE
18.	22OCS19	Information Retrieval	3	0	0	3	3	60 / 40	OE
19.	22OCS20	Information Security Management	3	0	0	3	3	60 / 40	OE
20.	22OCS21	Intelligent Transportation Systems	3	0	0	3	3	60 / 40	OE
21.	22OAG12	Irrigation and Drainage Engineering	3	0	0	3	3	60 / 40	OE
22.	22OEC14	Mechatronics and Control Systems	3	0	0	3	3	60 / 40	OE
23.	22OEC15	Micro and Nano Electronics	3	0	0	3	3	60 / 40	OE
24.	22OEC19	Optical Communication and Networks	3	0	0	3	3	60 / 40	OE
25.	22OCS25	Quantum Computing	3	0	0	3	3	60 / 40	OE
26.	22OEC20	Radar and Navigation Systems	3	0	0	3	3	60 / 40	OE

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
27.	22OME29	Refrigeration and Air-Conditioning	3	0	0	3	3	60 / 40	OE
28.	22OME32	Robotics and Automation	3	0	0	3	3	60 / 40	OE
29.	22OCS26	Social Network Analysis	3	0	0	3	3	60 / 40	OE
30.	22OEC26	Wireless Communication Networks	3	0	0	3	3	60 / 40	OE

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SUMMARY

S.No	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1	**HS**	4	2					3		**9**
2	**BS**	8	8	4						**20**
3	**ES**	9	10	4	3					**26**
4	**PC**		2	14	15	11	4	3	3	**52**
5	**PE**					6	6	3	3	**18**
6	**OE**				3	3	6	6		**18**
7	**EEC**	1	1	1		1	1	2	10	**17**
8	**AC**	1	1							**2**
	Total	**23**	**24**	**23**	**21**	**21**	**17**	**17**	**16**	**162**
9	**MC (Non Credit)**	**~**			**~**		**~**			

HUMANITIES AND SOCIAL SCIENCES (HS)

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22HS101	English for Communication	3	0	2	5	4	60 / 40	HS
2.	22HS203	Universal Human Values	2	0	0	2	2	0 / 100	HS
3.	22MG701	Principles of Management	3	0	0	3	3	60/40	HS

BASIC SCIENCES (BS)

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22CH101	Engineering Chemistry	3	0	2	5	4	60 / 40	BS
2.	22MA101	Matrices and Calculus	3	1	0	4	4	60 / 40	BS
3.	22PH101	Engineering Physics	3	0	2	5	4	60 / 40	BS
4.	22MA201	Numerical Methods	3	1	0	4	4	60 / 40	BS
5.	22MA302	Discrete Mathematics	3	1	0	4	4	60/40	BS

ENGINEERING SCIENCES (ES)

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22CS101	Problem Solving Techniques I	3	0	2	5	4	60 / 40	ES
2.	22ES101	Innovation and Design Thinking	1	0	2	3	2	0 / 100	ES
3.	22EE102	Basics of Electrical and Electronics Engineering	3	0	0	3	3	60 / 40	ES
4.	22CS201	Problem Solving Techniques II	3	0	2	5	4	60 / 40	ES

5.	22CS202	Digital Principles & System Design	3	0	2	5	4	60 / 40	ES
6.	22ES201	Engineering Practice Laboratory	0	0	4	4	2	40 / 60	ES
7.	22CS302	Problem Solving Techniques III	3	0	2	5	4	60 / 40	ES
8.	22IT402	Embedded Systems and IOT	3	0	0	3	3	60/40	ES

PROFESSIONAL CORE (PC)

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22CS203	Computer Hardware & Networking	0	0	4	4	2	40 / 60	PC
2.	22ML301	Data Structures and Algorithms	3	0	2	5	4	60/40	PC
3.	22CS303	Foundations of Data Science	3	0	2	5	4	60/40	PC
4.	22CS304	Software Engineering	3	0	0	3	3	60/40	PC
5.	22CS305	Computer Architecture	3	0	0	3	3	60/40	PC
6.	22CS401	Operating Systems	3	0	2	5	4	60/40	PC
7.	22ML401	Foundations of Artificial Intelligence	3	0	2	5	4	60/40	PC
8.	22CS403	Database Management Systems	3	0	2	5	4	60/40	PC
9.	22CS404	Theory of Computation	3	0	0	3	3	60/40	PC
10.	22ML501	Natural Language Processing	3	0	2	5	4	60/40	PC
11.	22AI401	Machine Learning	3	0	2	5	4	60/40	PC
12.	22CS503	Cryptography and Cyber Security	3	0	0	3	3	60/40	PC
13.	22ML601	Object Oriented Software Engineering	3	0	0	3	3	60/40	PC

14.	22CS701	Distributed Computing	3	0	0	3	3	60/40	PC
15.	22IT801	Software Testing	3	0	0	3	3	60/40	PC

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22EEC101	Aptitude and Soft Skills	1	0	0	1	1	0 / 100	EEC
2.	22EEC201	Aptitude and Soft Skills II	1	0	0	1	1	0 / 100	EEC
3.	22EEC301	Industrial Training / Internship - I	0	0	0	2 Weeks	1	0/100	EEC
4.	22EEC501	Industrial Training / Internship - II	0	0	0	2 Weeks	1	0 / 100	EEC
5.	22EEC502	Mini Project	0	0	2	2	1	0 / 100	EEC
6.	22EEC701	Project Work – Phase I	0	0	4	4	2	0 / 100	EEC
7.	22EEC801	Project Work – Phase II	0	0	20	20	10	60/40	EEC

AUDIT COURSES (AC)

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22AC101	Heritage of Tamil	1	0	0	1	1	0 / 100	AC
2.	22AC201	Tamils and Technology	1	0	0	1	1	0 / 100	AC

NON CREDIT MANDATORY COURSES (NCMC)

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.		Student Induction Programme							MC
2.	22MC402	Innovation and Patent Development					-	0/100	MC
3.	22MC602	Environmental Science					-	0/100	MC

22HS101 **ENGLISH FOR COMMUNICATION I** L T P C
3 0 2 4

OBJECTIVE:

• To improve the communicative competence of learners
• To help learners use language effectively in academic /work contexts
• To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
• To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.
• To use language efficiently in expressing their opinions via various media.

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION **12**

Listening –for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form
Speaking - Self Introduction; Introducing a friend; Conversation - politeness strategies; Telephone conversation; Leave a voicemail; Leave a message with another person; asking for information to fill details in a form.
Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails.
Writing - Writing emails / letters introducing oneself
Grammar - Present Tense (simple and progressive); Question types: Wh/ Yes or No/ and Tags
Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT II NARRATION AND SUMMATION **12**

Listening - Listening to podcast, anecdotes / stories / event narration; documentaries and interviews with celebrities.
Speaking - Narrating personal experiences / events; Interviewing a celebrity; Reporting / and summarising of documentaries / podcasts/ interviews.
Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs.
Writing - Guided writing-- Paragraph writing Short Report on an event (field trip etc.) Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions
Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

UNIT III DESCRIPTION OF A PROCESS / PRODUCT **12**

Listening - Listen to a product and process descriptions; a classroom lecture;and advertisements about a products.
Speaking – Picture description; Giving instruction to use the product; Presenting a product; and Summarising a lecture.
Reading – Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description.
Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses.
Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers(connectives & sequence words)

UNIT IV CLASSIFICATION ND RECOMMENDATIONS **12**

Listening – Listening to TED Talks; Scientific lectures; and educational videos. Speaking – Small Talk; Mini presentations and making recommendations.
Reading – Newspaper articles; Journal reports –and Non Verbal Communication (tables, pie charts etc,.)
Writing – Note-making / Note-taking (*Study skills to be taught, not tested); ; Writing recommendations; Transferring information from non verbal (chart , graph etc, to verbal mode)
Grammar – Articles; Pronouns - Possessive & Relative pronouns.
Vocabulary - Collocations; Fixed / Semi fixed expressions.

UNIT V EXPRESSION **12**

Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions.
Speaking –group discussions, Debates, and Expressing opinions through Simulations & Roleplay.
Reading – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative).
Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content vs Function words.

OUTCOMES: At the end of the course, learners will be able

- To listen and comprehend complex academic texts
- To read and infer the denotative and connotative meanings of technical texts
- To write definitions, descriptions, narrations and essays on various topics
- To speak fluently and accurately in formal and informal communicative contexts
- To express their opinions effectively in both oral and written medium of communication

TEXT BOOKS:

1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)
2. English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCES:

1. Technical Communication – Principles And Practices, Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.
3. English For Technical Communication (With CD) By Aysha Viswamohan, Mcgraw Hill Education, ISBN : 0070264244.
4. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.
5. Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi,2003.

TOTAL : 60 PERIODS

22CH101	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	2	4

Course Objectives:

1. To inculcate sound understanding of water softening methods and desalination techniques.
2. To make the students conversant with basics of polymer chemistry.
3. To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems.
4. To facilitate the understanding of different types of fuels, their preparation, properties.
5. To familiarize the students with the operating principles, working processes and applications of energy Conversion and storage devices.
6. To induce the students to familiarize with electroanalytical techniques such as, potentiometer and conductometry in the determination of impurities in aqueous solutions.

Course Content:

UNIT I WATER TECHNOLOGY 9

Hardness of water- types - disadvantages of using hard water in industries – estimation of total, permanent and temporary hardness of water by EDTA method -Boiler troubles (scale and sludge)- Boiler feed water treatment – external conditioning - demineralization process - desalination by reverse osmosis – potable water treatment - breakpoint of chlorination.

UNIT II POLYMER AND COMPOSITES 9

Polymer: types – addition and condensation polymerization – mechanism of free radical addition polymerization – copolymers – plastics: classification – thermoplastics and thermosetting plastics, preparation, properties and uses of commercial plastics – PVC, Bakelite.
Composites: definition, types of composites – polymer matrix composites (PMC)– fibre reinforced plastics (FRP) - applications.

UNIT III ALLOYS AND PHASE RULE 9

Alloys: Properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel.

Phase rule: definition of terms with examples, one component system -water system – reduced phase rule – two component systems – lead-silver system –Pattinson process, Cu-Ni system.

UNIT IV ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear fission – controlled nuclear fission – nuclear fusion – nuclear chain reactions – nuclear energy – light water nuclear power plant – breeder reactor – solar energy conversion – solar cells – wind energy.

Batteries, fuel cells and super capacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H_2-O_2 fuel cell- super capacitors.

UNIT V FUELS AND COMBUSTION 9

Fuels: Classification of fuels – coal – proximate and ultimate analysis – carbonization – manufacture of metallurgical coke (Otto Hoffmann method) – petroleum – refining – manufacture of synthetic petrol (Bergius process) – knocking – octane number – diesel oil – cetane number – compressed natural gas (CNG) – liquefied petroleum gases (LPG) – power alcohol and biodiesel.

Combustion of fuels: Calorific values – calculations – theoretical air requirement – ignition temperature – spontaneous ignition temperature– flue gas analysis (chromatography and gas sensors).

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome:

1. To analyse the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
2. Discuss the types of polymer formation and composites.
3. To apply the knowledge of phase rule and alloys for material selection requirements.
4. To recommend suitable fuels for engineering processes and applications.
5. To recognize different forms of energy resources and apply them for suitable applications in energy sectors.
6. To quantitatively analyse the impurities in solution by electro analytical techniques.

Text Book(s):

1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3. S.S. Dara, "A Text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018.

Reference Books:

1. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
2. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
3. ShikhaAgarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019.
4. O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

List of Experiments:

1.	Determination of total, temporary & permanent hardness of water by EDTA method.	**3**
2.	Determination of chloride content of water sample by Argentometric method.	**3**
3.	Estimation of copper content of the given solution by Iodometry.	**3**
4.	Determination of alkalinity in water sample.	**3**
5.	Determination of DO content of water sample by Winkler's Method.	**3**
6.	Estimation of Phase change in a solid.	**3**
7.	Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.	**3**
8.	Determine strength of given hydrochloric acid using pH meter.	**3**

9.	Determine strength of acids in a mixture of acids using conductivity meter.	**3**
10.	Determine iron content of the given solution using potentiometer.	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**75 Periods**

22CS101 PROBLEM SOLVING TECHNIQUES I L T P C
3 0 2 4

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, dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

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, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9

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

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

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

Files and exceptions: 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:

Upon completion of the course, students 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 loops 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.

List of Experiments:

1.	Identification and solving of simple real life or scientific or technical problems, and developingflow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)	**3**
2.	Python programming using simple statements and expressions (exchange the values of twovariables, circulate the values of n variables, distance between two points).	**2**
3.	Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns,pyramid pattern)	**3**
4.	Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building – operations oflist & tuples)	**3**
5.	Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)	**2**
6.	Implementing programs using Functions. (Factorial, largest number in a list, area of shape)	**3**
7.	Implementing programs using Strings. (reverse, palindrome, character count, replacingcharacters)	**3**
8.	Implementing programs using written modules and Python Standard Libraries (pandas,numpy. Matplotlib, scipy)	**3**
9.	Implementing real-time/technical applications using File handling. (copy from one file toanother, word count, longest word)	**3**
10.	Implementing real-time/technical applications using Exception handling. (divide by zeroerror, voter's age validity, student mark range validation)	**3**
11.	Exploring Pygame tool.	**3**
12.	Developing a game activity using Pygame like bouncing ball, car race etc	**3**

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 75 Periods

List of Equipment: (for batch of 30 students)

1.	Pyton 3.10 Version	30 nos

22ES101	INNOVATION AND DESIGN THINKING	L	T	P	C
		1	0	2	2

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To explain the concept of design thinking for product and service development
2. To explain the fundamental concept of innovation and design thinking
3. To discuss the methods of implementing design thinking in the real world.

Expected Course Outcome:

1. To immerse students into the world of innovation as a systematic process of tackling relevant business and/or social problems.
2. To provide a social and thinking space for the recognition of innovation challenges and the design of creative.
3. To expose the student with state of the art perspectives, ideas, concepts, and solutions related to the design and execution of innovation driven projects using design thinking principles.
4. To develop an advance innovation and growth mindset form of problem identification and reframing, foresight, hindsight and insight generation.

Course Content:

UNIT I PROCESS OF DESIGN **3 Hours**

Understanding Design thinking - Shared model in team-based design – Theory and practice in Design thinking – Explore presentation signers across globe – MVP or Prototyping.

UNIT II TOOLS OF DESIGN THINKING **3 Hours**

Real-Time design interaction captures and analysis – Enabling efficient collaboration in digital space – Empathy for design – Collaboration in distributed Design.

UNIT III DESIGN THINKING IN IT **3 Hours**

Design Thinking to Business Process modelling – Agile in Virtual collaboration environment – Scenario based Prototyping.

UNIT IV DT FOR STRATEGIC INNOVATIONS **3 Hours**

Growth – Story telling representation – Strategic Foresight - Change – Sense Making - Maintenance Relevance – Value redefinition - Extreme Competition – experience design - Standardization – Humanization - Creative Culture – Rapid prototyping, Strategy and Organization – Business Model design.

UNIT V DESIGN THINKING WORKSHOP **3 Hours**

Design Thinking Workshop Empathize, Design, Ideate, Prototype and Test.

TOTAL LECTURE CUM PRACTICAL HOURS **15 Hours**

Text Book(s):

1. John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design",Cengage learning (International edition) Second Edition, 2013.
2. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.
3. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011.
4. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.

Reference Books:

1. Yousef Haik and Tamer M.Shahin, "Engineering Design Process", CengageLearning, Second Edition, 2011.
2. Book - Solving Problems with Design Thinking - Ten Stories of What Works (Columbia Business School Publishing) Hardcover – 20 Sep 2013 by Jeanne Liedtka (Author), Andrew King (Author), Kevin Bennett (Author)

22MA101	MATHEMATICS I	L	T	P	C
		3	1	0	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
2. To familiarize the students with differential calculus.
3. To familiarize the student with functions of several variables. This is needed in many branches of engineering.
4. To make the students understand various techniques of integration.
5. To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

Expected Course Outcome:

1. At the end of the course the students will be able to Use the matrix algebra methods for solving practical problems.
2. Apply differential calculus tools in solving various application problems.
3. Able to use differential calculus ideas on several variable functions.
4. Apply different methods of integration in solving practical problems.
5. Apply multiple integral ideas in solving areas, volumes and other practical problems.

Course Content:

UNIT I MATRICES 12 Hours

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley – Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications: Stretching of an elastic membrane.

UNIT II DIFFERENTIAL CALCULUS 12 Hours

Representation of functions – Limit of a function – Continuity – Derivatives – Differentiation rules (sum, product, quotient, chain rules) – Implicit differentiation – Logarithmic differentiation – Applications: Maxima and Minima of functions of one variable.

UNIT III FUNCTIONS OF SEVERAL VARIABLES 12 Hours

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

UNIT IV INTEGRAL CALCULUS 12 Hours

Definite and Indefinite integrals – Substitution rule – Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction– Improper integrals – Applications: Hydrostatic force

and pressure, moments and centres of mass.

UNIT V MULTIPLE INTEGRALS 12 Hours

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals – Applications: Moments and centres of mass, moment of inertia.

TOTAL LECTURE CUM TUTORIAL HOURS 60 Hours

Text Book(s):

1. Kreyszig. E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal. B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015.

Reference Books:

1. Anton. H, Bivens. I and Davis. S, "Calculus", Wiley, 10th Edition, 2016.
2. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
4. Narayanan. S. and Manicavachagom Pillai. T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6. Srimantha Pal and Bhunia. S.C, "Engineering Mathematics" Oxford University Press, 2015.
7. Thomas. G. B., Hass. J, and Weir. M.D, "Thomas Calculus", 14th Edition, Pearson India, 2018.

Web Links:

1. https://www.pdfdrive.com/higher-engineering-mathematics-d18621876.html
2. https://www.pdfdrive.com/advanced-engineering-mathematics-d166759888.html
3. https://theswissbay.ch/pdf/Gentoomen%20Library/Maths/Calculus/Calculus%20-%20Early%20Transcendentals%206e.pdf

22AC101	HERITAGE OF TAMIL	L	T	P	C
		1	0	0	1

Pre-requisite Nil **Syllabus Version** V 0.1

Course Content:

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 3 Hours

Language Families in India - Dravidian Languages – Tamil as aClassical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT II NARRATION AND SUMMATION 3 Hours

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III DESCRIPTION OF A PROCESS / PRODUCT 3 Hours

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV CLASSIFICATION ND RECOMMENDATIONS 3 Hours

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V EXPRESSION 3 Hours

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL LECTURE HOURS 15 Hours

Text cum Reference Book(s):

1. தமிழக வரலொறு – மக்களும் பண் பொடும் – கக.கக. பிள்ளள (தவளியீடு: தமிழ்நொடு பொடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ் – முளனவர்இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – ளவளக நதிக்களரயில் சங்ககொல நகர நொகரிகம் (ததொல்லியல் துளற தவளியீடு)
4. தபொருளந – ஆற்றங்களர நொகரிகம். (ததொல்லியல் துளற

தவளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: 38 Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

22EEC101	APTITUDE AND SOFT SKILLS	L	T	P	C
		1	0	0	1

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To enhance students' cognitive prowess and mental potential.
2. To improve students' mental aptitude relevant to their academic choices, vocational preferences, job profiles and their ability to succeed.
3. To measure a range of skills such as language comprehension, logical thinking and numerical ability.
4. To get familiar with the method of solving aptitude and multi-choice questions.

Course Content:

UNIT I FUNDAMENTALS OF APTITUDE 2 Hours

English diagnostic test - EDT - Logical Reasoning-Puzzles - Factors influencing positive mind set- Importance of self-confidence and self-esteem.

UNIT II SPEAKING SKILLS 3 Hours

Effective communication – Barriers & Strategies – Day to Day conversation - Improving responding capacity – Extempore speech practice – Speech assessment. Arithmetic aptitude – Simplification.

UNIT III READING SKILLS 2 Hours

Reading editorials and opinion blogs-skimming and scamming methods -speed reading. Logical Reasoning-verbal analogies.

UNIT IV GREETINGS 2 Hours

Greetings and expressions- expressing gratitude and apologies -*expressions* of courtesy. Arithmetic aptitude – Percentages.

UNIT V ETIQUETTE 3 Hours

Etiquette- Respect, Consideration & Honesty-oral presentation-role of audio/video visual aids. Logical Reasoning – Non-verbal - Arithmetic aptitude – Introduction to numbers.

TOTAL LECTURE HOURS 12 Hours

Text Book(s):

1. English for Job Seekers (Language and Soft Skills for the Aspiring) by Geetha Rajeevan,
   C.L.N. Prakash) Cambridge University Press pvt,Ltd.
2. New International Business English by Leo Jones and Richard Alexander. Cambridge University Press pvt,Ltd.
3. Quantitative Aptitude for Competitive Examinations by R S Aggarwal, S. CHAND Publishers.
4. A Modern Approach To Logical Reasoning by R S Aggarwal, S. CHAND Publishers.

22EE102	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To introduce the basics of electric circuits and analysis
2. To impart knowledge in the basics of working principles and application of electrical machines
3. To introduce analog devices and their characteristics
4. To educate on the fundamental concepts of digital electronics
5. To introduce the functional elements and working of measuring instruments

Course Content:

UNIT I ELECTRICAL CIRCUITS 9

Introduction to DC Circuits - Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws - Nodal Analysis, Mesh analysis with Independent sources only (Steady state) - Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, real power, reactive power and apparent power, power factor

UNIT II ELECTRICAL MACHINES 9

Construction and Working principle- DC Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, working principle and Applications of Transformer, Three Phase Induction Motor.

UNIT III ANALOG ELECTRONICS 9

Semiconductor Materials: Silicon &Germanium – PN Junction Diodes, Zener Diode – Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, UJT, MOSFET, DIAC, TRIAC – Types, V-I Characteristics and Applications, Rectifiers.

UNIT IV DIGITAL ELECTRONICS 9

Number systems (Binary, Gray, Decimal and Hexa-decimal), Code Converters (Binary to Gray, Gray to Binary, BCD to Excess-3, Excess-3 to BCD) - Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps-Flip Flop.

UNIT V MEASUREMENTS AND INSTRUMENTATION 9

Functional elements of an instrument, Standards and calibration, Operating Principle, types - Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers-CT and PT, DSO- Block diagram.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome:

1. Compute the electric circuit parameters for simple problems
2. Explain the working principle and applications of electrical machines

3. Analyze the characteristics of analog electronic devices
4. Explain the basic concepts of digital electronics
5. Explain the operating principles of measuring instruments

Text Book(s):

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020
2. S.K.Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition, 2017.
3. James A. Svoboda, Richard C. Dorf, "Dorf's Introduction to Electric Circuits", Wiley, 2018.
4. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.

Reference Books:

1. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019.
2. Thomas L. Floyd, 'Digital Fundamentals', 11th Edition, Pearson Education, 2017.
3. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 9th edition,2021.
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 7th Edition, 2018.
5. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

Course Code	PROBLEM SOLVING TECHNIQES - II	L	T	P	C
22CS201		3	0	2	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To understand the constructs of C Language.
2. To develop C Programs using basic programming constructs
3. To develop C programs using arrays and strings
4. To develop modular applications in C using functions
5. To develop applications in C using pointers and structures
6. To do input/output and file handling in C

Course Content:

UNIT I BASICS OF C PROGRAMMING 9

Introduction to programming paradigms – Applications of C Language - Structure of C program - C programming: Data Types - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements – Decision making statements - Switch statement - Looping statements – Preprocessor directives - Compilation process.

UNIT II ARRAYS AND STRINGS 9

Introduction to Arrays: Declaration, Initialization – One dimensional array –Two dimensional arrays - String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.

UNIT III FUNCTIONS AND POINTERS 9

Modular programming - Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion, Binary Search using recursive functions –Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Parameter passing: Pass by value, Pass by reference.

UNIT IV STRUCTURES AND UNION 9

Structure - Nested structures – Pointer and Structures – Array of structures – Self referential structures – Dynamic memory allocation - Singly linked list – typedef – Union - Storage classes and Visibility.

UNIT V FILE PROCESSING 9

Files – Types of file processing: Sequential access, Random access – Sequential access file - Random access file - Command line arguments.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Demonstrate knowledge on C Programming constructs
2. Develop simple applications in C using basic constructs
3. Design and implement applications using arrays and strings
4. Develop and implement modular applications in C using functions.
5. Develop applications in C using structures and pointers.
6. Design applications using sequential and random access file processing.

Text Book(s):

1. ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.

2. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.

Reference Books:

1. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.
2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
3. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.

List of Experiments:

1.	Write a C program to calculate and display the area of a rectangle using the input values entered by the user.	**3**
2.	Write a C program to sort an array of integers using selection sort technique.	**3**
3.	Write a C program to concatenate two strings entered by the user and display the resultant string.	**3**
4.	Write a C program to find the factorial of a number using recursion.	**3**
5.	Write a C program to swap two numbers using call by value and call by reference.	**3**
6.	Write a C program to create a structure named student with the fields roll no, name, and marks in three subjects. Initialize the structure with the values entered by the user and display the details.	**3**
7.	Write a C program to read data from a text file and display it on the screen.	**3**
8.	Write a C program to implement a singly linked list and display its elements.	**3**
9.	Write a C program to open a binary file, write data to it, and read data from it.	**3**
10.	Write a C program to implement a stack using an array and perform push, pop, and display operations.	**3**

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 75 Periods

List of Equipment: (for batch of 30 students)

1.	Standalone Computer	30 nos
2.	TURBO C	-

22PH101	ENGINEERING PHYSICS	L	T	P	C
		3	0	2	4

Course Objectives:

1. To make the students effectively achieve an understanding of mechanics and properties of matter.
2. To enable the students to gain knowledge of electromagnetic waves.
3. To introduce the basics of solid-state physics.
4. Equipping the students to successfully understand the importance of optics and Laser.
5. To motivate the students towards the applications of quantum mechanics.
6. To learn problem solving skills related to physics principles and interpretation of experimental data.
7. To determine error in experimental measurements and techniques used to minimize such error.

Course Content:

UNIT I MECHANICS AND PROPERTIES OF MATTER 9

Mechanics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of the system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy-moment of inertia and its theorem- gyroscope - torsional pendulum.

Elasticity: Elastic modules – Poisson's ratio – relation between them – determination of Young's modulus by uniform and non-uniform bending- I section girders.

UNIT II ELECTROMAGNETIC WAVES 9

Maxwell's equations (Basics) - Charged particles in uniform and constant electric field – Charged particles in an alternating electric field- polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium vacuum interface for normal incidence.

UNIT III SOLID STATE PHYSICS 9

Elements of crystallography; diffraction methods for structure determination; bonding in solids; lattice vibrations and thermal properties of solids; free electron theory; band theory of solids: nearly free electron and tight binding models; metals, semiconductors and insulators; conductivity, mobility and effective mass; optical, dielectric and magnetic properties of solids; elements of superconductivity: Type-I and Type II superconductors, Meissner effect, London equation.

UNIT IV OPTICS & LASER 9

Classification of optical materials – carrier generation and recombination processes - insulators and semiconductors (concepts only) - photo current in a P-N diode – solar cell - LED– Laser diodes – Optical data storage techniques.

Laser (Basics)– Einstein's coefficient- Types of Laser- He- Ne Laser - CO_2 laser, Nd-YAG laser, semiconductor laser – MASER Introduction - Holography: Principle and construction - Reconstruction of Holography.

UNIT V QUANTUM MECHANICS & NANODEVICES 9

Compton effect - The Schrodinger equation (Time dependent and time independent forms)- particle in an infinite potential well: 1D,2D and 3D Boxes.

NanoDevices: Introduction - quantum confinement – quantum structures: quantum wells, wires and dots –– band gap of nanomaterials. Tunneling – Single electron phenomena: Coulomb blockade - resonant- tunneling diode – single electron transistor – quantum cellular automata - Quantum system for information processing.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome:

1. Understand the importance of mechanics and properties of matter
2. Express their knowledge in electromagnetic waves.
3. Demonstrate a strong foundational knowledge in solid state physics.
4. Gain the knowledge in optics and Laser.
5. Understand the importance of quantum physics and Nanodevices.
6. Understand the functioning of various physics laboratory equipment.
7. Use graphical models to analyze laboratory data.
8. Use mathematical models as a medium for quantitative reasoning and describing physical reality.

Text Book(s):

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2. Brijlal and N. Subramaniam "Properties of Matter", Eurasia Publishing House Limited, 1993.
3. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ. Press.
4. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGrawHill (Indian Edition), 2017.
5. Parag K. Lala, Quantum Computing: A Beginner's Introduction, McGraw-Hill Education (Indian Edition), 2020.

Reference Books:

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition), 2009.
2. Paul A. Tipler, Physics – Volume 1 & 2, CBS, (Indian Edition), 2004.
3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019.
4. D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.
5. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson Education (Indian Edition) 2009.

Web Links:

1. https://bayanbox.ir/view/7764531208313247331/Kleppner-D.-Kolenkow-R.J.-Introduction-to-Mechanics-2014.pdf
2. https://physicaeducator.files.wordpress.com/2017/11/electricity_and_magnetism-by-purcell-3ed-ed.pdf
3. https://safehandsakola.org/downloads/Physics/Concepts%20of%20Modern%20Physics%20-Arthur%20Beiser.pdf
4. https://web.pdx.edu/~pmoeck/books/Tipler_Llewellyn.pdf
5. https://farside.ph.utexas.edu/teaching/qmech/qmech.pdf
6. https://web.pdx.edu/~pmoeck/phy381/workbook%20nanoscience.pdf

List of Experiments:

1.	Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.	**3**
2.	Uniform bending – Determination of Young's modulus.	**3**
3.	Laser- Determination of the wavelength of the laser using grating.	**3**
4.	Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids.	**3**
5.	Melde's string experiment	**3**
6.	Simple harmonic oscillations of cantilever.	
7.	Non-uniform bending - Determination of Young's modulus.	
8.	Laser-Determination of particle size and acceptance angle of the laser.	
9.	Determination of wavelength of mercury spectrum – spectrometer grating.	
10.	Determination of thickness of a thin wire – Air wedge method.	

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 75 Periods

22CS202	DIGITAL PRINCIPLES AND SYSTEM DESIGN	L	T	P	C
		3	0	2	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

- To design digital circuits using simplified Boolean functions
- To analyze and design combinational circuits
- To analyze and design synchronous and asynchronous sequential circuits
- To understand Programmable Logic Devices
- To write HDL code for combinational and sequential circuits

Course Content:

UNIT I BOOLEAN ALGEBRA AND LOGIC GATES 9

Number Systems - Arithmetic Operations - Binary Codes- Boolean Algebra and Logic Gates- Theorems and Properties of Boolean Algebra - Boolean Functions - Canonical and Standard Forms - Simplification of Boolean Functions using Karnaugh Map - Logic Gates – NAND and NOR Implementations

UNIT II COMBINATIONAL LOGIC 9

Combinational Circuits – Analysis and Design Procedures - Binary Adder-Subtractor - Decimal Adder - Binary Multiplier - Magnitude Comparator - Decoders – Encoders – Multiplexers - Introduction to HDL – HDL Models of Combinational circuits

UNIT III SYNCHRONOUS SEQUENTIAL LOGIC 9

Sequential Circuits - Storage Elements: Latches , Flip-Flops - Analysis of Clocked Sequential Circuits - State Reduction and Assignment - Design Procedure - Registers and Counters - HDL Models of Sequential Circuits

UNIT IV ASYNCHRONOUS SEQUENTIAL LOGIC 9

Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards.

UNIT V MEMORY AND PROGRAMMABLE LOGIC 9

RAM – Memory Decoding – Error Detection and Correction - ROM - Programmable Logic Array – Programmable Array Logic – Sequential Programmable Devices

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Simplify Boolean functions using KMap
2. Design and Analyze Combinational and Sequential Circuits
3. Implement designs using Programmable Logic Devices
4. Write HDL code for combinational and Sequential Circuitsms

Text Book(s):

1. M. Morris R. Mano, Michael D. Ciletti, “Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog”, 6th Edition, Pearson Education, 2017.

Reference Books:

1. G. K. Kharate, Digital Electronics, Oxford University Press, 2010
2. John F. Wakerly, Digital Design Principles and Practices, Fifth Edition, PearsonEducation, 2017.
3. Charles H. Roth Jr, Larry L. Kinney, Fundamentals of Logic Design, Sixth Edition,CENGAGE Learning, 2013
4. Donald D. Givone, Digital Principles and Design‖, Tata Mc Graw Hill, 2003

List of Experiments:

1.	Familiarization with digital circuits and breadboard	**3**
2.	Analysis of combinational circuits such as half adder, full adder, and decoder	**3**
3.	Analysis of sequential circuits such as flip-flops and counters	**3**
4.	Design and implementation of logic gates and Boolean algebra circuits	**3**
5.	Design and implementation of arithmetic circuits such as adders and subtractors	**3**
6.	Analysis and design of Multiplexer and Demultiplexer circuits	**3**
7.	Design and implementation of Combinational Logic Circuits using Verilog HDL	**3**
8.	Design and implementation of Sequential Logic Circuits using Verilog HDL	**3**
9.	Testing of digital circuits using simulation software such as Quartus	**3**
10.	Interfacing digital circuits with microprocessors/microcontrollers	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**75 Periods**

List of Equipment: (for batch of 30 students)

1.	Digital Multimeter (DMM),Logic Probe,Function Generator,Oscilloscope,Power Supply Unit (PSU),IC Trainer Kit,FPGA Development Board,Logic,Analyzer,Microprocessor/Microcontroller Kit,Various digital ICs, such as logic gates, flip-flops, counters, multiplexers, etc.,Various passive components, such as resistors, capacitors, and inductors.	30 nos

22MA201	NUMERICAL METHODS	L	T	P	C
		3	1	0	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To introduce the basic concepts of solving algebraic and transcendental equations.
2. To introduce the numerical techniques of interpolation in various intervals in real life situations.
3. To acquaint the student with understanding of numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
4. To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.
5. To understand the knowledge of various techniques and methods of solving various types of partial differential equations.

Course Content:

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

Solution of algebraic and transcendental equations - Fixed point iteration method– Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT II INTERPOLATION AND APPROXIMATION 9+3

Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+3

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's Method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS

Single step methods - Taylor's series method - Euler's method - Modified Euler's method – Fourth order Runge - Kutta method for solving first order equations - Multi step methods - Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

Finite difference methods for solving second order two - point linear boundary value problems - One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL LECTURE PERIODS 60 Periods

Expected Course Outcome:

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

1. Understand the basic concepts and techniques of solving algebraic and transcendental equations.
2. Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations.
3. Apply the numerical techniques of differentiation and integration for engineering problems.
4. Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
5. Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

Text Book(s):

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.

Reference Books:

1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education, Asia, New Delhi, 2007.
2. Gerald. C. F. and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia,6th Edition, New Delhi, 2006.
3. Mathews, J.H. "Numerical Methods for Mathematics, Science and Engineering", 2nd Edition, Prentice Hall, 1992.
4. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, 3rd Edition, New Delhi, 2007.
5. Sastry, S.S, "Introductory Methods of Numerical Analysis", PHI Learning Pvt. Ltd, 5thEdition, 2015.

		L	T	P	C
22AC201	**TAMILS AND TECHNOLOGY**	**1**	**0**	**0**	**1**

Pre-requisite Nil **Syllabus Version** V 0.1

Course Content:

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3

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

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY 3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

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

TOTAL LECTURE PERIODS 15 Periods

Text cum Reference Books:

1. தமிழக வரலொறு – மக்களும் பண் பொடும் – மக.மக. பிள்மள (தவளியீடு: தமிழ்நொடு பொடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முமனவர ்இல. சுந்தரம் . (விகடன் பிரசுரம்).
3. கீழடி – மவமக நதிக்கமரயில் ெங்ககொல நகர நொகரிகம் (ததொல்லியல் துமற தவளியீடு)
4. தபொருமந – ஆற்றங்கமர நொகரிகம். (ததொல்லியல் துமற தவளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

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

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

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

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

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

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

12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

22EEC201	APTITUDE AND SOFT SKILLS II	L	T	P	C
		1	0	0	1

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

- To enhance Cognitive Abilities Improving critical thinking, problem-solving and decision-making skills to achieve better academic and professional outcomes.
- Boosting Soft Skills and Developing interpersonal, communication and time-management skills to excel in personal and professional relationships.
- Enhancing verbal and written communication skills to promote effective collaboration and build relationships.
- Developing self-awareness, empathy, and social skills to navigate complex interpersonal situations and increase team morale.

Course Content:

UNIT I APTITUDE 3

Personality Assessment - SWOT analysis - Adaptability and Flexibility - Team building activity - Numerical Reasoning - calculations, identify patterns, and problem solving.

UNIT II SPEAKING SKILLS 3

Core Components of Effective Communication - Non-Verbal Communication - active listening and written communication - Business English - Communication enhancement activities - Abstract Reasoning - shapes, symbols, or images - Visual Reasoning.

UNIT III READING SKILLS 3

Vocabulary Building – Comprehension – Fluency - Critical Reading - Reading for Information - Group problem-solving activities - Critical thinking and analysis - Creative problem solving - Decision making and evaluation - Deductive reasoning and connectives - Logical puzzles and games.

UNIT IV FLOW STATE 3

S.M.A.R.T Goal Setting - Developing action plans - Overcoming Obstacles - Review and Reflection - Habit Building - Identifying Habits - Maintaining Habits - Habit Stacking Arithmetic aptitude - Number system.

UNIT V EMOTIONAL QUOTIENT 3

Emotional Intelligence - Empathy and interpersonal skills - Self-awareness and self-regulation - Motivation and drive - Social awareness and relationship management - Quantitative aptitude - Equations - Word problems.

TOTAL LECTURE PERIODS 15 Periods

Expected Course Outcome:

- Increased efficiency, productivity and performance in academic and professional settings.
- Enhanced communication, collaboration and teamwork among students.

- Increased ability to identify, analyze and solve complex problems in personal and professional settings.
- Improved self-awareness, emotional intelligence and interpersonal skills leading to better personal and professional relationships.

Text Book(s):

- Quantitative Aptitude for Competitive Examinations - 2022/edition-S Chand Publishing- Paperback_Edition-2022.
- Fast Track Objective Arithmetic by Rajesh Verma, January 2018 edition.
- How to Talk to Anyone: 92 Little Tricks for Big Success in Relationships, Publisher: Harper Element; New edition.
- Emotional Intelligence by Daniel Goleman, Bloomsbury Publishing India Private Limited; new edition, January 1995.

Reference Books:

- How to Prepare for Quantitative Aptitude for CAT by Arun Sharma, McGraw Hill Education; Eighth edition.
- The Pearson Guide to Quantitative Aptitude for Competitive Examinations by Dinesh Khattar
- Crucial Conversations by Al Switzler, Joseph Grenny, and Ron McMillan, Brilliance Audio; Abridged, Updated edition, August 2013.
- Nonviolent Communication by Marshall B. Rosenberg, Puddle Dancer Press; 3rd edition, September 2015

22HS203	UNIVERSAL HUMAN VALUES	L	T	P	C
		2	0	0	2

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

The Course prepares second semester engineering and Technology students to:

1. Understand the importance of "VALUES" and "SKILLS" working together to ensure long-term happiness and prosperity.
2. Developing a holistic view on life, careers, happiness, and prosperity based on an accurate understanding of human reality and the rest of existence.
3. Attention to realistic ramifications of such a holistic view in terms of moral behaviour, reliable and gratifying human relationship with nature, and ethical human conduct.

Course Content:

UNIT I COURSE INTRODUCTION – AND VALUE EDUCATION 6

Introduction to human virtues, recognizing the need, fundamental guidelines, Content and Process on Value Education. Self-exploration-Wealth vs Prosperity, Understanding Needs of Self and Body.

UNIT II KNOWING HUMAN HAPPINESS AND MY HAPPINESS 6

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

UNIT III FAMILY AND SOCIETY HARMONY AND HUMAN RELATIONSHIP 6

The basic unit of human interaction, "trust" - the core value of Relations, "respect" - understood as correct evaluation, different emotions, justice in relationships, harmony in society, a vision of Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family! - Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT IV WHOLE EXISTENCE AS CO-EXISTENCE AND CONCORD OF NATURE 6

Concord in nature, link, self-monitoring, understanding of mutual fulfilment in the four orders of nature, recognizing existence as coexistence on all levels, holistic awareness of happiness in existence.

UNIT V HOLISTIC UNDERSTANDING OF HAPPINESS OF UNIVERSAL HUMAN VALUES 6

Inference of the above holistic understanding of happiness of universal human values. Accepting human values naturally. Finality of ethical human behaviour. A Humanistic Constitution and a Humanistic World Order. Ability in Professional Ethics Holistic

Technologies, Production Systems and Management Models-Typical, Strategies for Transition.

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome:

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

1. The big picture of life
2. Socially Responsible Behavior
3. Environmentally friendly work
4. Ethical Human Behaviour
5. Have the ability and skills to maintain good health and hygiene
6. Recognize and pursue excellence (merit) and appreciate everyone

Reference Books:

1.Vivekananda - Romain Rolland (English).
2.Gandhi - Romain Rolland (English).
3.Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991 15. Donella H.
4.Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5.A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.

Reference Links:

1.https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw

2. https://fdp-si.aicte-india.org/8dayUHV_download.php

3. https://www.youtube.com/watch?v=8ovkLRYXIjE

4.https://www.youtube.com/watch?v=OgdNx0X923I

5.https://www.youtube.com/watch?v=nGRcbRpvGoU

6.https://www.youtube.com/watch?v=sDxGXOgYEKM

22ES201	ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	4	2

Pre-requisite **Syllabus Version** V 0.1

GROUP A (CIVIL &MECHANICAL)

List of Experiments: (Civil Engineering)

PLUMBING WORK

1 Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
2 Preparing plumbing line sketches.
3 Laying pipe connection to the suction side of a pump
4 Laying pipe connection to the delivery side of a pump.
5 Connecting pipes of different materials: Metal, plastic and flexible pipes used inhousehold appliances

WOOD WORK:

1 Sawing
2 Planing and
3 Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.
4 Studying joints in door panels and wooden furniture
5 Studying common industrial trusses using models.

WELDING WORK:

1 Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
2 Practicing gas welding.

BASIC MACHINING WORK:

1 (simple)Turning.
2 (simple)Drilling.
3 (simple)Tapping.

ASSEMBLY WORK:

1 Assembling a centrifugal pump.
2 Assembling a household mixer.
3 Assembling an airconditioner.

SHEET METAL WORK:

1 Making of a square tray

FOUNDRY WORK:

1 Demonstrating basic foundry operations.

GROUP B (ELECTRICAL AND ELECTRONICS)

ELECTRICAL ENGINEERING PRACTICES

1 Introduction to switches, fuses, indicators and lamps - Basic switch boardwiring with lamp, fan and three pin socket
2 Staircase wiring
3 Fluorescent Lamp wiring with introduction to CFL and LED types.
4 Energy meter wiring and related calculations/ calibration
5 Study of Iron Box wiring and assembly
6 Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)
7 Study of emergency lamp wiring/Water heater

ELECTRONIC ENGINEERING PRACTICES

SOLDERING WORK:

1 Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

1 Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

1 Study an elements of smart phone.
2 Assembly and dismantle of LED TV.
3 Assembly and dismantle of computer/ laptop

TOTAL PRACTICAL PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
2. Wire various electrical joints in common household electrical wire work.
3. Weld various joints in steel plates using arc welding work; Machine various simple processeslike turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
4. Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

Reference Books:

1. S Gowri & T Jeyapoovan, Engineering Practices Lab Manual, Vikas Publishing-2021.

List of Equipment: (For A Batch of 30 Students)

1. CIVIL ENGINEERING

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

2. MECHANICAL

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

9.	Study-purpose items: centrifugal pump, air-conditioner	**One each**

3. ELECTRICAL

1.	Assorted electrical components for house wiring	**15 Sets.**
2.	Electrical measuring instruments	**10 Sets.**
3.	Study purpose items: Iron box, fan and regulator, emergency lamp	**1 Each.**
4.	Megger (250V/500V)	**1 No.**
5.	Range Finder	**2 Nos.**
6.	Digital Live-wire detector	**2 Nos.**

4. ELECTRONICS

1.	Soldering guns	**10 Nos.**
2.	Assorted electronic components for making circuits	**50 Nos.**
3.	Small PCBs	**10 Nos.**
4.	Multimeters	**10 Nos.**
5.	Study purpose items: Telephone, FM radio, low-voltage power supply	**1 Each.**

22CS203	COMPUTER HARDWARE & NETWORKING	L	T	P	C
		0	0	4	2

Pre-requisite **Syllabus Version** V 0.1

List of Experiments:

1.	Assembling a computer system	6
2.	Installing and configuring the operating system	5
3.	Configuring network settings and protocols	6
4.	Installing and configuring network devices such as routers and switches	5
5.	Setting up a wireless network	6
6.	Implementing network security measures	5
7.	Troubleshooting common network problems	6
8.	Configuring network services such as DHCP and DNS	5
9.	Setting up and configuring network storage devices such as NAS and SAN	6
10.	Implementing remote access solutions such as VPN and Remote Desktop	5
	TOTAL PRACTICAL PERIODS	**60 Periods**

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the basics of computer hardware and networking.
2. Learn to configure and troubleshoot computer systems and network devices.
3. Acquire skills in setting up and managing network services and protocols.
4. Develop knowledge in implementing network security measures and remote access solutions.
5. Understand the importance of proper maintenance and safety procedures for computer hardware and networking equipment.

Reference Books:

1. Computer Hardware: Installation, Interfacing, Troubleshooting and Maintenance by Muhammad E. Abdullah
2. CompTIA A+ Certification All-in-One Exam Guide, Tenth Edition by Mike Meyers
3. Computer Networking: A Top-Down Approach, Seventh Edition by James F. Kurose and Keith W. Ross
4. Network Security Essentials: Applications and Standards, Sixth Edition by William Stallings
5. Computer Hardware: Installation, Interfacing, Troubleshooting and Maintenance by Muhammad E. Abdullah

List of Equipments: (for batch of 30 students)

1.	monitor, keyboard, mouse,routers, switches, firewall, VPN, NAS, SAN	30 no

22ML301	DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	2	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To understand the concepts of ADTs
2. To design linear data structures – lists, stacks, and queues
3. To understand sorting, searching, and hashing algorithms
4. To apply Tree and Graph structures

Course Content:

UNIT I ABSTRACT DATA TYPES 9

Abstract Data Types (ADTs) – ADTs and classes – introduction to OOP – classes in Python –inheritance – namespaces – shallow and deep copying

Introduction to analysis of algorithms – asymptotic notations – divide & conquer – recursion – analyzing recursive algorithms

UNIT II LINEAR STRUCTURES 9

List ADT – array-based implementations – linked list implementations – singly linked lists – circularly linked lists – doubly linked lists – Stack ADT – Queue ADT – double ended queues –applications

UNIT III SORTING AND SEARCHING 9

Bubble sort — selection sort — insertion sort — merge sort — quick sort — analysis of sorting algorithms – linear search – binary search – hashing – hash functions – collision handling – load factors, rehashing, and efficiency.

UNIT IV TREE STRUCTURES 9

Tree ADT – Binary Tree ADT – tree traversals – binary search trees – AVL trees – heaps – multi-way search trees.

UNIT V GRAPH STRUCTURES 9

Graph ADT – representations of graph – graph traversals – DAG – topological ordering – greedyalgorithms – dynamic programming – shortest paths – minimum spanning trees – introduction tocomplexity classes and intractability

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Explain abstract data types
2. Design, implement, and analyze linear data structures, such as lists, queues, and stacks,according to the needs of different applications
3. Design, implement, and analyze efficient tree structures to meet requirements such assearching, indexing, and sorting

4. Model problems as graph problems and implement efficient graph algorithms to solve them

Text Book(s):

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, "Data Structures & Algorithms in Python", An Indian Adaptation, John Wiley & Sons Inc., 2021

Reference Books:

1. Lee, Kent D., Hubbard, Steve, "Data Structures and Algorithms with Python" SpringerEdition 2015
2. Rance D. Necaise, "Data Structures and Algorithms Using Python", John Wiley & Sons,2011
3. Aho, Hopcroft, and Ullman, "Data Structures and Algorithms", Pearson Education, 1983.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms", Second Edition, McGraw Hill, 2002.
5. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Fourth Edition, Pearson Education, 2014

List of Experiments:

1.	Implement simple ADTs as Python classes	**3**
2.	Implement recursive algorithms in Python	**3**
3.	Implement List ADT using Python arrays	**3**
4.	Linked list implementations of List	**3**
5.	Implementation of Stack and Queue ADTs	**3**
6.	Applications of List, Stack and Queue ADTs	**3**
7.	Implementation of sorting and searching algorithms	**3**
8.	Implementation of Hash tables	**3**
9.	Tree representation and traversal algorithms	**3**
10.	Implementation of Binary Search Trees	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**75 Periods**

List of Equipment: (for batch of 30 students)

1.	Code::Blocks,Java	30 nos

22CS302	PROBLEM SOLVING TECHNIQUE-III	L	T	P	C
		3	0	2	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To understand Object Oriented Programming concepts and basics of Java programminglanguage
2. To know the principles of packages, inheritance and interfaces
3. To develop a java application with threads and generics classes
4. To define exceptions and use I/O streams
5. To design and build Graphical User Interface Application using JAVAFX.

Course Content:

UNIT I INTRODUCTION TO OOP AND JAVA 9

Overview of OOP – Object oriented programming paradigms – Features of Object Oriented Programming – Java Buzzwords – Overview of Java – Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java – Defining classes in Java – Constructors- Methods -Access specifiers - Static members- Java Doc comments

UNIT II INHERITANCE, PACKAGES AND INTERFACES 9

Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces.

UNIT III EXCEPTION HANDLING AND MULTITHREADING 9

Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model–Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication- Suspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.

UNIT IV I/O, GENERICS, STRING HANDLING 9

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.

UNIT V JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS 9

JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, ToggleButton – RadioButtons – ListView – ComboBox – ChoiceBox – Text

Controls – ScrollPane. Layouts – FlowPane – HBox and VBox – BorderPane – StackPane – GridPane. Menus – Basics – Menu Menu bars – MenuItem

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Apply the concepts of classes and objects to solve simple problems
2. Develop programs using inheritance, packages and interfaces
3. Make use of exception handling mechanisms and multithreaded model to solve real world problems
4. Build Java applications with I/O packages, string classes, Collections and generics concepts Integrate the concepts of event handling and JavaFX components and controls for developing GUIbased applications

Text Book(s):

1. Herbert Schildt, "Java: The Complete Reference", 11 th Edition, McGraw Hill Education, New Delhi,2019
2. Herbert Schildt, "Introducing JavaFX 8 Programming", 1 st Edition, McGraw Hill Education, NewDelhi, 2015

Reference Books:

1. Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11 th Edition, Prentice Hall, 2018.

List of Experiments:

1. Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection, insertion). **3**
2. Develop stack and queue data structures using classes and objects. **3**
3. Develop a java application with an Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club funds. Generate pay slips for the employees with their grossand net salary. **3**
4. Write a Java Program 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 such 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 the given shape. **3**
5. Solve the above problem using an interface **3**
6. Implement exception handling and creation of user defined exceptions **3**
7. Write a java program that implements a multi-threaded application that has three threads. Firstthread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the **3**

value is odd, the third thread will print thevalue of the cube of the number.

8. Write a program to perform file operations. **3**
9. Develop applications using JavaFX controls, layouts and menus **3**
10. Develop a mini project for any application using Java concepts. **3**

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 75 Periods

List of Equipments: (for batch of 30 students)

1. Operating Systems: Linux / Windows 30 nos
2. Front End Tools: Eclipse IDE / Netbeans IDE -

22CS303	FOUNDATIONS OF DATA SCIENCE	L	T	P	C
		3	0	2	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To understand the data science fundamentals and process.
2. To learn to describe the data for the data science process.
3. To learn to describe the relationship between data.
4. To utilize the Python libraries for Data Wrangling.
5. To present and interpret data using visualization libraries in Python

Course Content:

UNIT I INTRODUCTION **9**

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 ofData.

UNIT II DESCRIBING DATA **9**

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**

Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error ofestimate – interpretation of r2 –multiple regression equations –regression towards the mean

UNIT IV PYTHON LIBRARIES FOR DATA WRANGLING **9**

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

UNIT V DATA VISUALIZATION **9**

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 LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Define the data science process
2. Understand different types of data description for data science processCO3: Gain knowledge on relationships between data
3. Use the Python Libraries for Data Wrangling
4. Apply visualization Libraries in Python to interpret and explore data

Text Book(s):

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", ManningPublications, 2016. (Unit I)
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017. (Units IIand III)
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016. (Units IV and V).

Reference Books:

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

List of Experiments:

1.	Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandaspackages.	**4**
2.	Working with Numpy arrays	**4**
3.	Working with Pandas data frames	**4**
4.	Reading data from text files, Excel and the web and exploring various commands for doingdescriptive analytics on the Iris data set.	**4**
5.	Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing thefollowing: a. Univariate analysis: Frequency, Mean, Median, Mode, Standard Deviation,Skewness and Kurtosis. b. Bivariate analysis: Linear and logistic regression modelin c. Multiple Regression analysis d. Also compare the results of the above analysis for the two data sets	**5**
6.	Apply and explore various plotting functions on UCI data sets a. Normal curves b. Density and contour plots c. Correlation and scatter plots d. Histograms e. Three dimensional plotting	**5**
7.	Visualizing Geographic Data with Basemap	**4**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**75 Periods**

List of Equipment: (for batch of 30 students)

1. Systems with MySql 30 nos
2. Visual Studio 30 nos
3. Server -

22MA302	DISCRETE MATHEMATICS	L	T	P	C
		3	1	0	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To extend student's logical and mathematical maturity and ability to deal with abstraction.
2. To introduce most of the basic terminologies used in computer science courses andapplication of ideas to solve practical problems.
3. To understand the basic concepts of combinatorics and graph theory.
4. To familiarize the applications of algebraic structures.
5. To understand the concepts and significance of lattices and boolean algebra which arewidely used in computer science and engineering

Course Content:

UNIT I LOGIC AND PROOFS 9+3

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

UNIT II COMBINATORICS 9+3

Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications

UNIT III GRAPHS 9+3

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

UNIT IV ALGEBRAIC STRUCTURES 9+3

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism's – Normalsubgroup and cosets – Lagrange's theorem – Definitions and examples of Rings and Fields

UNIT V LATTICES AND BOOLEAN ALGEBRA 9+3

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems-Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra – SubBoolean Algebra – Boolean Homomorphism

TOTAL LECTURE PERIODS 60 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Have knowledge of the concepts needed to test the logic of a program.
2. Have an understanding in identifying structures on many levels.

3. Be aware of a class of functions which transform a finite set into another finite set whichrelates to input and output functions in computer science.
4. Be aware of the counting principles.
5. Be exposed to concepts and properties of algebraic structures such as groups, rings andfields.

Text Book(s):

1. Rosen. K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGrawHill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2017.
2. Tremblay. J.P. and Manohar. R, "Discrete Mathematical Structures with Applications toComputer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.

Reference Books:

1. Grimaldi. R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 5thEdition, Pearson Education Asia, Delhi, 2013.
2. Koshy. T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.
3. Lipschutz. S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGrawHill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010

22CS304	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To understand the phases in a software project
2. To understand fundamental concepts of requirements engineering and Analysis Modelling.
3. To understand the various software design methodologies
4. To learn various testing and maintenance measures

Course Content:

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

Introduction to Software Engineering, Software Process, Perspective and Specialized ProcessModels –Introduction to Agility-Agile Process-Extreme programming-XP Process

UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION **9**

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

UNIT III SOFTWARE DESIGN **9**

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

UNIT IV TESTING AND MAINTENANCE **9**

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

UNIT V PROJECT MANAGEMENT **9**

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

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Identify the key activities in managing a software project.
2. Compare different process models.

3. Concepts of requirements engineering and Analysis Modeling.
4. Apply systematic procedure for software design and deployment.
5. Compare and contrast the various testing and maintenance.
6. Manage project schedule, estimate project cost and effort required

Text Book(s):

1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Seventh Edition, Mc Graw-Hill International Edition, 2010.
2. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011

Reference Books:

1. Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI LearningPrivateLimited, 2009.
2. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.
3. Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007.
4. Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing CompanyLimited,2007.
5. http://nptel.ac.in/.

22CS305	COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To learn the basic structure and operations of a computer.
2. To learn the arithmetic and logic unit and implementation of fixed-point and floating pointarithmetic unit.
3. To learn the basics of pipelined execution.
4. To understand parallelism and multi-core processors.
5. To understand the memory hierarchies, cache memories and virtual memories.
6. To learn the different ways of communication with I/O devices.

Course Content:

UNIT I BASIC STRUCTURE OF A COMPUTER SYSTEM 9

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

UNIT II ARITHMETIC FOR COMPUTERS 9

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

UNIT III PROCESSOR AND CONTROL UNIT 9

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

UNIT IV PARALLELISIM 9

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

UNIT V MEMORY & I/O SYSTEMS 9

Memory Hierarchy - memory technologies – cache memory – measuring and improving cache performance – virtual memory, TLB's – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Bus operation – Arbitration – Interface circuits - USB

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the basics structure of computers, operations and instructions.
2. Design arithmetic and logic unit.
3. Understand pipelined execution and design control unit.
4. Understand parallel processing architectures.

5. Understand the various memory systems and I/O communication

Text Book(s):

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

Reference Books:

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

22CS401	OPERATING SYSTEMS	L	T	P	C
		3	0	2	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To understand the basic concepts and functions of operating systems.
2. To understand Processes and Threads
3. To analyze Scheduling algorithms.
4. To understand the concept of Deadlocks.
5. To analyze various memory management schemes.
6. To understand I/O management and File systems.
7. To be familiar with the basics of Linux system and Mobile OS like iOS and Android.

Course Content:

UNIT I OPERATING SYSTEM OVERVIEW 9

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

UNIT II PROCESS MANAGEMENT 9

Processes - Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; CPU Scheduling - Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Threads- Overview, Multithreading models, Threading issues; Process Synchronization - The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock - System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT III STORAGE MANAGEMENT 9

Main Memory – Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, 32 and 64 bit architecture Examples; Virtual Memory – Background, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples

UNIT IV FILE SYSTEMS AND I/O SYSTEMS 9

Mass Storage system – Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space management; File-System Interface - File concept, Access methods, Directory Structure, Directory organization, File system mounting, File Sharing and Protection; File System Implementation- File System Structure, Directory implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery; I/O

Performance.

UNIT V CASE STUDY **9**

Linux System - Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Inter-process Communication; Mobile OS - iOS and Android - Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Analyze various scheduling algorithms.
2. Understand deadlock, prevention and avoidance algorithms.
3. Compare and contrast various memory management schemes.
4. Understand the functionality of file systems.
5. Perform administrative tasks on Linux Servers.
6. Compare iOS and Android Operating Systems.

Text Book(s):

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2012

Reference Books:

1. Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems – A Spiral Approach",Tata McGraw Hill Edition, 2010.
2. Achyut S.Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.
3. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, PearsonEducation, 2004.
4. Gary Nutt, "Operating Systems", Third Edition, Pearson Education, 2004.
5. Harvey M. Deitel, "Operating Systems", Third Edition, Pearson Education, 2004.
6. Daniel P Bovet and Marco Cesati, "Understanding the Linux kernel", 3rd edition, O'Reilly,2005.
7. Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", Fourth Edition, Payload media,2011.

List of Experiments:

1. Installation of windows operating system **3**
2. Illustrate UNIX commands and Shell Programming. **3**
3. Process Management using System Calls : Fork, Exit, Getpid, Wait, Close. **3**
4. Write C programs to implement the various CPU Scheduling Algorithms **3**
5. Illustrate the inter process communication strategy. **3**
6. Implement mutual exclusion by Semaphore. **3**
7. Write C programs to avoid Deadlock using Banker's Algorithm. **3**
8. Write a C program to Implement Deadlock Detection Algorithm. **3**
9. Implement the paging Technique using C program **3**
10. Install any guest operating system like Linux using VMware. **3**

TOTAL PRACTICAL PERIODS **30 Periods**

TOTAL LECTURE CUM PRACTICAL PERIODS **75 Periods**

List of Equipment: (for batch of 30 students)

1. Systems with Linux OS and GNU Computer 30 nos

22ML401	FOUNDATIONS OF ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	2	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. Learn the basic AI approaches
2. Develop problem solving agents
3. Perform logical and probabilistic reasoning.

Course Content:

UNIT I INTELLIGENT AGENTS 9

Introduction to AI – Agents and Environments – concept of rationality – nature of environments – structure of agents. Problem solving agents – search algorithms – uninformed search strategies.

UNIT II PROBLEM SOLVING 9

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

UNIT III GAME PLAYING AND CSP 9

Game theory – optimal decisions in games – alpha-beta search – monte-carlo tree search – stochastic games – partially observable games. Constraint satisfaction problems – constraint propagation – backtracking search for CSP – local search for CSP – structure of CSP

UNIT IV LOGICAL REASONING 9

Knowledge-based agents – propositional logic – propositional theorem proving – propositional model checking – agents based on propositional logic. First-order logic – syntax and semantics –knowledge representation and engineering – inferences in first-order logic – forward chaining – backward chaining — resolution.

UNIT V PROBABILISTIC REASONING 9

Acting under uncertainty – Bayesian inference – naïve Bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Explain intelligent agent frameworks
2. Apply problem solving techniques
3. Apply game playing and CSP techniques

4. Perform logical reasoning
5. Perform probabilistic reasoning under uncertainty.

Text Book(s):

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021

Reference Books:

1. Dan W. Patterson, "Introduction to AI and ES", Pearson Education,2007
2. Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill, 2008
3. Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006
4. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013
5. http://nptel.ac.in/.

List of Experiments:

1.	Develop PEAS descriptions for given AI tasks	**3**
2.	Implement basic search strategies for selected AI applications	**3**
3.	Implement A* and memory bounded A* algorithms	**3**
4.	Implement genetic algorithms for AI tasks	**3**
5.	Implement simulated annealing algorithms for AI tasks	**3**
6.	Implement alpha-beta tree search	**3**
7.	Implement backtracking algorithms for CSP	**3**
8.	Implement local search algorithms for CSP	**3**
9.	Implement propositional logic inferences for AI tasks	**3**
10.	Implement resolution based first order logic inferences for AI tasks	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**75 Periods**

List of Equipment: (for batch of 30 students)

1.	Python with statistical Packages	30 nos

22CS403	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	2	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To learn the fundamentals of data models and to represent a database system using ERdiagrams.
2. To study SQL and relational database design.
3. To understand the internal storage structures using different file and indexingtechniques which will help in physical DB design.
4. To understand the fundamental concepts of transaction processing-concurrencycontrol techniques and recovery procedures.
5. To have an introductory knowledge about the Storage and Query processing Techniques

Course Content:

UNIT I RELATIONAL DATABASES 9

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL.

UNIT II DATABASE DESIGN 9

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

UNIT III TRANSACTIONS 9

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

UNIT IV IMPLEMENTATION TECHNIQUES 9

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

UNIT V ADVANCED TOPICS 9

Distributed Databases: Architecture, Data Storage, Transaction Processing –MongoDB–DDL,DLL,DML– Object-based Databases: Object Database Concepts, Object-Relational features, ODMG Object Model, ODL, OQL - XML Databases: XML Hierarchical Model, DTD, XML Schema, XQuery – Information Retrieval: IR Concepts, Retrieval Models,

Queries in IR systems.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Classify the modern and futuristic database applications based on size and complexity
2. Map ER model to Relational model to perform database design effectively
3. Write queries using normalization criteria and optimize queries
4. Compare and contrast various indexing strategies in different database systems
5. Appraise how advanced databases differ from traditional databases

Text Book(s):

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", SixthEdition, Tata McGraw Hill, 2011.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Sixth Edition,Pearson Education, 2011.

Reference Books:

1. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition,Pearson Education, 2006.
2. Raghu Ramakrishnan, —Database Management Systems‖, Fourth Edition, McGraw-HillCollege Publications, 2015.
3. G.K.Gupta,"Database Management Systems", Tata McGraw Hill, 2011

List of Experiments:

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

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 75 Periods

List of Equipment: (for batch of 30 students)

1.	Systems with MySql	30 nos
2.	Visual Studio	30 nos
3.	Server	-

22CS404	THEORY OF COMPUTATION	L	T	P	C
		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To understand foundations of computation including automata theory
2. To construct models of regular expressions and languages.
3. To design context free grammar and push down automata
4. To understand Turing machines and their capability
5. To understand Undecidability and NP class problems

Course Content:

UNIT I AUTOMATA AND REGULAR EXPRESSIONS 9

Need for automata theory - Introduction to formal proof – Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Equivalence between NFA and DFA – Finite Automata with Epsilon transitions – Equivalence of NFA and DFA- Equivalence of NFAs with andwithout ε-moves- Conversion of NFA into DFA – Minimization of DFAs

UNIT II REGULAR EXPRESSIONS AND LANGUAGES 9

Regular expression – Regular Languages- Equivalence of Finite Automata and regular expressions – Proving languages to be not regular (Pumping Lemma) – Closure properties of regular languages

UNIT III CONTEXT FREE GRAMMAR AND PUSH DOWN AUTOMATA 9

Types of Grammar - Chomsky's hierarchy of languages -Context-Free Grammar (CFG) and Languages Derivations and Parse trees – Ambiguity in grammars and languages – Push Down Automata (PDA): Definition – Moves - Instantaneous descriptions -Languages of pushdown automata – Equivalence of pushdown automata and CFG-CFG to PDA-PDA to CFG – Deterministic Pushdown Automata

UNIT IV NORMAL FORMS AND TURING MACHINES 9

Normal forms for CFG – Simplification of CFG- Chomsky Normal Form (CNF) and Greibach Normal Form (GNF) – Pumping lemma for CFL – Closure properties of Context Free Languages –Turing Machine : Basic model – definition and representation – Instantaneous Description – Language acceptance by TM – TM as Computer of Integer functions – Programming techniques for Turing machines (subroutines).

UNIT V UNDECIDABILITY 9

Unsolvable Problems and Computable Functions –PCP-MPCP- Recursive and recursively enumerable languages – Properties - Universal Turing machine -Tractable and Intractable problems - P and NP completeness – Kruskal's algorithm – Travelling Salesman Problem- 3-CNF SAT problems

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Construct automata theory using Finite Automata
2. Write regular expressions for any pattern
3. Design context free grammar and Pushdown Automata
4. Design Turing machine for computational functions
5. Differentiate between decidable and undecidable problems

Text Book(s):

1. Hopcroft J.E., Motwani R. & Ullman J.D., "Introduction to Automata Theory, Languages andComputations", 3rd Edition, Pearson Education, 2008.
2. John C Martin , "Introduction to Languages and the Theory of Computation", 4th Edition, TataMcGraw Hill, 2011

Reference Books:

1. Harry R Lewis and Christos H Papadimitriou , "Elements of the Theory of Computation", 2ndEdition, Prentice Hall of India, 2015.
2. Peter Linz, "An Introduction to Formal Language and Automata", 6th Edition, Jones & Bartlett,2016.
3. K.L.P.Mishra and N.Chandrasekaran, "Theory of Computer Science: Automata Languages andComputation", 3rd Edition, Prentice Hall of India, 2006

22IT402	EMBEDDED SYSTEMS AND IOT	L	T	P	C
		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To provide students with good depth of knowledge of Designing Embedded and IOT Systems for various application.
2. Knowledge for the design and analysis of Embedded and IOT Systems for Electronics Engineering students.

Course Content:

UNIT I Introduction to Embedded and IOT Systems 9

Definition, Examples and components of embedded Systems, Classification of an Embedded system. Architecture of Embedded system. General purpose computers vs embedded system, Embedded System Design Process, Various Embedded cores controller. Embedded system with IOT connectivity.

UNIT II Hardware/Software Co-design for Embedded Systems 9

Microcontrollers for embedded systems, 32-bit RISC Architectures for embedded Design, ARM architectural details, The ARM programmer's model, ARM development tools, ARM microcontroller programming in C, Peripheral Interfacing with ARM, Basic Wire and Wireless Protocols like, UART, I2C, SPI, PLCC, Bluetooth, WiFi, Zig-Bee and LoRa for IoT applications.

UNIT III Embedded Operating Systems 9

Operating system requirements for Embedded systems, Fundamentals of Real Time Operating System (RTOS), Operating system services, Process, Task and Thread, System calls, Timer and Event Function, Memory management, File and I/O subsystem management, Device Management, Device drivers and It's Programming for Embedded platform.

UNIT IV OS based Software development 9

Programming in higher level languages on embedded OS platform, Communication protocols and it's applications, Embedded Systems with Internet of Things (IoT) and Cloud support

UNIT V Introduction to IOT based Embedded Systems 9

Basic architecture of an IoT based Embedded Systems., Embedded Hardware for IoT applications, like Raspberry Pi, Arduino, and ARM development board, IoT Cloud Platform and IoT client applications on mobile phones

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Knowledge of theory and practice related to Embedded and IOT System.

2. Ability to identify, formulate and solve engineering problems by using Embedded Systems with IoT.
3. Ability to implement real field problem by gained knowledge of Embedded Systems with IoT capability.

Text Book(s):

1. Peckol, “Embedded System Design”, John Wiley,2010.
2. Industrial IoT Challenges, Design Principles, Applications, and Security by Ismail Butun(editor).
3. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press).

Reference Books:

1. Muhammad Ali Mazidi,Shujen Chen, Sepehr Naimi,Sarmad Naimi, “Embedded Programming Using C Language”, 1st Edition, Freescale ARM Cortex-M.
2. Steve Ferbur, “ARM System on Chip”.
3. Rajkamal, “Embedded System: Architecture, Programming and Design”, TMH3.
4. Dr. OvidiuVermesan, Dr. Peter Friess, “Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publisher

22MC402	INNOVATION AND PATENT DEVELOPMENT	L	T	P	C
		-	-	-	-

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To impart the knowledge of various aspects of Innovation and Patent Development.

Course Content:

UNIT I INTRODUCTION 9

The process of technological innovation - factors contributing to successful technological innovation - the need for creativity and innovation - creativity and problem solving - brain storming - different techniques.

UNIT II PROJECT SELECTION AND EVALUATION 9

Collection of ideas and purpose of project - Selection criteria - screening ideas for new products (evaluation techniques).

UNIT III NEW PRODUCT PLANNING 9

Design of proto type - testing - quality standards - marketing research - introducing new products.

UNIT IV NEW PRODUCT DEVELOPMENT 9

Research and new product development - Patents - Patent search - Patent laws - International code for patents - Intellectual property rights (IPR)

UNIT V MODEL PREPARATION & EVALUATION 9

Creative design - Model Preparation - Testing - Cost evaluation - Patent application.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

Text Book(s):

1. Twiss, Brian. “Managing Technological Innovation”, Pitman Publishing Ltd., 1992.
2. Watton, Harry B. “New Product Planning”, Prentice Hall Inc., 1992.

Reference Books:

1. Nystrom, Harry “Creativity and Innovation”, John Wiley & Sons, 1979.
2. Khandwalla, N. – “Fourth Eye (Excellence through Creativity) - Wheeler Publishing”, 1992.
3. I.P.R. Bulletins, TIFAC, New Delhi, 1997..

22ML501	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	2	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To learn the fundamentals of natural language processing.
2. To learn the word level analysis methods .
3. To explore the syntactic analysis concepts.
4. To understand the semantics and pragmatics.
5. To learn to analyze discourses and Lexical Resources

Course Content:

UNIT I INTRODUCTION 9

Origins and challenges of NLP — Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

UNIT II WORD LEVEL ANALYSIS 9

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff — Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models

UNIT III SYNTACTIC ANALYSIS 9

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

UNIT IV SEMANTICS AND PRAGMATICS 9

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments — Word Senses, Relations between Senses, Thematic Roles, selectional restrictions — Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods — Word Similarity using Thesaurus and Distributional methods.

UNIT V DISCOURSE ANALYSIS AND LEXICAL RESOURCES 9

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm — Coreference Resolution — Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Tag a given text with basic Language features
2. Implement a rule based system to tackle morphology/syntax of a language
3. Design a tag set to be used for statistical processing for real-time applications.
4. Compare and contrast the use of different statistical approaches for different types of NLPapplications.
5. Use tools to process natural language and design innovative NLP applications

Text Book(s):

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, O'Reilly Media, 2009

Reference Books:

1. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, —Natural Language Processing with Java‖, O'Reilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval",Oxford University Press, 2008

List of Experiments:

1.	Word Analysis	**3**
2.	Word Generation	**3**
3.	Morphology	**3**
4.	N-Grams	**3**
5.	N-Grams Smoothing	**3**
6.	POS Tagging: Hidden Markov Model	**3**
7.	POS Tagging: Viterbi Decoding	**3**
8.	Building POS Tagger	**3**
9.	Chunking	**3**
10.	Building Chunker	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**75 Periods**

List of Equipment: (for batch of 30 students)

1.	Systems with Linux Operating System with gnu compiler	30 nos

22AI401	MACHINE LEARNING	L	T	P	C
		3	0	2	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To understand the basic concepts of machine learning.
2. To understand and build supervised learning models.
3. To understand and build unsupervised learning models.
4. To evaluate the algorithms based on corresponding metrics identified

Course Content:

UNIT I INTRODUCTION TO MACHINE LEARNING 9

Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik-Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off.

UNIT II SUPERVISED LEARNING 9

Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Perceptron algorithm, Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random Forests.

UNIT III ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING 9

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.

UNIT IV NEURAL NETWORKS 9

Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.

UNIT V DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS 9

Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms – t test, McNemar's test, K-fold CV paired t test

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Explain the basic concepts of machine learning.
2. Construct supervised learning models.
3. Construct unsupervised learning algorithms.
4. Evaluate and compare different models.
5. Practical understanding on regression, classification and decision making

Text Book(s):

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRC Press, 2014.

Reference Books:

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997.
3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, 2012, 2018.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016
5. Sebastain Raschka, Vahid Mirjalili, "Python Machine Learning", Packt publishing, 3rd Edition, 2019.

List of Experiments:

1.	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.	**4**
2.	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	**4**
3.	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.	**3**
4.	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file and compute the accuracy with a few test data sets.	**3**
5.	Implement naïve Bayesian Classifier model to classify a set of documents and measure the accuracy, precision, and recall.	**3**
6.	Write a program to construct a Bayesian network to diagnose CORONA infection using standard WHO Data Set.	**3**
7.	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using the k-Means algorithm. Compare the results of these two algorithms.	**3**
8.	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.	**3**
9.	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**

TOTAL LECTURE CUM PRACTICAL PERIODS 75 Periods

List of Equipments: (for batch of 30 students)

1. The programs can be implemented in either Python or R 30 nos

22CS503	CRYPTOGRAPHY AND CYBER SECURITY	L	T	P	C
		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To understand Cryptography Theories, Algorithms and Systems.
2. To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks

Course Content:

UNIT I INTRODUCTION 9

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

UNIT II SYMMETRIC CRYPTOGRAPHY 9

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

UNIT III PUBLIC KEY CRYPTOGRAPHY 9

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

UNIT IV MESSAGE AUTHENTICATION AND INTEGRITY 9

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

UNIT V SECURITY PRACTICE AND SYSTEM SECURITY 9

Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the fundamentals of networks security, security architecture, threats and vulnerabilities
2. Apply the different cryptographic operations of symmetric cryptographic algorithms
3. Apply the different cryptographic operations of public key cryptography
4. Apply the various Authentication schemes to simulate different applications.
5. Understand various Security practices and System security standards.

Text Book(s):

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

Reference Books:

1. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd
2. BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007

22ML601	OBJECT ORIENTED SOFTWARE ENGINEERING	L	T	P	C
		3	0	2	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To understand Software Engineering Lifecycle Models
2. To Perform software requirements analysis
3. To gain knowledge of the System Analysis and Design concepts using UML.
4. To understand software testing and maintenance approaches
5. To work on project management scheduling using DevOps.

Course Content:

UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT 9

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process-Case Study

UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION 9

Requirement analysis and specification – Requirements gathering and analysis – Software Requirement Specification – Formal system specification – Finite State Machines – Petrinets – Object modelling using UML – Use case Model – Class diagrams – Interaction diagrams – Activitydiagrams – State chart diagrams – Functional modelling – Data Flow Diagram- CASE TOOLS.

UNIT III SOFTWARE DESIGN 9

Software design – Design process – Design concepts – Coupling – Cohesion – Functional independence – Design patterns – Model-view-controller – Publish-subscribe – Adapter – Command – Strategy – Observer – Proxy – Facade – Architectural styles – Layered - Client Server - Tiered - Pipe and filter- User interface design-Case Study

UNIT IV SOFTWARE TESTING AND MAINTENANCE 9

Testing – Unit testing – Black box testing– White box testing – Integration and System testing– Regression testing – Debugging - Program analysis – Symbolic execution – Model Checking- Case Study

UNIT V PROJECT MANAGEMENT 9

Software Project Management- Software Configuration Management - Project Scheduling- DevOps: Motivation-Cloud as a platform-Operations- Deployment Pipeline:Overall Architecture Building and Testing-Deployment- Tools- Case Study

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Compare various Software Development Lifecycle Models
2. Evaluate project management approaches as well as cost and schedule estimation strategies.
3. Perform formal analysis on specifications.
4. Use UML diagrams for analysis and design.
5. Architect and design using architectural styles and design patterns, and test the system

Text Book(s):

1. Bernd Bruegge and Allen H. Dutoit, "Object-Oriented Software Engineering: Using UML, Patterns and Java", Third Edition, Pearson Education, 2009.
2. Roger S. Pressman, Object-Oriented Software Engineering: An Agile Unified Methodology, FirstEdition, Mc Graw-Hill International Edition, 2014.

Reference Books:

1. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, 2ndedition, PHI Learning Pvt. Ltd., 2010.
2. Craig Larman, Applying UML and Patterns, 3rd ed, Pearson Education, 2005.
3. Len Bass, Ingo Weber and Liming Zhu, —DevOps: A Software Architect's Perspective‖, Pearson Education, 2016
4. Rajib Mall, Fundamentals of Software Engineering, 3rd edition, PHI Learning Pvt. Ltd., 2009.
5. Stephen Schach, Object-Oriented and Classical Software Engineering, 8th ed, McGraw-Hill,2010

List of Experiments:

1.	Identify a software system that needs to be developed.	**3**
2.	Document the Software Requirements Specification (SRS) for the identified system.	**3**
3.	Identify use cases and develop the Use Case model	**3**
4.	Identify the conceptual classes and develop a Domain Model and also derive a Class Diagramfrom that.	**3**
5.	Using the identified scenarios, find the interaction between objects and represent them usingUML Sequence and Collaboration Diagrams	**3**
6.	Draw relevant State Chart and Activity Diagrams for the same system.	**3**
7.	Implement the system as per the detailed design	**3**
8.	Test the software system for all the scenarios identified as per the usecase diagram	**3**
9.	Improve the reusability and maintainability of the software system by applying appropriatedesign patterns.	**3**
10.	Implement the modified system and test it for various scenarios	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**

TOTAL LECTURE CUM PRACTICAL PERIODS 75 Periods

SUGGESTED DOMAINS FOR MINI-PROJECT:

1. Passport automation system.
2. Book bank
3. Exam registration
4. Stock maintenance system.
5. Online course reservation system
6. Airline/Railway reservation system
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system
11. Foreign trading system
12. Conference management system
13. BPO management system
14. Library management system
15. Student information system

List of Equipments: (for batch of 30 students)

1. Operating Systems: Windows 30 nos
2. ArgoUML -

22EEC502	MINI PROJECT	L	T	P	C
		0	0	2	1

Pre-requisite **Syllabus Version** V 0.1

Course Objectives:

1. To develop their own innovative prototype of ideas.
2. To train the students in preparing mini project reports and examination.

The students in a group of 4 to 6 works on a topic approved by the head of the department and prepares a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A mini project report is required at the end of the semester. The mini project work is evaluated based on oral presentation and the mini project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL PRACTICAL PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. On Completion of the mini project work students will be in a position to take up their final year project work and find solution by formulating proper methodology.

22MC602	ENVIRONMENTAL SCIENCES	L	T	P	C
		-	-	-	-

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To introduce the basic concepts of environment, ecosystems and biodiversity and emphasizeon the biodiversity of India and its conservation.
2. To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
3. To facilitate the understanding of global and Indian scenario of renewable and nonrenewableresources, causes of their degradation and measures to preserve them.
4. To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management.
5. To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyze the role of sustainable urbanization.

Course Content:

UNIT I ENVIRONMENT AND BIODIVERSITY 9

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threatsto biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ

UNIT II ENVIRONMENTAL POLLUTION 9

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts.

UNIT III RENEWABLE SOURCES OF ENERGY 9

Energy management and conservation, New Energy Sources: Need of new sources. Different typesnew energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy

UNIT IV SUSTAINABILITY AND MANAGEMENT 9

Development , GDP ,Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols- Sustainable Development Goals-targets, indicators and intervention

areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT V SUSTAINABILITY PRACTICES 9

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles- carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio- economical and technological change.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. To recognize and understand the functions of environment, ecosystems and biodiversity andtheir conservation.
2. To identify the causes, effects of environmental pollution and natural disasters and contributeto the preventive measures in the society.
3. To identify and apply the understanding of renewable and non-renewable resources andcontribute to the sustainable measures to preserve them for future generations.
4. To recognize the different goals of sustainable development and apply them for suitabletechnological advancement and societal development.
5. To demonstrate the knowledge of sustainability practices and identify green materials, energycycles and the role of sustainable urbanization

Text Book(s):

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition,New Age International Publishers ,2018.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi,2016.
3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition,Pearson Education, 2004.

Reference Books:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances andStandards', Vol. I and II, Enviro Media. 38 . edition 2010.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House,Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.

22CS701	DISTRIBUTED COMPUTING	L	T	P	C
		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To introduce the computation and communication models of distributed systems
2. To illustrate the issues of synchronization and collection of information in distributed systems
3. To describe distributed mutual exclusion and distributed deadlock detection techniques
4. To elucidate agreement protocols and fault tolerance mechanisms in distributed systems
5. To explain the cloud computing models and the underlying concepts.

Course Content:

UNIT I INTRODUCTION 9

Introduction: Definition-Relation to Computer System Components – Motivation – Message - PassingSystems versus Shared Memory Systems – Primitives for Distributed Communication – Synchronous versus Asynchronous Executions – Design Issues and Challenges; A Model of Distributed Computations: A Distributed Program – A Model of Distributed Executions – Models of Communication Networks – Global State of a Distributed System.

UNIT II LOGICAL TIME AND GLOBAL STATE 9

Logical Time: Physical Clock Synchronization: NTP – A Framework for a System of Logical Clocks-Scalar Time – Vector Time; Message Ordering and Group Communication: Message Ordering Paradigms – Asynchronous Execution with Synchronous Communication – Synchronous Program Order on Asynchronous System – Group Communication – Causal Order – Total Order; Global State and Snapshot Recording Algorithms: Introduction – System Model and Definitions – SnapshotAlgorithms for FIFO Channels.

UNIT III DISTRIBUTED MUTEX AND DEADLOCK 9

Distributed Mutual exclusion Algorithms: Introduction – Preliminaries – Lamport's algorithm – Ricart- Agrawala's Algorithm –– Token-Based Algorithms – Suzuki-Kasami's Broadcast Algorithm; Deadlock Detection in Distributed Systems: Introduction – System Model – Preliminaries – Models of Deadlocks – Chandy-Misra-Haas Algorithm for the AND model and OR Model

UNIT IV CONSENSUS AND RECOVERY 9

Consensus and Agreement Algorithms: Problem Definition – Overview of Results – Agreement in a Failure-Free System(Synchronous and Asynchronous) – Agreement in Synchronous Systems withFailures; Checkpointing and Rollback Recovery: Introduction – Background and Definitions – Issuesin Failure Recovery – Checkpoint-based Recovery – Coordinated Checkpointing Algorithm -Algorithm for Asynchronous Checkpointing

and Recovery.

UNIT V CLOUD COMPUTING 9

Definition of Cloud Computing – Characteristics of Cloud – Cloud Deployment Models – Cloud Service Models – Driving Factors and Challenges of Cloud – Virtualization – Load Balancing – Scalability and Elasticity – Replication – Monitoring – Cloud Services and Platforms: Compute Services – Storage Services – Application Services

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Explain the foundations of distributed systems
2. Solve synchronization and state consistency problems
3. Use resource sharing techniques in distributed systems
4. Apply working model of consensus and reliability of distributed systems
5. Explain the fundamentals of cloud computing .

Text Book(s):

1. Kshemkalyani Ajay D, Mukesh Singhal, "Distributed Computing: Principles, Algorithms andSystems", Cambridge Press, 2011.
2. Mukesh Singhal, Niranjan G Shivaratri, "Advanced Concepts in Operating systems", Mc-Graw Hill Publishers, 1994

Reference Books:

1. George Coulouris, Jean Dollimore, Time Kindberg, "Distributed Systems Concepts andDesign", Fifth Edition, Pearson Education, 2012.
2. Pradeep L Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall ofIndia, 2007.
3. Tanenbaum A S, Van Steen M, "Distributed Systems: Principles and Paradigms", PearsonEducation, 2007.
4. Liu M L, "Distributed Computing: Principles and Applications", Pearson Education, 2004.
5. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers, 2003.
6. Arshdeep Bagga, Vijay Madisetti, " Cloud Computing: A Hands-On Approach", UniversitiesPress, 2014.

22MG701	PRINCIPLES OF MANAGEMENT	L	T	P	C
		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. Sketch the Evolution of Management.
2. Extract the functions and principles of management.
3. Learn the application of the principles in an organization.
4. Study the various HR related activities.
5. Analyze the position of self and company goals towards business.

Course Content:

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur- types of managers- managerial roles and skills – Evolution of Management –Scientific, human relations, system and contingency approaches– Types of Business organization- Sole proprietorship, partnership, company-public and private sector enterprises- Organization culture and Environment – Current trends and issues in Management

UNIT II PLANNING 9

Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting objectives – Policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – Organization chart – Organization structure – Types – Line and staff authority – Departmentalization – delegation of authority – Centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management

UNIT IV DIRECTING 9

Foundations of individual and group behaviour– Motivation – Motivation theories – Motivational techniques – Job satisfaction – Job enrichment – Leadership – types and theories of leadership – Communication – Process of communication – Barrier in communication – Effective communication – Communication and IT.

UNIT V CONTROLLING 9

System and process of controlling – Budgetary and non - Budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control andperformance – Direct and preventive control – Reporting

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Upon completion of the course, students will be able to have clear Upon completion of the course, students will be able to have clear understanding ofmanagerial functions like planning, organizing, staffing, leading & controlling.
2. Have same basic knowledge on international aspect of management.
3. Ability to understand management concept of organizing.
4. Ability to understand management concept of directing.
5. Ability to understand management concept of controlling

Text Book(s):

1. Harold Koontz and Heinz Weihrich "Essentials of management" Tata McGraw Hill,1998.
2. Stephen P. Robbins and Mary Coulter, " Management", Prentice Hall (India)Pvt. Ltd., 10th Edition, 2009

Reference Books:

1. Robert Kreitner and MamataMohapatra, " Management", Biztantra, 2008.
2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, "Fundamentals ofManagement" Pearson Education, 7th Edition, 2011.
3. Tripathy PC and Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999.

22EEC701	PROJECT WORK- PHASE I	L	T	P	C
		0	0	4	2

Pre-requisite **Syllabus Version** V 0.1

Course Objectives:

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

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

TOTAL PRACTICAL PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

22IT801	SOFTWARE TESTING	L	T	P	C
		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To learn the criteria for test cases.
2. To learn the design of test cases.
3. To understand test management and test automation techniques.
4. To apply test metrics and measurements.

Course Content:

UNIT I INTRODUCTION 9

Testing as an Engineering Activity – Testing as a Process – Testing Maturity Model- Testing axioms – Basic definitions – Software Testing Principles – The Tester's Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design –Defect Examples- Developer/Tester Support of Developing a Defect Repository

UNIT II TEST CASE DESIGN STRATEGIES 9

Test case Design Strategies – Using Black Box Approach to Test Case Design – Boundary Value Analysis – Equivalence Class Partitioning – State based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing - Random Testing – Requirements based testing – Using White Box Approach to Test design – Test Adequacy Criteria– static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Additional White box testing approaches- Evaluating Test Adequacy Criteria

UNIT III LEVELS OF TESTING 9

The need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing –Compatibility testing – Testing the documentation – Website testing

UNIT IV TEST MANAGEMENT 9

People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group- The Structure of Testing Group- The Technical Training Program.

UNIT V TEST AUTOMATION 9

Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Design test cases suitable for a software development for different domains.
2. Identify suitable tests to be carried out.
3. Prepare test planning based on the document.
4. Document test plans and test cases designed.
5. Use automatic testing tools.
6. Develop and validate a test plan

Text Book(s):

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

Reference Books:

1. Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2003.
2. Edward Kit," Software Testing in the Real World – Improving the Process", PearsonEducation, 1995.
3. Boris Beizer," Software Testing Techniques" – 2nd Edition, Van Nostrand Reinhold, NewYork, 1990.
4. Aditya P. Mathur, "Foundations of Software Testing _ Fundamental Algorithms and Techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008

22EEC801	PROJECT WORK- PHASE II	L	T	P	C
		0	0	20	10

Pre-requisite **Syllabus Version** V 0.1

Course Objectives:

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

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

TOTAL PRACTICAL PERIODS 300 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

Professional Elective List

Course Code	ADVANCED JAVA PROGRAMMING	L	T	P	C
22PCS01		2	0	2	3

Pre-requisite Java Fundamentals **Syllabus Version** V 0.1

Course Objectives:

1. The course covers Graphical User Interface (GUI) networking, and database manipulation.
2. Student will be able to use advanced technology in Java such as Internationalization, and Remote method Invocation
3. Student will learn how to work with JavaBeans.
4. Student will be able to develop web application using Java Servlet and Java Server Pages technology.

Course Content:

UNIT I Introduction To Swing 6

Introduction To Swing, MVC Architecture, Applets, Applications and Pluggable Look and Feel, Basic swing components: Text Fields, Buttons, Toggle Buttons, Checkboxes, and Radio Buttons.

UNIT II Java Database Connectivity & Networking 6

Java database Programming, java.sql Package, JDBC driver. Network Programming With java.net Package, Client and Server Programs, Content And Protocol Handlers

UNIT III RMI Programming, Serialization and Internationalization 6

RMI architecture, RMI registry, Writing distributed application with RMI, Naming services, Naming And Directory Services, Overview of JNDI, Object serialization and Internationalization

UNIT IV J2EE Architecture and Servlet Programming 6

J2EE architecture, Enterprise application concepts, n-tier application concepts, J2EE platform, HTTP protocol, web application, Web containers and Application servers, Server side programming with Java Servlet, HTTP and Servlet, Servlet API, life cycle, configuration and context, Request and Response objects, Session handling and event handling, Introduction to filters with writing simple filter application

UNIT V JSP & JSTL 6

JSP architecture, JSP page life cycle, JSP elements, Expression Language, Tag Extensions, Tag Extension API, Tag handlers, JSP Fragments, Tag Files, JSTL, Core Tag library, overview of XML Tag library, SQL Tag library and Functions Tag library.

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. This module aims to introduce the students to some concepts of advanced programming and practice on reusing components.

2. A selected programming language is used such as Java. At the end of this course, the students should be able to write sophisticated Java applications

Text Book(s):

1. Java 6 Programming, Black Book, Dreamtech.

Reference Books:

1. Java Server Programming, Java EE6 (J2EE 1.6), Black Book, Dreamtech
2. 3. Advanced Java Technology, By M.T. Savaliya, Dreamtech

List of Experiments:

1.	i) Write a Program that displays two textboxes for entering a students' Roll-no and Name with appropriate labels and buttons.. ii) Write a Program in Java to implement Calculator using Swing technology	**3**
2.	Write a Java program that makes a connection with database using JDBC and prints metadata of this connection.	**3**
3.	i) Write a java program for one way TCP communication for server and client, where server will response to client with current data and time ii) Write a java program for two-way TCP communication for server and client. It should look like a simple chat application iii) Write a java program for UDP Communication where client will send name of country and server will return the capital of that country.	**4**
4.	Create a simple calculator application that demonstrates the use of RMI. You are not required to create GUI	**4**
5.	i) Create a Servlet for demo of KBC game. There will be continuous two or three pages with different MCQs. Each correct answer carries Rs. 10000. At the end as per user's selection of answers total prize he won should be declared. User should not be allowed to backtrack ii) Create Servlet for login page, if the username and password is correct then prints message "Hello username" else a message"login failed	**4**
6.	i) Create a Servlet that implements Servlet Context Attribute Listener interface such that a message dialog is displaued whenever an attribute is added or removed or replaced. ii) Create a Servlet filter that calculates server's response time and add it to response when giving it back to client.	**4**
7.	i) Create a jsp that prints hello world. ii) Create a jsp that add and subtract two numbers.	
8.	i) Create a custom JSP tag that prints current date and time. Use this tag into JSP page.	**4**

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 60 Periods

List of Equipment: (for batch of 30 students)

1.	Systems with either Netbeans or Eclipse	30 nos

Course Code	APP DEVELOPMENT	L	T	P	C
22PCS02		2	0	2	3

Pre-requisite Basic Java **Syllabus Version** V 0.1

Course Objectives:

1. To learn development of native applications with basic GUI Components
2. To develop cross-platform applications with event handling
3. To develop applications with location and data storage capabilities
4. To develop web applications with database access

Course Content:

UNIT I FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT **6**

Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, What is Progressive Web App, Responsive Web design.

UNIT II NATIVE APP DEVELOPMENT USING JAVA **6**

Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Dev elopment Frameworks, Java & Kotlin for Android, Swift & Objective-C for iOS, Basics of React Native, Native Components, JSX, State, Props

UNIT III HYBRID APP DEVELOPMENT **6**

Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks, Ionic, Apache Cordova.

UNIT IV CROSS-PLATFORM APP DEVELOPMENT USING REACT-NATIVE **6**

What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross- platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native, Native Components, JSX, State, Props.

UNIT V NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS **6**

Comparison of different App frameworks, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Development, UI/UX, Reusability

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Develop Native applications with GUI Components.
2. Develop hybrid applications with basic event handling.
3. Implement cross-platform applications with location and data storage capabilities.

4. Implement cross platform applications with basic GUI and event handling.
5. Develop web applications with cloud database access

Text Book(s):

1. Head First Android Development, Dawn Griffiths, O'Reilly, 1st edition
2. Apache Cordova in Action, Raymond K. Camden, Manning. 2015
3. Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, FullStack publishing.

Reference Books:

1. Android Programming for Beginners, John Horton, Packt Publishing, 2nd Edition
2. Native Mobile Development by Shaun Lewis, Mike Dunn
3. Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach, Pawan Lingras, Matt Triff, Rucha Lingras.

List of Experiments:

1.	Using react native, build a cross platform application for a BMI calculator.	**4**
2.	Build a cross platform application for a simple expense manager which allows entering expenses and income on each day and displays category wise weekly income and expense.	**4**
3.	Develop a cross platform application to convert units from imperial system to metric system(km to miles, kg to pounds etc.,)	**4**
4.	Design and develop a cross platform application for day to day task (to-do) management	**4**
5.	Design an android application using Cordova for a user login screen with username, password, reset button and a submit button. Also, include header image and a label. Use layout managers.	**4**
6.	Design and develop an android application using Apache Cordova to find and display the current location of the user.	**5**
7.	Write programs using Java to create Android application having Databases. For a simple library application. For displaying books available, books lend, book reservation. Assume that studentinformation is available in a database which has been stored in a database server	**5**

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 60 Periods

List of Equipments: (for batch of 30 students)

1.	Standalone desktops with Windows or Android or iOS or Equivalent Mobile Application Development Tools with appropriate emulators and debuggers	30 nos

Course Code	CLOUD SERVICES MANAGEMENT	L	T	P	C
22PCS03		2	0	2	3

Pre-requisite Cloud Computing **Syllabus Version** V 0.1

Course Objectives:

1. Introduce Cloud Service Management terminology, definition & concepts
2. Compare and contrast cloud service management with traditional IT service management
3. Identify strategies to reduce risk and eliminate issues associated with adoption of cloudservices
4. Select appropriate structures for designing, deploying and running cloud-based services ina business environment
5. Illustrate the benefits and drive the adoption of cloud-based services to solve real worldproblems

Course Content:

UNIT I CLOUD SERVICE MANAGEMENT FUNDAMENTALS 6

Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, CloudService Deployment Models.

UNIT II CLOUD SERVICES STRATEGY 6

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 6

Cloud Service Reference Model, Cloud Service LifeCycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service OperationsManagement.

UNIT IV CLOUD SERVICE ECONOMICS 6

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 6

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 LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1 Exhibit cloud-design skills to build and automate business solutions using cloud technologies.
2. Possess Strong theoretical foundation leading to excellence and excitement towards adoptionof cloud-based services
3. Solve the real world problems using Cloud services and technologies

Text Book(s):

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era byEnamul 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.

Reference Books:

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.

List of Experiments:

1.	Create a Cloud Organization in AWS/Google Cloud/or any equivalent Open Source cloudsoftwares like Openstack, Eucalyptus, OpenNebula with Role-based access control.	**6**
2.	Create a Cost-model for a web application using various services and do Cost-benefitanalysis.	**6**
3.	Create alerts for usage of Cloud resources	**6**
4.	Create Billing alerts for your Cloud Organization	**6**
5.	Compare Cloud cost for a simple web application across AWS, Azure and GCP and suggestthe best one.	**6**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1.	PC with latest version	30 nos
2.	Cloud tools from free of open source like open nebula, open stack, Eucalyptus software	30 nos

Course Code	UI AND UX DESIGN	L	T	P	C
22PCS04		2	0	2	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To provide a sound knowledge in UI & UX
2. To understand the need for UI and UX
3. To understand the various Research Methods used in Design
4. To explore the various Tools used in UI & UX
5. Creating a wireframe and prototype.

Course Content:

UNIT I FOUNDATIONS OF DESIGN 6

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking -Brainstorming and Game storming - Observational Empathy.

UNIT II FOUNDATIONS OF UI DESIGN 6

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles –Branding - Style Guides

UNIT III FOUNDATIONS OF UX DESIGN 6

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know aboutBusiness Goals

UNIT IV WIREFRAMING, PROTOTYPING AND TESTING 6

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

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 LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Build UI for user Applications
2. Evaluate UX design of any product or application

3. Demonstrate UX Skills in product development
4. Implement Sketching principles
5. Create Wireframe and Prototype

Text Book(s):

1. J Joel Marsh, "UX for Beginners", O'Reilly , 2022
2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" O'Reilly2021

Reference Books:

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3 rd Edition , O'Reilly2020
2. Steve Schoger, Adam Wathan "Refactoring UI", 2018
3. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web &Mobile", Third Edition, 2015
4. https://www.nngroup.com/articles/
5. https://www.interaction-design.org/literature

List of Experiments:

1.	Designing a Responsive layout for an societal application	**3**
2.	Exploring various UI Interaction Patterns.	**3**
3.	Developing an interface with proper UI Style Guides	**3**
4.	Developing Wireflow diagram for application using open source software	**3**
5.	Exploring various open source collaborative interface Platform	**3**
6.	Hands on Design Thinking Process for a new product	**3**
7.	Brainstorming feature for proposed product	**3**
8.	Defining the Look and Feel of the new Project.	**3**
9.	Create a Sample Pattern Library for that product (Mood board, Fonts, Colors based onUI principles)	**3**
10.	Sketch, design with popular tool and build a prototype and perform usability testing andidentify improvements	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1.	Systems with either Netbeans or Eclipse	30 nos

Course Code	SOFTWARE TESTING AND AUTOMATION	L	T	P	C
22PCS05		2	0	2	3

Pre-requisite **Syllabus Version** V 0.1

Course Objectives:

1. To understand the basics of software testing
2. To learn how to do the testing and planning effectively
3. To build test cases and execute them
4. To focus on wide aspects of testing and understanding multiple facets of testing
5. To get an insight about test automation and the tools used for test automation.

Course Content:

UNIT I FOUNDATIONS OF SOFTWARE TESTING 6

Why do we test Software?, Black-Box Testing and White-Box Testing, Software Testing Life Cycle,V-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing.

UNIT II TEST PLANNING 6

The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting,Metrics and Statistics

UNIT III TEST DESIGN AND EXECUTION 6

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle

UNIT IV ADVANCED TESTING CONCEPTS 6

Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation,Security testing, Testing in the Agile Environment, Testing Web and Mobile Applications

UNIT V TEST AUTOMATION AND TOOLS 6

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the basic concepts of software testing and the need for software testing
2. Design Test planning and different activities involved in test planning
3. Design effective test cases that can uncover critical defects in the application
4. Carry out advanced types of testing
5. Automate the software testing using Selenium and TestNG

Text Book(s):

1. Yogesh Singh, "Software Testing", Cambridge University Press, 2012
2. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" - SecondEdition 2018

Reference Books:

1. Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition,2012, John Wiley & Sons, Inc.
2. Ron Patton, Software testing, 2nd Edition, 2006, Sams Publishing

List of Experiments:

1.	Develop the test plan for testing an e-commerce web/mobile application (www.amazon.in).	**3**
2.	Design the test cases for testing the e-commerce application.	**3**
3.	Test the e-commerce application and report the defects in it	**3**
4.	Develop the test plan and design the test cases for an inventory control system	**3**
5.	Execute the test cases against a client server or desktop application and identify the defects	**3**
6.	Test the performance of the e-commerce application	**3**
7.	Automate the testing of e-commerce applications using Selenium	**3**
8.	Integrate TestNG with the above test automation.	**4**
9.	Mini Project: a) Build a data-driven framework using Selenium and TestNG b) Build Page object Model using Selenium and TestNG Build BDD framework with Selenium, TestNG and Cucumber	**5**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1.	Systems with either Netbeans or Eclipse	30 nos
2.	Cloud tools from free of open source like open nebula, open stack, Eucalyptus software	30 nos

Course Code	WEB APPLICATION SECURITY	L	T	P	C
22PCS06		2	0	2	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To understand the fundamentals of web application security
2. To focus on wide aspects of secure development and deployment of web applications
3. To learn how to build secure APIs, To learn the basics of vulnerability assessment and penetration testing, To get an insight about Hacking techniques and Tools.

Course Content:

UNIT I FUNDAMENTALS OF WEB APPLICATION SECURITY 6

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, SessionManagement-Input Validation.

UNIT II SECURE DEVELOPMENT AND DEPLOYMENT 6

Web Applications Security - Security Testing, Security Incident Response Planning,The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)

UNIT III SECURE API DEVELOPMENT 6

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys, OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests

UNIT IV VULNERABILITY ASSESSMENT AND PENETRATION TESTING 6

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database- based vulnerability scanners, Types of Penetration Tests: External Testing, Web ApplicationTesting, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing

UNIT V HACKING TECHNIQUES AND TOOLS 6

Social Engineering, Injection, Cross-Site Scripting (XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite,etc

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understanding the basic concepts of web application security and the need for it
2. Be acquainted with the process for secure development and deployment of web applications
3. Acquire the skill to design and develop Secure Web Applications that use Secure APIs
4. Be able to get the importance of carrying out vulnerability assessment and penetration testing
5. Acquire the skill to think like a hacker and to use hackers tool sets

Text Book(s):

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for ModernWeb Applications, First Edition, 2020, O'Reilly Media, Inc.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw-Hill Companies.

Reference Books:

1. Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing,Inc.
2. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & FrancisGroup, LLC.
3. Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.

List of Experiments:

1.	Install wireshark and explore the various protocols a) Analyze the difference between HTTP vs HTTPS b)Analyze the various security mechanisms embedded with different protocols	**6**
2.	Identify the vulnerabilities using OWASP ZAP tool.	**6**
3.	Create simple REST API using python for following operation a)GET, b) PUSH, c)POST, d)DELETE	**6**
4.	Install Burp Suite to do following vulnerabilities: a) SQL injection b)cross-site scripting (XSS)	**6**
5.	Attack the website using Social Engineering method	**6**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipment: (for batch of 30 students)

1.	Systems with MySql	30 nos
2.	Visual Studio and Server	30 nos
3.	Dream Weaver or Equivalent, MySQL or Equivalent, Apache Server, WAMP/XAMPP	30 nos

Course Code	PRINCIPLES OF PROGRAMMING LANGUAGES	L	T	P	C
22PCS07		2	0	2	3

Pre-requisite C/ Python Programming **Syllabus Version** V 0.1

Course Objectives:

1. To understand and describe syntax and semantics of programming languages
2. To understand data, data types, and basic statements
3. To understand call-return architecture and ways of implementing them
4. To understand object-orientation, concurrency, and event handling in programminglanguages
5. To develop programs in non-procedural programming paradigms.

Course Content:

UNIT I SYNTAX AND SEMANTICS 6

Evolution of programming languages – describing syntax – context-free grammars – attribute grammars – describing semantics – lexical analysis – parsing – recursive-descent – bottom up parsing.

UNIT II DATA, DATA TYPES, AND BASIC STATEMENTS 6

Names – variables – binding – type checking – scope – scope rules – lifetime and garbage collection – primitive data types – strings – array types – associative arrays – record types –union types – pointers and references – Arithmetic expressions – overloaded operators – type conversions – relational and boolean expressions – assignment statements – mixed mode assignments – control structures – selection – iterations – branching – guarded statements

UNIT III SUBPROGRAMS AND IMPLEMENTATIONS 6

Subprograms – design issues – local referencing – parameter passing – overloaded methods – generic methods – design issues for functions – semantics of call and return – implementing simple subprograms – stack and dynamic local variables – nested subprograms – blocks – dynamic scoping

UNIT IV OBJECT-ORIENTATION, CONCURRENCY, AND EVENT HANDLING 6

Object-orientation – design issues for OOP languages – implementation of object-oriented constructs – concurrency – semaphores – monitors – message passing – threads – statement level concurrency – exception handling – event handling

UNIT V FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES 6

Introduction to lambda calculus – fundamentals of functional programming languages –Programming with Scheme – Programming with ML – Introduction to logic and logic programming – Programming with Prolog – multi-paradigm languages

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Describe syntax and semantics of programming languages
2. Explain data, data types, and basic statements of programming languages
3. Design and implement subprogram constructs
4. Apply object-oriented, concurrency, and event handling programming constructsand Develop programs in Scheme, ML, and Prolog
5. Understand and adopt new programming languages

Text Book(s):

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

Reference Books:

1. R. Kent Dybvig, "The Scheme programming language", Fourth Edition, Prentice Hall, 2011.
2. Jeffrey D. Ullman, "Elements of ML programming", Second Edition, Pearson, 1997.

List of Experiments:

1.	Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the filein bytes	**6**
2.	Develop a java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.	**6**
3.	Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape	**6**
4.	Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.	**6**
5.	Develop a mini project for any application using Java concepts	**6**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1.	Systems with either Netbeans or Eclipse	30 nos

Course Code	WEB TECHNOLOGIES	L	T	P	C
22PCS08		2	0	2	3

Pre-requisite HTML, basic java script **Syllabus Version** V 0.1

Course Objectives:

1. To understand different Internet Technologies
2. To learn java-specific web services architecture
3. To Develop web applications using frameworks.

Course Content:

UNIT I WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0 6

Web Essentials: Clients, Servers and Communication – The Internet – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables –Lists – Image – HTML5 control elements – Drag and Drop – Audio – Video controls - CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations. Bootstrap Framework

UNIT II CLIENT SIDE PROGRAMMING 6

Java Script: An introduction to JavaScript–JavaScript DOM Model-Exception Handling-Validation- Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files

UNIT III SERVER SIDE PROGRAMMING 6

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- DATABASE CONNECTIVITY: JDBC

UNIT IV PHP and XML 6

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions-Form Validation. XML: Basic XML- Document Type Definition- XML Schema, XML Parsers and Validation,XSL

UNIT V INTRODUCTION TO ANGULAR and WEB APPLICATIONS FRAMEWORKS 6

Introduction to AngularJS, MVC Architecture, understanding attributes, Expressions and data binding, Conditional Directives, Style Directives, Controllers, Filters, Forms, Routers, Modules, Services; Web Applications Frameworks and Tools – Firebase- Docker- Node JS-React- Django- UI & UX

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Construct a basic website using HTML and Cascading Style Sheets
2. Build dynamic web page with validation using Java Script objects and by applying differentevent handling mechanisms.
3. Develop server side programs using Servlets and JSP.

4. Construct simple web pages in PHP and to represent data in XML format.
5. Develop interactive web applications.

Text Book(s):

1. Deitel and Deitel and Nieto, Internet and World Wide Web - How to Program, Prentice Hall, 5thEdition, 2011.
2. Jeffrey C and Jackson, Web Technologies A Computer Science Perspective, PearsonEducation, 2011.
3. Angular 6 for Enterprise-Ready Web Applications, Doguhan Uluca, 1st edition, Packt Publishing

Reference Books:

1. Stephen Wynkoop and John Burke "Running a Perfect Website", QUE, 2nd Edition,1999.
2. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2009

List of Experiments:

1.	Create a web page with the following using HTML a) To embed an image map in a web page. b) To fix the hot spots. c)Show all the related information when the hot spots are clicked	**4**
2.	Create a web page with all types of Cascading style sheets.	**4**
3.	Client Side Scripts for Validating Web Form Controls using DHTML	**4**
4.	Installation of Apache Tomcat web server	**4**
5.	Write programs in Java using Servlets: a) To invoke servlets from HTML forms. b) Session Tracking	**4**
6.	Write programs in Java to create three-tier applications using JSP and Databases a)For conducting on-line examination. b)For displaying student mark list. Assume that student information is available in a databasewhich has been stored in a database server	**5**
7.	Programs using XML – Schema – XSLT/XSL	**5**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1.	Dream Weaver or Equivalent, MySQL or Equivalent, Apache Server, WAMP/XAMPP	30 nos
2.	Standalone desktops	30 nos

Course Code	DATA ANALYTICS AND VISUALIZATION	L	T	P	C
22PCS09		2	0	2	3

Pre-requisite Python programming, Data Science **Syllabus Version** V 0.1

Course Objectives:

The objective of this course is to equip students with the necessary skills to effectively analyze and visualize data using Python. By the end of this course, students will be able to manipulate and explore data, conduct statistical analysis, build and evaluate machine learning models, and create advanced visualizations.

Course Content:

UNIT I INTRODUCTION TO DATA ANALYTICS AND VISUALIZATION 6

Introduction to data analytics and visualization - Understanding the data analytics process - Tools and techniques for data analysis and visualization

UNIT II DATA MANIPULATION AND EXPLORATION 6

Data types and data structures in Python - Data manipulation using Pandas - Data exploration using Matplotlib and Seaborn.

UNIT III STATISTICAL ANALYSIS 6

Statistical inference and hypothesis testing - Descriptive statistics - Correlation and regression analysis.

UNIT IV MACHINE LEARNING FOR DATA ANALYTICS 6

Introduction to machine learning - Supervised and unsupervised learning - Building and evaluating machine learning models.

UNIT V ADVANCED DATA VISUALIZATION TECHNIQUES 6

Interactive data visualization using Plotly - Geospatial data visualization - Network visualization

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Students will be able to use Python for data manipulation, exploration, and analysis.
2. Students will be able to apply statistical concepts and techniques to real-world datasets.
3. Students will be able to build and evaluate machine learning models for classification and regression tasks.
4. Students will be able to create advanced visualizations using Plotly, geospatial data, and network data.
5. Students will be able to effectively communicate insights derived from data through visualizations and presentations.

Text Book(s):

1. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and

IPython, Author: Wes McKinney, Publisher: O'Reilly Media, Edition: 2nd edition (2017), ISBN-13: 978-1491957660

Reference Books:

1. Data Science from Scratch: First Principles with Python, Author: Joel Grus, Publisher: O'Reilly Media, Edition: 2nd edition (2019), ISBN-13: 978-1492041139

List of Experiments:

1	Data Manipulation with Pandas	**3**
2	Data Exploration with Matplotlib and Seaborn	**3**
3	Statistical Analysis using Scipy	**3**
4	Machine Learning using Scikit-Learn	**3**
5	Interactive Data Visualization using Plotly	**3**
6	Geospatial Data Visualization using Folium	**3**
7	Network Visualization using NetworkX	**3**
8	Data Cleaning and Preprocessing	**3**
9	Model Evaluation and Selection	**3**
10	Final Project - Applying Data Analytics and Visualization techniques to a real-world dataset.	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipment: (for batch of 30 students)

1.	Systems with MySql	30 nos
2.	Visual Studio and Server	30 nos
3.	Dream Weaver or Equivalent, MySQL or Equivalent, Apache Server, WAMP/XAMPP	30 nos

Course Code	EXPLORATORY DATA ANALYSIS	L	T	P	C
22PCS10		2	0	2	3

Pre-requisite Python, pandas numpy **Syllabus Version** V 0.1

Course Objectives:

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

Course Content:

UNIT I EXPLORATORY DATA ANALYSIS 6

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

UNIT II EDA USING PYTHON 6

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 6

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

UNIT IV BIVARIATE ANALYSIS 6

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

UNIT V MULTIVARIATE AND TIME SERIES ANALYSIS 6

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

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the fundamentals of exploratory data analysis.
2 Implement the data visualization using Matplotlib.
3. Perform univariate data exploration and analysis.
4. Apply bivariate data exploration and analysis.
5. Use Data exploration and visualization techniques for multivariate and time series data

Text Book(s):

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)

Reference Books:

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

List of Experiments:

1.	Install the data Analysis and Visualization tool: R/ Python /Tableau Public/ Power BI	**3**
2.	Perform exploratory data analysis (EDA) with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.	**3**
3.	Working with Numpy arrays, Pandas data frames, Basic plots using Matplotlib	**3**
4.	Explore various variable and row filters in R for cleaning data. Apply various plot features inR on sample data sets and visualize	**3**
5.	Perform Time Series Analysis and apply the various visualization techniques	**4**
6.	Perform Data Analysis and representation on a Map using various Map data sets with MouseRollover effect, user interaction, etc	**3**
7.	Build cartographic visualization for multiple datasets involving various countries of the world;states and districts in India etc	**4**
8.	Perform EDA on Wine Quality Data Set	**3**
9.	Use a case study on a data set and apply the various EDA and visualization techniques andpresent an analysis report	**4**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipment: (for batch of 30 students)

1.	Python 3.9 or later, Anaconda Distribution	30 nos
2.	Systems with either Netbeans or Eclipse	30 nos

Course Code	RECOMMENDER SYSTEMS	L	T	P	C
22PCS11		2	0	2	3

Pre-requisite Classification, Regression **Syllabus Version** V 0.1

Course Objectives:

1. To understand the foundations of the recommender system.
2. To learn the significance of machine learning and data mining algorithms forRecommender systems
3. To learn about collaborative filtering
4. To make students design and implement a recommender system.
5. To learn collaborative filtering

Course Content:

UNIT I INTRODUCTION 6

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

UNIT II CONTENT-BASED RECOMMENDATION SYSTEMS 6

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

UNIT III COLLABORATIVE FILTERING 6

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

UNIT IV ATTACK-RESISTANT RECOMMENDER SYSTEMS 6

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

UNIT V EVALUATING RECOMMENDER SYSTEMS 6

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design-Design Issues – Accuracy metrics – Limitations of Evaluation measures.

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

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

6. Learn about advanced topics of recommender systems applications

Text Book(s):

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich ,Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.

Reference Books:

1. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Systems Handbook, 1st ed,Springer (2011),
2. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 2020

List of Experiments:

1.	Implement Data similarity measures using Python	**4**
2.	Implement dimension reduction techniques for recommender systems.	**4**
3.	Implement user profile learning	**4**
4.	Implement content-based recommendation systems	**5**
5.	Implement collaborative filter techniques	**4**
6.	Create an attack for tampering with recommender systems	**4**
7.	Implement accuracy metrics like Receiver Operated Characteristic curves	**5**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipment: (for batch of 30 students)

1.	Systems with either Netbeans or Eclipse	30 nos

Course Code	NEURAL NETWORKS AND DEEP LEARNING	L	T	P	C
22PCS12		2	0	2	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To understand the basics in deep neural networks
2. To understand the basics of associative memory and unsupervised learning networks
3. To apply CNN architectures of deep neural networks
4. To analyze the key computations underlying deep learning, then use them to build and traindeep neural networks for various tasks.
5. To apply autoencoders and generative models for suitable applications.

Course Content:

UNIT I INTRODUCTION 6

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

UNIT II ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS 6

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

UNIT III THIRD-GENERATION NEURAL NETWORKS 6

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 6

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 6

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

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Apply Convolution Neural Network for image processing.
2. Understand the basics of associative memory and unsupervised learning networks.
3. Apply CNN and its variants for suitable applications.
4. Analyze the key computations underlying deep learning and use them to build and train deepneural networks for various tasks.
5. Apply autoencoders and generative models for suitable applications

Text Book(s):

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2. Francois Chollet, "Deep Learning with Python", Second Edition, Manning Publications,2021

Reference Books:

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", SpringerInternational Publishing, 1st Edition, 2018.

List of Experiments:

1.	Implement simple vector addition in TensorFlow	**3**
2.	Implement a regression model in Keras.	**3**
3.	Implement a perceptron in TensorFlow/Keras Environment.	**3**
4.	Implement a Feed-Forward Network in TensorFlow/Keras.	**3**
5.	Implement an Image Classifier using CNN in TensorFlow/Keras.	**3**
6.	Improve the Deep learning model by fine tuning hyper parameters.	**3**
7.	Implement a Transfer Learning concept in Image Classification.	**3**
8.	Using a pre trained model on Keras for Transfer Learning	**3**
9.	Perform Sentiment Analysis using RNN	**3**
10.	Implement an LSTM based Autoencoder in TensorFlow/Keras	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1.	PC with Linux/Windows/Solaris/Mac OSX operating system	30 nos
2.	Dream Weaver or Equivalent, MySQL or Equivalent, Apache Server, WAMP/XAMPP	30 nos

Course Code	TEXT AND SPEECH ANALYSIS	L	T	P	C
22PCS13		2	0	2	3

Pre-requisite Classification and Regression **Syllabus Version** V 0.1

Course Objectives:

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

Course Content:

UNIT I NATURAL LANGUAGE BASICS 6

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.

UNIT II TEXT CLASSIFICATION 6

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

UNIT III QUESTION ANSWERING AND DIALOGUE SYSTEMS 6

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.

UNIT IV TEXT-TO-SPEECH SYNTHESIS 6

Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing - Concatenative and parametric approaches, WaveNet and other deep learning-based TTSsystems.

UNIT V AUTOMATIC SPEECH RECOGNITION 6

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

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Explain existing and emerging deep learning architectures for text and speech processing
2 Apply deep learning techniques for NLP tasks, language modelling and machine translation
3. Explain coreference and coherence for text processing
4. Build question-answering systems, chatbots and dialogue systems
5. Apply deep learning models for building speech recognition and text-to-

speech systems

Text Book(s):

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

Reference Books:

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 SpeechRecognition" 1st Edition, Pearson, 2009.
4. Steven Bird, Ewan Klein, and Edward Loper, "Natural language processing with Python",O'REILLY

List of Experiments:

1.	Create Regular expressions in Python for detecting word patterns and tokenizing text	**3**
2.	Getting started with Python and NLTK - Searching Text, Counting Vocabulary, FrequencyDistribution, Collocations, Bigrams	**3**
3.	Accessing Text Corpora using NLTK in Python	**3**
4.	Write a function that finds the 50 most frequently occurring words of a text that are not stopwords	**3**
5.	Implement the Word2Vec model	**3**
6.	Use a transformer for implementing classification	**3**
7.	Design a chatbot with a simple dialog system	**4**
8.	Convert text to speech and find accuracy	**4**
9.	Design a speech recognition system and find the error rate	**4**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1.	Standalone Desktops	30 nos
2.	Python 3.9 or later, Anaconda Distribution	30 nos
3.	Systems with either Netbeans or Eclipse	30 nos

Course Code	BUSINESS ANALYTICS	L	T	P	C
22PCS14		2	0	2	3

Pre-requisite Data analytics **Syllabus Version** V 0.1

Course Objectives:

1. To understand the Analytics Life Cycle.
2. To comprehend the process of acquiring Business Intelligence
3. To understand various types of analytics for Business Forecasting
4. To model the supply chain management for Analytics.
5. To apply analytics for different functions of a business.

Course Content:

UNIT I INTRODUCTION TO BUSINESS ANALYTICS 6

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 6

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 6

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models –DataMining and Predictive Analysis Modelling –Machine Learning for Predictive analytics

UNIT IV HR & SUPPLY CHAIN ANALYTICS 6

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

UNIT V MARKETING & SALES ANALYTICS 6

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 LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

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

Text Book(s):

1. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2nd Edition, Wiley,2016
2. R. Evans James, Business Analytics, 2nd Edition, Pearson, 2017

Reference Books:

1. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
2. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
3. Mahadevan B, "Operations Management -Theory and Practice",3rd Edition,Pearson Education,2018

List of Experiments:

Use MS-Excel and Power-BI to perform the following experiments using a Business data set, andmake presentations. Students may be encouraged to bring their own real-time socially relevant data set

1	Explore the features of Power BI Desktop	**4**
2	Prepare & Load data	**4**
3	Develop the data model	**4**
4	Perform DAX calculations	**5**
5	Design a report	**5**
6	Create a dashboard and perform data analysis	**5**
7	Presentation of a case study	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1. Systems with either Netbeans or Eclipse 30 nos

Course Code	IMAGE AND VIDEO ANALYTICS	L	T	P	C
22PCS15		2	0	2	3

Pre-requisite Matrix, understanding about data types **Syllabus Version** V 0.1

Course Objectives:

1. To understand the basics of image processing techniques for computer vision.
2. To learn the techniques used for image pre-processing.
3. To discuss the various object detection techniques.
4. To understand the various Object recognition mechanisms.
5. To elaborate on the video analytics techniques.

Course Content:

UNIT I INTRODUCTION 6

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

UNIT II IMAGE PRE-PROCESSING 6

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 6

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 6

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 6

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 LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the basics of image processing techniques for computer vision and video analysis.
2. Explain the techniques used for image pre-processing.

3. Develop various object detection techniques.
4. Understand the various face recognition mechanisms.
5. Elaborate on deep learning-based video analytics

Text Book(s):

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

Reference Books:

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 BusinessIntelligence", 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

List of Experiments:

1.	Write a program that computes the T-pyramid of an image	**3**
2.	Write a program that derives the quad tree representation of an image using the homogeneitycriterion of equal intensity	**4**
3.	Develop programs for the following geometric transforms: (a) Rotation (b) Change of scale (c) Skewing (d) Affine transform calculated from three pairs of corresponding points (e) Bilinear transform calculated from four pairs of corresponding points	**6**
4.	Develop a program to implement Object Detection and Recognition	**5**
5.	Develop a program for motion analysis using moving edges, and apply it to your imagesequences.	**3**
6.	Develop a program for Facial Detection and Recognition	**6**
7.	Write a program for event detection in video surveillance system	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1.	Systems with either Netbeans or Eclipse	30 nos

Course Code	BIG DATA ANALYTICS	L	T	P	C
22PCS16		2	0	2	3

Pre-requisite Data Science **Syllabus Version** V 0.1

Course Objectives:

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

Course Content:

UNIT I UNDERSTANDING BIG DATA 6

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 6

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 6

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

UNIT IV BASICS OF HADOOP 6

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 6

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

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1 Describe big data and use cases from selected business domains.

2. Explain NoSQL big data management.
3. Install, configure, and run Hadoop and HDFS.
4. Perform map-reduce analytics using Hadoop.
5. Use Hadoop-related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

Text Book(s):

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

Reference Books:

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

List of Experiments:

1.	Downloading and installing Hadoop; Understanding different Hadoop modes. Startup scripts,Configuration files.	**3**
2.	Hadoop Implementation of file management tasks, such as Adding files and directories,retrieving files and Deleting files	**3**
3.	Implement of Matrix Multiplication with Hadoop Map Reduce	**4**
4.	Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.	**3**
5.	Installation of Hive along with practice examples.	**4**
6.	Installation of HBase, Installing thrift along with Practice examples	**4**
7.	Practice importing and exporting data from various databases	**4**
8.	Downloading and installing Hadoop; Understanding different Hadoop modes. Startup scripts,Configuration files.	**5**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1.	Cassandra, Hadoop, Java, Pig, Hive and HBase	30 nos

Course Code	MERN FULL STACK DEVELOPMENT	L	T	P	C
22PCS17		2	0	2	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To introduce students to the MERN stack and its components
2. To teach students how to build full stack web applications using MERN stack
3. To equip students with the necessary knowledge and skills to deploy and maintain MERN stack applications

Course Content:

UNIT I Introduction to MERN Stack Development 6

Overview of MERN stack and its components (MongoDB, Express.js, React, Node.js) - Advantages and disadvantages of MERN stack development - Understanding the role of each component in MERN stack

UNIT II Backend Development with Node.js and Express.js 6

Understanding Node.js and its architecture - Building RESTful APIs with Express.js - Handling middleware and error handling in Express.js - Introduction to MongoDB and NoSQL databases

UNIT III Frontend Development with React 6

Understanding React and its component-based architecture - Building reusable components and handling state in React - Introduction to React Router and Redux for managing state - Consuming RESTful APIs in React using Axios

UNIT IV Full Stack Development with MERN Stack 6

Integrating backend and frontend in MERN stack development - Building CRUD operations using MERN stack - Deploying MERN stack applications to cloud platforms

UNIT V Advanced Topics in MERN Stack Development 6

Securing MERN stack applications using authentication and authorization - Optimizing MERN stack applications for performance and scalability - Testing and debugging MERN stack applications using Jest and other tools - Introduction to other popular technologies and frameworks in full stack development

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Students will gain a deep understanding of the individual components of the MERN stack, including MongoDB, Express.js, React, and Node.js
2. Students will learn how to develop and implement RESTful APIs with Express.js, manage state with Redux, and handle routing with React Router
3. Students will acquire the ability to design and implement scalable and performant web applications using the MERN stack
4. Students will learn how to leverage the strengths of NoSQL databases to implement

robust data storage and retrieval

5. Students will develop proficiency in front-end design and development with React, including the ability to create and manage reusable components and effectively consume APIs.

Text Book(s):

1. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node by Vasan Subramanian
2. Full-Stack React, TypeScript, and Node: Build Scalable Full-Stack Applications with React, TypeScript, and Node.js by David Choi and Jack Hsu

Reference Books:

1. Mastering Node.js: Build robust and scalable real-time server-side web applications efficiently, Second Edition by Sandro Pasquali
2. Express.js Guide: The Comprehensive Book on Express.js by Azat Mardan
3. React: Up & Running: Building Web Applications by Stoyan Stefanov and Chad R. Adamshttps://www.nngroup.com/articles/

List of Experiments:

1.	Setting up the Development Environment	**3**
2.	Creating a Simple React App	**3**
3.	Building a RESTful API with Express.js	**3**
4.	Implementing User Authentication with Passport.js	**3**
5.	Building a Single-Page Application with React	**3**
6.	State Management with Redux	**3**
7.	Data Modeling with Mongoose	**3**
8.	Aggregation Framework with MongoDB	**3**
9.	Deploying a MERN Stack Application to Heroku	**3**
10.	Testing a MERN Stack Application with Jest and Enzyme	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1.	Systems with either Netbeans or Eclipse	30 nos

Course Code	WEB ESSENTIALS	L	T	P	C
22PCS18		2	0	2	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To comprehend and analyze the basic concepts of web programming and internet protocols.
2. To describe how the client-server model of Internet programming works.
3. To demonstrate the uses of scripting languages
4. To write simple scripts for the creation of web sites
5. To create database applications

Course Content:

UNIT I WEBSITE BASICS 6

Internet Overview - Fundamental computer network concepts - Web Protocols - URL – Domain Name- Web Browsers and Web Servers- Working principle of a Website –Creating a Website - Client-side and server-side scripting.

UNIT II WEB DESIGNING 6

HTML – Form Elements - Input types and Media elements - CSS3 - Selectors, Box Model, Backgrounds and Borders, Text Effects, Animations, Multiple Column Layout, User Interface

UNIT III CLIENT-SIDE PROCESSING AND SCRIPTING 6

JavaScript Introduction – Variables and Data Types-Statements – Operators - Literals-FunctionsObjects-Arrays-Built-in Objects- Regular Expression, Exceptions, Event handling, Validation - JavaScript Debuggers

UNIT IV SERVER SIDE PROCESSING AND SCRIPTING – PHP 6

PHP - Working principle of PHP - PHP Variables - Constants - Operators – Flow Control and Looping - Arrays - Strings - Functions - File Handling - File Uploading – Email Basics - Email with attachments - PHP and HTML - Simple PHP scripts - Databases with PHP

UNIT V SERVLETS AND DATABASE CONNECTIVITY 6

Servlets: Java Servlet Architecture – Servlet Life cycle- Form GET and POST actions -Sessions – Cookies – Database connectivity - JDBC Creation of simple interactive applications - Simple database applications.

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Apply JavaScript, HTML and CSS effectively to create interactive and dynamic websites.
2. Create simple PHP scripts
3. Design and deploy simple web-applications.
4. Create simple database applications.
5. Handle multimedia components

Text Book(s):

1. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" Third Edition, O'Reilly publishers, 2014
2. Paul Deitel, Harvey Deitel, Abbey Deitel, "Internet & World Wide Web - How to Program", 5th edition, Pearson Education, 2012

Reference Books:

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
2. James F. Kurose, "Computer Networking: A Top-Down Approach", Sixth Edition, Pearson Education, 2012
3. Steven Holzener , "PHP – The Complete Reference", 1st Edition, Mc-Graw Hill, 2017
4. Fritz Schneider, Thomas Powell , "JavaScript – The Complete Reference", 3rd Edition, McGraw Hill Publishers, 2017
5. Bates, "Developing Web Applications", Wiley Publishers, 2006

List of Experiments:

1.	Creation of interactive web sites - Design using HTML and authoring tools	4
2.	Form validation using JavaScript	4
3.	Creation of simple PHP scripts	4
4.	Handling multimedia content in web sites	5
5.	Write programs using Servlets: i. To invoke servlets from HTML forms ii. Session tracking using hidden form fields and Session tracking for a hit count	4
6.	Creation of information retrieval system using web, PHP and MySQL	4
7.	Creation of personal Information System	5
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipment: (for batch of 30 students)

1.	Standalone desktops	30 nos
2.	Systems with either Netbeans or Eclipse	30 nos
3.	Dream Weaver or Equivalent, MySQL or Equivalent, Apache Server, WAMP/XAMPP	30 nos

Course Code	ROBOTIC PROCESS AUTOMATION	L	T	P	C
22PCS19		2	0	2	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

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

Course Content:

UNIT I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION 6

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 6

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 6

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 6

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 6

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 LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Enunciate the key distinctions between RPA and existing automation techniques andplatforms.
2. Use UiPath to design control flows and work flows for the target process
3. Implement recording, web scraping andprocess mining by automation

4. Use UIPath Studio to detect, and handle exceptions in automation processes
5. Implement and use Orchestrator for creation, monitoring, scheduling, and controlling ofautomated bots and processes

Text Book(s):

1. Learning Robotic Process Automation: Create Software robots and automate businessprocesses 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 RPASystems", Apress publications, 2020

Reference Books:

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

List of Experiments:

1.	Create a Sequence to obtain user inputs display them using a message box;	2
2.	Create a Flowchart to navigate to a desired page based on a condition;	2
3.	Create a State Machine workflow to compare user input with a random number.	2
4.	Build a process in the RPA platform using UI Automation Activities.	2
5.	Create an automation process using key System Activities, Variables and Arguments	2
6.	Also implement Automation using System Trigger	2
7.	Automate login to (web)Email account	3
8.	Recording mouse and keyboard actions.	3
9.	Scraping data from website and writing to CSV	3
10.	Implement Error Handling in RPA platform	3
11.	Web Scraping	3
12.	Email Query Processing	
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1.	Systems with either Netbeans or Eclipse	30 nos

Couse Code	BLOCKCHAIN TECHNOLOGIES	L	T	P	C
22PCS20		2	0	2	3

Pre-requisite Computer networks **Syllabus Version** V 0.1

Course Objectives:

1. To understand the basics of Blockchain
2. To learn Different protocols and consensus algorithms in Blockchain
3. To learn the Blockchain implementation frameworks
4. To understand the Blockchain Applications
5. To experiment the Hyperledger Fabric, Ethereum networks.

Course Content:

UNIT I INTRODUCTION TO BLOCKCHAIN 6

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 6

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 6

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 6

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

UNIT V BLOCKCHAIN APPLICATIONS 6

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 LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand emerging abstract models for Blockchain Technology
2. Identify major research challenges and technical gaps existing between theory and practicein the crypto currency domain.
3. It provides conceptual understanding of the function of Blockchain as a method of securingdistributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
4. Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application

Text Book(s):

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

Reference Books:

1. Daniel Drescher, "Blockchain Basics", First Edition, Apress, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder.Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton UniversityPress, 2016.
3. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015
4. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contractsfor Ethereum and Blockchain", Packt Publishing
5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020

List of Experiments:

1.	Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.	4
2.	Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.	5
3.	Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules.	5
4.	Deploy an asset-transfer app using blockchain. Learn app development within a HyperledgerFabric network.	5
5.	Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabricto track and trace member rewards	5
6.	Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chain code while storing results and data in the starter plan	6
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1.	Systems with either Netbeans or Eclipse	30 nos

Couse Code	MEAN FULL STACK DEVELOPMENT	L	T	P	C
22PCS21		2	0	2	3

Pre-requisite NIL **Syllabus Version** V 0.1

Course Objectives:

1. To understand the fundamentals of the MEAN Stack and its benefits in web development.
2. To gain proficiency in MongoDB and NoSQL database management.
3. To learn Node.js and Express.js for building the backend of web applications.
4. To become proficient in AngularJS for building single page applications.
5. To learn best practices for building, testing, and deploying MEAN Stack applications.

Course Content:

UNIT I Introduction to MEAN Stack Development 6

Introduction to MEAN Stack - MongoDB and NoSQL Databases - Node.js and Express.js - AngularJS and Single Page Applications (SPAs) - Benefits of using MEAN Stack.

UNIT II MongoDB and NoSQL Databases 6

Introduction to MongoDB - MongoDB Architecture and Data Modeling - CRUD Operations with MongoDB - Indexing and Query Optimization - Aggregation Framework

UNIT III Node.js and Express.js 6

Introduction to Node.js - Asynchronous Programming with Node.js - Node.js Modules and NPM - Introduction to Express.js - Routing, Middleware, and Error Handling

UNIT IV AngularJS and Single Page Applications 6

Introduction to AngularJS - AngularJS Architecture and Data Binding - Directives and Filters - Services and Dependency Injection - Routing and Navigation in Single Page Applications

UNIT V MEAN Stack Application Development 6

MEAN Stack Application Architecture - Building the Backend with Node.js and Express.js - Building the Frontend with AngularJS - User Authentication and Authorization - Testing and Debugging MEAN Stack Applications

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Develop a deep understanding of the MEAN Stack architecture and its components.
2. Design and implement efficient database schema and data modeling using MongoDB.
3. Build server-side web applications with Node.js and Express.js using asynchronous programming.
4. Create interactive single page applications with AngularJS.
5. Test and deploy MEAN Stack applications to production environments

Text Book(s):

1. "MongoDB: The Definitive Guide" by Kristina Chodorow
2. "Node.js in Action" by Mike Cantelon, Marc Harter, TJ Holowaychuk, and Nathan Rajlich

Reference Books:

1. "MEAN Web Development" by Amos Q. Haviv
2. "Pro MEAN Stack Development" by Elad Elrom and David Gotterba

List of Experiments:

1.	Building a simple CRUD (Create, Read, Update, Delete) application using the MEAN Stack.	**3**
2.	Implementing user authentication and authorization using Passport.js.	**3**
3.	Building a real-time chat application using Node.js and Socket.IO.	**3**
4.	Integrating a third-party API (such as Google Maps or Twitter) into an AngularJS application.	**3**
5.	Implementing server-side pagination and filtering of data in a MEAN Stack application.	**3**
6.	Building a RESTful API using Node.js and Express.js.	**3**
7.	Implementing web sockets for real-time communication in a MEAN Stack application.	**3**
8.	Creating a web application that uses geolocation and maps with the Google Maps API.	**3**
9.	Building a social media application that allows users to create profiles and follow other users.	**3**
10.	Creating a dashboard that visualizes data in real-time using AngularJS and D3.js	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1.	Systems with MongoDB, Express.js, AngularJS, and Node.js	30 nos

Course Code	DEVOPS	L	T	P	C
22PCS22		2	0	2	3

Pre-requisite HTML, **Syllabus Version** V 0.1

Course Objectives:

1. To introduce DevOps terminology, definition & concepts
2. To understand the different Version control tools like Git, Mercurial
3. To understand the concepts of Continuous Integration/ Continuous Testing/ ContinuousDeployment)
4. To understand Configuration management using Ansible
5. Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve realworld problems.

Course Content:

UNIT I INTRODUCTION TO DEVOPS 6

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

UNIT II COMPILE AND BUILD USING MAVEN & GRADLE 6

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build usingGradle

UNIT III CONTINUOUS INTEGRATION USING JENKINS 6

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace

UNIT IV CONFIGURATION MANAGEMENT USING ANSIBLE 6

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

UNIT V BUILDING DEVOPS PIPELINES USING AZURE 6

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

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand different actions performed through Version control tools like Git
2. Perform Continuous Integration and Continuous Testing and Continuous Deploymentusing Jenkins by building and automating test cases using Maven & Gradle.

3. Ability to Perform Automated Continuous Deployment
4. Ability to do configuration management using Ansible
5. Understand to leverage Cloud-based DevOps tools using Azure DevOps

Text Book(s):

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginnerto Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014

Reference Books:

1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020
2. by Mitesh Soni
3. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", FirstEdition, 2015.
4. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible forDevOps", Second Edition, 2016.
5. Mariot Tsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to VersionControl, Project Management, and Teamwork for the New Developer", Second Edition, 2019.

List of Experiments:

1.	Create Maven Build pipeline in Azure	3
2.	Run regression tests using Maven Build pipeline in Azure	3
3.	Install Jenkins in Cloud	4
4.	Create CI pipeline using Jenkins	4
5.	Create a CD pipeline in Jenkins and deploy in Cloud	4
6.	Create an Ansible playbook for a simple web application infrastructure	4
7.	Build a simple application using Gradle	4
8.	Install Ansible and configure ansible roles and to write playbooks	4
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1.	Systems with either Netbeans or Eclipse	30 nos

Course Code	SOFT COMPUTING	L	T	P	C
22PCS23		2	0	2	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

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

Course Content:

UNIT I INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC 6

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 6

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

UNIT III GENETIC ALGORITHMS 6

Chromosome Encoding Schemes -Population initialization and selection methods - Evaluation function - Genetic operators- Cross over – Mutation - Fitness Function – Maximizing function

UNIT IV NEURO FUZZY MODELING 6

ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling – Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum - Analysisof Adaptive Learning Capability

UNIT V APPLICATIONS 6

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 LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the fundamentals of fuzzy logic operators and inference mechanisms
2. Understand neural network architecture for AI applications such as classification and clustering

3 Learn the functionality of Genetic Algorithms in Optimization problems
4. Use hybrid techniques involving Neural networks and Fuzzy logic
5. Apply soft computing techniques in real world applications

Text Book(s):

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

Reference Books:

1. 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, 1996

List of Experiments:

1.	Implementation of fuzzy control/ inference system	4
2.	Programming exercise on classification with a discrete perceptron	4
3.	Implementation of XOR with backpropagation algorithm	4
4.	Implementation of self-organizing maps for a specific application	5
5.	Programming exercises on maximizing a function using Genetic algorithm	5
6.	Implementation of two input sine function	4
7.	Implementation of three input non-linear function	4
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1.	Systems with either Netbeans or Eclipse	30 nos

Course Code	OPTIMIZATION TECHNIQUES	L	T	P	C
22PCS24		2	0	2	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. Formulate and solve linear programming problems (LPP)
2. Evaluate Integer Programming Problems, Transportation and Assignment Problems.
3. Obtain a solution to network problems using CPM and PERT techniques.
4. Able to optimize the function subject to the constraints.
5. Identify and solve problems under Markovian queuing models.

Course Content:

UNIT I LINEAR MODELS 6

Introduction of Operations Research - mathematical formulation of LPP- Graphical Methods to solveLPP- Simplex Method- Two-Phase method.

UNIT II INTEGER PROGRAMMING AND TRANSPORTATION PROBLEMS 6

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

UNIT III PROJECT SCHEDULING 6

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

UNIT IV CLASSICAL OPTIMIZATION THEORY 6

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

UNIT V QUEUING MODELS 6

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 LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Formulate and solve linear programming problems (LPP)
2. Evaluate Integer Programming Problems, Transportation and Assignment Problems.
3. Obtain a solution to network problems using CPM and PERT techniques.
4. Able to optimize the function subject to the constraints.
5. Identify and solve problems under Markovian queuing models

Text Book(s):

1. Hamdy A Taha, Operations Research: An Introduction, Pearson, 10th Edition, 2017

Reference Books:

1. J 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

List of Experiments:

1.	Solving simplex maximization problems using R programming.	2
2.	Solving simplex minimization problems using R programming.	2
3.	Solving mixed constraints problems – Big M & Two phase method using TORA.	3
4.	Solving transportation problems using R.	3
5.	Solving assignment problems using R.	3
6.	Solving optimization problems using LINGO.	3
7.	Studying Primal-Dual relationships in LP using TORA.	2
8.	Solving LP problems using dual simplex method using TORA.	2
9.	Sensitivity & post optimality analysis using LINGO.	2
10.	Solving shortest route problems using optimization software	2
11.	Solving Project Management problems using optimization software	3
12.	Testing random numbers and random variates for their uniformity.	3
13.	Testing random numbers and random variates for their independence	2
14.	Solve single server queuing model using simulation software package.	2
15	Solve multi server queuing model using simulation software package	3
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipment: (for batch of 30 students)

1.	Systems with either Netbeans or Eclipse	30 nos

Course Code	GAME THEORY	L	T	P	C
22PCS25		2	0	2	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. 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.
2. To formalize the notion of strategic thinking and rational choice by using the tools of gametheory, and to provide insights into using game theory in 41odelling applications.
3. To draw the connections between game theory, computer science, and economics, especially emphasizing the computational issues.
4. To introduce contemporary topics in the intersection of game theory, computer science, and economics.
5. To apply game theory in searching, auctioning and trading.

Course Content:

UNIT I INTRODUCTION 6

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, eBayauctions, electricity trading markets).

UNIT II GAMES WITH PERFECT INFORMATION 6

Games with Perfect Information — Strategic games — prisoner's dilemma, matching pennies - Nashequilibria —mixed strategy equilibrium — zero-sum games

UNIT III GAMES WITH IMPERFECT INFORMATION 6

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 6

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 6

Aggregating Preferences — Social Choice — Formal Model — Voting — Existence of social functions-Ranking systems — Protocols for Strategic Agents: Mechanism Design — Mechanism design.

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Discuss the notion of a strategic game and equilibria and identify the characteristics of mainapplications of these concepts.
2. Discuss the use of Nash Equilibrium for other problems.
3. Identify key strategic aspects and based on these be able to connect them to appropriategame theoretic concepts given a real world situation.
4. Identify some applications that need aspects of Bayesian Games.
5. Implement a typical Virtual Business scenario using Game theory

Text Book(s):

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.

Reference Books:

1. YoavShoham, Kevin Leyton-Brown, Multiagent Systems: Algorithmic, Game-Theoretic,and Logical Foundations, Cambridge University Press 2008.
2. Zhu Han, DusitNiyato, WalidSaad, TamerBasar and Are Hjorungnes, "Game Theory inWireless and Communication Networks", Cambridge University Press, 2012.
3. Y.Narahari, "Game Theory and Mechanism Design", IISC Press, World Scientific.

List of Experiments:

1.	Prisoner's dilemma	3
2.	Pure Strategy Nash Equilibrium	3
3.	Extensive Form – Graphs and Trees, Game Trees	3
4.	Strategic Form – Elimination of dominant strategy	3
5.	Minimax theorem, minimax strategies	3
6.	Perfect information games: trees, players assigned to nodes, payoffs, backward Induction,subgame perfect equilibrium,	3
7.	imperfect-information games - Mixed Strategy Nash Equilibrium - Finding mixed-strategy Nash equilibria for zero sum games, mixed versus behavioral strategies.	4
8.	Repeated Games	4
9.	Bayesian Nash equilibrium	4

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 60 Periods

List of Equipments: (for batch of 30 students)

1. Systems with either Netbeans or Eclipse 30 nos

Course Code	COGNITIVE SCIENCE	L	T	P	C
22PCS26		2	0	2	3

Pre-requisite Java Programming **Syllabus Version** V 0.1

Course Objectives:

1. To know the theoretical background of cognition.
2. To understand the link between cognition and computational intelligence.
3. To explore probabilistic programming language.
4. To study the computational inference models of cognition.
5. To study the computational learning models of cognition.

Course Content:

UNIT I PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE 6

Philosophy: Mental-physical Relation – From Materialism to Mental Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing –Cognitive Neuroscience – Perception – Decision – Learning and Memory-Language Understanding and Processing.

UNIT II COMPUTATIONAL INTELLIGENCE 6

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 6

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 6

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

UNIT V LEARNING MODELS OF COGNITION 6

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

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the underlying theory behind cognition.
2. Connect to the cognition elements computationally.
3. Implement mathematical functions through WebPPL.
4. Develop applications using cognitive inference model.
5. Develop applications using cognitive learning model

Text Book(s):

1. Vijay V Raghavan,Venkat N.Gudivada, VenuGovindaraju, C.R. Rao, Cognitive Computing:Theory and Applications: (Handbook of Statistics 35), Elsevier publications, 2016
2. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley Publications, 2015
3. Robert A. Wilson, Frank C. Keil, "The MIT Encyclopedia of the Cognitive Sciences",The MITPress, 1999.
4. Jose Luis Bermúdez, Cognitive Science -An Introduction to the Science of the Mind,Cambridge University Press 2020

Reference Books:

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, 2016, https://probmods.org/

List of Experiments:

1.	Demonstration of Mathematical functions using WebPPL.	5
2.	Implementation of reasoning algorithms	5
3.	Developing an application system using generative model.	5
4.	Developing an application using conditional inference learning model.	5
5.	Application development using hierarchical model.	5
6.	Application development using Mixture model	5
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1.	Systems with either Netbeans or Eclipse	30 nos

Course Code	ETHICS AND AI	L	T	P	C
22PCS27		2	0	2	3

Pre-requisite Industrial process, Basic AI processing **Syllabus Version** V 0.1

Course Objectives:

1. Study the morality and ethics in AI
2. Learn about the Ethical initiatives in the field of artificial intelligence
3. Study about AI standards and Regulations
4. Study about social and ethical issues of Robot Ethics
5. Study about AI and Ethics- challenges and opportunities.

Course Content:

UNIT I INTRODUCTION 6

Definition of morality and ethics in AI-Impact on society-Impact on human psychology-Impact on thelegal system-Impact on the environment and the planet-Impact on trust.

UNIT II ETHICAL INITIATIVES IN AI 6

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

UNIT III AI STANDARDS AND REGULATION 6

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 6

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 6

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 LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Learn about morality and ethics in AI
2. Acquire the knowledge of real time application ethics, issues and its challenges.
3. Understand the ethical harms and ethical initiatives in AI
4. Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous andSemi-Autonomous Systems
5. Understand the concepts of Roboethics and Morality with professional responsibilities.
6. Learn about the societal issues in AI with National and International Strategies on AI

Text Book(s):

1. y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and AlanWinfield ,"The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March2020
2. Patrick Lin, Keith Abney, George A Bekey," Robot Ethics: The Ethical and Social Implicationsof Robotics", The MIT Press- January 2014

Reference Books:

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_65
5. https://www.scu.edu/ethics/all-about-ethics/artificial-intelligence-and-ethics-sixteen- challenges-and-opportunities/
6. https://www.weforum.org/agenda/2016/10/top-10-ethical-issues-in-artificial-intelligence/ 7. https://sci-hub.mksa.top/10.1159/000492428

List of Experiments:

1.	Recent case study of ethical initiatives in healthcare, autonomous vehicles and defense	**5**
2.	Exploratory data analysis on a 2 variable linear regression model	**5**
3.	Experiment the regression model without a bias and with bias	**5**
4.	Classification of a dataset from UCI repository using a perceptron with and without bias	**5**
5.	Case study on ontology where ethics is at stake	**5**
6.	Identification on optimization in AI affecting ethics	**5**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1.	Systems with either Netbeans or Eclipse	30 nos

Course Code	AMAZON WEB SERVICES	L	T	P	C
22PCS28		2	0	2	3

Pre-requisite Cloud computing **Syllabus Version** V 0.1

Course Objectives:

The objective of this course is to provide students with a comprehensive understanding of Amazon Web Services (AWS) and its various components. By the end of this course, students will be able to launch and manage EC2 instances, configure autoscaling and load balancing, work with S3, EBS, and RDS, set up a VPC and secure it using security groups, ACLs, and IAM, and use advanced AWS services like Lambda, CloudFront, and ECS.

Course Content:

UNIT I Introduction to AWS **6**

Overview of AWS services - Getting started with AWS - Understanding AWS global infrastructure.

UNIT II Computing on AWS **6**

EC2 instance types and configurations - Launching and managing EC2 instances - Autoscaling and load balancing.

UNIT III Storage and Databases on AWS **6**

Amazon S3 for object storage - Amazon EBS for block storage - Amazon RDS for managed databases.

UNIT IV Networking and Security on AWS **6**

Virtual Private Cloud (VPC) and Subnets - Security Groups and Network Access Control Lists (ACLs) - Identity and Access Management (IAM).

UNIT V Advanced AWS Services **6**

AWS Lambda for serverless computing - Amazon CloudFront for content delivery - Amazon Elastic Container Service (ECS) for container orchestration.

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Students will be able to launch and manage EC2 instances on AWS.
2. Students will be able to use AWS storage and database services like S3, EBS, and RDS.
3. Students will be able to set up a VPC and secure it using security groups, ACLs, and IAM.
4. Students will be able to use advanced AWS services like Lambda, CloudFront, and ECS for their applications.
5. Students will be able to design and deploy scalable and fault-tolerant applications on AWS.

Text Book(s):

1. AWS Certified Solutions Architect Official Study Guide: Associate Exam, Author: Joe Baron, Hisham Baz, Tim Bixler, Biff Gaut, Kevin E. Kelly, Sean

Senior, John Stamper, Publisher: Sybex, Edition: 3rd edition (2020), ISBN-13: 978-1119504214

Reference Books:

1. AWS Lambda in Action: Event-driven serverless applications, Author: Danilo Poccia, Publisher: Manning Publications, Edition: 1st edition (2016), ISBN-13: 978-1617293719

List of Experiments:

1	Launching an EC2 instance using Boto3	**3**
2	Configuring Autoscaling and Load Balancing	**3**
3	Working with Amazon S3 using Boto3	**3**
4	Setting up a VPC using Boto3	**3**
5	Identity and Access Management (IAM) using Boto3	**3**
6	Launching an RDS instance using Boto3	**3**
7	Deploying a Serverless Application using AWS Lambda	**3**
8	Content Delivery using Amazon CloudFront	**3**
9	Elastic Container Service (ECS) using Boto3	**3**
10	Final Project - Building a scalable and fault-tolerant application on AWS	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipment: (for batch of 30 students)

1.	Standalone Systems	30 nos
2.	Amazon Web services	30 nos

Course Code	CLOUD COMPUTING VIRTUALIZATION	L	T	P	C
22PCS29		2	0	2	3

Pre-requisite Cloud computing **Syllabus Version** V 0.1

Course Objectives:

This course gives students an insight into the basics of cloud computing along with virtualization, cloud computing is one of the fastest growing domain from a while now. It will provide the students basic understanding about cloud and virtualization along with it how one can migrate over it.

Course Content:

UNIT I CLOUD COMPUTING OVERVIEW 6

Origins of Cloud computing – Cloud components - Essential characteristics – On-demand self- service, Broad network access, Location independent resource pooling, Rapid elasticity, Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing.

UNIT II CLOUD INSIGHTS 6

Architectural influences – High-performance computing, Utility and Enterprise grid computing, Cloud scenarios – Benefits: scalability, simplicity, vendors, security, Limitations – Sensitive information - Application development- security level of third party - security benefits, Regularity issues: Government policies.

UNIT III CLOUD ARCHITECTURE- LAYERS AND MODELS 6

Layers in cloud architecture, Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service (PaaS), features of PaaS and benefits, Infrastructure as a Service (IaaS), features of IaaS and benefits, Service providers, challenges and risks in cloud adoption. Cloud deployment model: Public clouds – Private clouds – Community clouds - Hybrid clouds - Advantages of Cloud computing.

UNIT IV CLOUD SIMULATORS- CLOUDSIM AND GREENCLOUD 6

Introduction to Simulator, understanding CloudSim simulator, CloudSim Architecture (User code, CloudSim, GridSim, SimJava) Understanding Working platform for CloudSim, Introduction to Green Cloud.

UNIT V INTRODUCTION TO VMWARE SIMULATOR 6

Basics of VMWare, advantages of VMware virtualization, using Vmware workstation, creating virtual machines-understanding virtual machines, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understanding of cloud computing fundamentals
2. Familiarity with cloud simulators

3. Practical experience with VMware virtualization
4. Knowledge of cloud security
5. Ability to evaluate cloud service providers

Text Book(s):

1. Cloud Computing: Principles and Paradigms" by Rajkumar Buyya, James Broberg, and Andrzej Goscinski.

Reference Books:

1. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, and Zaigham Mahmood.
2. Cloud Computing: A Hands-On Approach by Arshdeep Bahga and Vijay Madisetti.
3. Cloud Computing: Implementation, Management, and Security by John Rittinghouse and James Ransome.
4. Cloud Computing: Saas, Paas, Iaas, Virtualization, Business Models, Mobile, Security and More by Dr. Kris Jamsa.
5. Mastering VMware vSphere 6 by Nick Marshall, Grant Orchard, and Josh Atwell.

List of Experiments:

1	Setting up a virtual machine using VMware workstation	**3**
2	Creating a cloud computing environment using CloudSim	**3**
3	Analyzing the performance of a cloud computing system using CloudSim	**3**
4	Deploying a web application on a cloud platform	**3**
5	Creating a software as a service (SaaS) application using a PaaS platform	**3**
6	Implementing a cloud-based backup solution for data protection	**3**
7	Evaluating the security risks of using cloud computing and proposing mitigation strategies	**3**
8	Creating a hybrid cloud environment using AWS and Azure	**3**
9	Implementing load balancing in a cloud environment	**3**
10	Developing a disaster recovery plan for a cloud-based system	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipment: (for batch of 30 students)

1. Standalone Systems 30 nos

Course Code	DATA WAREHOUSING (DW)	L	T	P	C
22PCS30		2	0	2	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To know the details of data warehouse Architecture
2. To understand the OLAP Technology
3. To understand the partitioning strategy
4. To differentiate various schema
5. To understand the roles of process manager & system manager

Course Content:

UNIT I INTRODUCTION TO DATA WAREHOUSE 6

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 6

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 6

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 6

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 6

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 LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Design data warehouse architecture for various Problems
2. Apply the OLAP Technology
3. Analyse the partitioning strategy

4. Critically analyze the differentiation of various schema for given problem
5. Frame roles of process manager & system manager

Text Book(s):

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

Reference Books:

1. Paul Raj Ponniah, "Data warehousing fundamentals for IT Professionals", 2012.
2. K.P. Soman, ShyamDiwakar and V. Ajay "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.

List of Experiments:

1.	Data exploration and integration with WEKA	**3**
2.	Apply weka tool for data validation	**3**
3.	Plan the architecture for real time application	**3**
4.	Write the query for schema definition	**3**
5.	Design data ware house for real time applications	**3**
6.	Analyse the dimensional Modeling	**3**
7.	Case study using OLAP	**4**
8.	Case study using OTLP	**4**
9.	Implementation of warehouse testing.	**4**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1. Stand alone computers 30 nos.

Course Code	STORAGE TECHNOLOGIES (ST)	L	T	P	C
22PCS31		2	0	2	3

Pre-requisite Hardware & networking **Syllabus Version** V 0.1

Course Objectives:

1. Characterize the functionalities of logical and physical components of storage
2. Describe various storage networking technologies
3. Identify different storage virtualization technologies
4. Discuss the different backup and recovery strategies
5. Understand common storage management activities and solutions

Course Content:

UNIT I STORAGE SYSTEMS 6

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 6

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and scaleout storage Architecture.

UNIT III STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION 6

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 6

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

UNIT V SECURING STORAGE INFRASTRUCTURE 6

Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance,

Storage infrastructure management functions, Storage infrastructure management processes.

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment
2. Illustrate the usage of advanced intelligent storage systems and RAID
3. Interpret various storage networking architectures - SAN, including storage subsystems and virtualization
4. Examine the different role in providing disaster recovery and remote replication technologies
5. Infer the security needs and security measures to be employed in information storage management

Text Book(s):

1. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas,
2. 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.

Reference Books:

1. EMC Corporation, Information Storage and Management, Wiley, India.

List of Experiments:

1.	Building a RAID (Redundant Array of Independent Disks) array using different configurations (e.g. RAID 0, RAID 1, RAID 5) and benchmarking their performance.	**3**
2.	Configuring and testing a Storage Area Network (SAN) with multiple servers and shared storage.	**3**
3.	Implementing a backup and disaster recovery plan for a network using hardware and software solutions.	**3**
4.	Testing different storage protocols (e.g. iSCSI, Fibre Channel) for performance and reliability.	**3**
5.	Configuring and testing network-attached storage (NAS) devices for file sharing and collaboration.	**3**
6.	Building and testing a cloud-based storage solution using virtualization and distributed storage technologies.	**3**
7.	Investigating and comparing different types of storage media (e.g. HDD, SSD, tape) for performance and reliability.	**3**
8.	Configuring and testing data deduplication and compression technologies for storage optimization.	**3**
9.	Building and testing a high-availability storage cluster using network	**3**

redundancy and failover mechanisms.

10.	Investigating and comparing different storage encryption technologies (e.g. AES, RSA) for data security.	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipment: (for batch of 30 students)

1. Standalone computers 30 nos.

Course Code	SOFTWARE DEFINED NETWORKS	L	T	P	C
22PCS32		2	0	2	3

Pre-requisite Networking **Syllabus Version** V 0.1

Course Objectives:

1. To understand the need for SDN and its data plane operations
2. To understand the functions of control plane
3. To comprehend the migration of networking functions to SDN environment
4. To explore various techniques of network function virtualization
5. To comprehend the concepts behind network virtualization

Course Content:

UNIT I SDN: INTRODUCTION **6**

Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane ,

UNIT II SDN DATA PLANE AND CONTROL PLANE **6**

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 **6**

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

UNIT IV NETWORK FUNCTION VIRTUALIZATION **6**

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

UNIT V NFV FUNCTIONALITY **6**

NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases – SDN and NFV

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1.Describe the motivation behind SDN
2. Identify the functions of the data plane and control plane
3. Design and develop network applications using SDN
4. Orchestrate network services using NFV
5. Explain various use cases of SDN and NFV

Text Book(s):

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

Reference Books:

1. Ken Gray, Thomas D. Nadeau, "Network Function Virtualization", Morgan Kauffman, 2016.
2. Thomas D Nadeau, Ken Gray, "SDN: Software Defined Networks", O'Reilly Media, 2013.
3. Fei Hu, "Network Innovation through OpenFlow and SDN: Principles and Design", 1st Edition,CRC Press, 2014.
4. Paul Goransson, Chuck Black Timothy Culver, "Software Defined Networks: A Comprehensive Approach", 2nd Edition, Morgan Kaufmann Press, 2016.
5. Oswald Coker, Siamak Azodolmolky, "Software-Defined Networking with OpenFlow", 2nd Edition, O'Reilly Media, 2017.

List of Experiments:

1.	Setup your own virtual SDN lab i) Virtualbox/Mininet Environment for SDN - http://mininet.org ii) https://www.kathara.org iii) GNS3	**6**
2.	Create a simple mininet topology with SDN controller and use Wireshark to capture andvisualize the OpenFlow messages such as OpenFlow FLOW MOD, PACKET IN, PACKET OUT etc.	6
3.	Create a SDN application that uses the Northbound API to program flow table rules on the switch for various use cases like L2 learning switch, Traffic Engineering, Firewall etc.	6
4.	Create a simple end-to-end network service with two VNFs using vim-emu https://github.com/containernet/vim-emu	6
5.	Install OSM and onboard and orchestrate network service.	**6**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1. Stand alone computers 30 nos.

Course Code	STREAM PROCESSING	L	T	P	C
22PCS33		2	0	2	3

Pre-requisite Data Science **Syllabus Version** V 0.1

Course Objectives:

1. Introduce Data Processing terminology, definition & concepts
2. Define different types of Data Processing
3. Explain the concepts of Real-time Data processing
4. Select appropriate structures for designing and running real-time data services in a business environment
5. Illustrate the benefits and drive the adoption of real-time data services to solve real world problems

Course Content:

UNIT I FOUNDATIONS OF DATA SYSTEMS 6

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 6

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 6

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

UNIT IV EVENT PROCESSING WITH APACHE KAFKA 6

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 6

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

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the applicability and utility of different streaming algorithms.
2. Describe and apply current research trends in data-stream processing.
3. Analyze the suitability of stream mining algorithms for data stream systems.
4. Program and build stream processing systems, services and applications.
5. Solve problems in real-world applications that process data streams.

Text Book(s):

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

Reference Books:

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

List of Experiments:

1.	Install MongoDB	3
2.	Design and Implement Simple application using MongoDB	3
3.	Query the designed system using MongoDB	4
4.	Create a Event Stream with Apache Kafka	4
5.	Create a Real-time Stream processing application using Spark Streaming	4
6.	Build a Micro-batch application	4
7.	Real-time Fraud and Anomaly Detection,	4
8.	Real-time personalization, Marketing, Advertising	4

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 60 Periods

List of Equipments: (for batch of 30 students)

1. Standalone computers 30 nos.

Course Code	SECURITY AND PRIVACY IN CLOUD	L	T	P	C
22PCS34		2	0	2	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To Introduce Cloud Computing terminology, definition & concepts
2. To understand the security design and architectural considerations for Cloud
3. To understand the Identity, Access control in Cloud
4. To follow best practices for Cloud security using various design patterns
5. To be able to monitor and audit cloud applications for security

Course Content:

UNIT I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 6

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 SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 6

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 6

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

UNIT IV CLOUD SECURITY DESIGN PATTERNS 6

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 6

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 LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the cloud concepts and fundamentals.
2. Explain the security challenges in the cloud.
3. Define cloud policy and Identity and Access Management.
4. Understand various risks and audit and monitoring mechanisms in the cloud.
5. Define the various architectural and design considerations for security in the cloud.

Text Book(s):

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

Reference Books:

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

List of Experiments:

1.	Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm not present in Cloud Sim	**3**
2.	simulate resource management using cloud sim	3
3.	simulate log forensics using cloud sim	3
4.	simulate a secure file sharing using a cloud sim	3
5.	Implement data anonymization techniques over the simple dataset (masking, kanonymization, etc)	**3**
6.	Implement any encryption algorithm to protect the images	**3**
7.	Implement any image obfuscation mechanism	**3**
8.	Implement a role-based access control mechanism in a specific scenario	**3**
9.	implement an attribute-based access control mechanism based on a particular scenario	**3**
10.	Develop a log monitoring system with incident management in the cloud	**3**

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 60 Periods

List of Equipments: (for batch of 30 students)

1. Stand alone computers 30 nos.

Course Code	ETHICAL HACKING (EH)	L	T	P	C
22PCS35		2	0	2	3

Pre-requisite Basics of Networking **Syllabus Version** V 0.1

Course Objectives:

1. To understand the basics of computer-based vulnerabilities.
2. To explore different foot printing, reconnaissance and scanning methods.
3. To expose the enumeration and vulnerability analysis methods.
4. To understand hacking options available in Web and wireless applications.
5. To explore the options for network protection.
6. To practice tools to perform ethical hacking to expose the vulnerabilities.

Course Content:

UNIT I INTRODUCTION **6**

Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware – Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security

UNIT II FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS **6**

Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering - Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques -Scanning Beyond IDS and Firewall

UNIT III ENUMERATION AND VULNERABILITY ANALYSIS **6**

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss

UNIT IV SYSTEM HACKING **6**

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade

UNIT V NETWORK PROTECTION SYSTEMS **6**

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network-Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. To express knowledge on basics of computer based vulnerabilities
2. To gain understanding on different foot printing, reconnaissance and scanning methods.
3. To demonstrate the enumeration and vulnerability analysis methods
4. To gain knowledge on hacking options available in Web and wireless applications.
5. To acquire knowledge on the options for network protection.
6. To use tools to perform ethical hacking to expose the vulnerabilities

Text Book(s):

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

Reference Books:

1. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

List of Experiments:

1.	Install Kali or Backtrack Linux / Metasploitable/ Windows XP	3
2.	Practice the basics of reconnaissance.	3
3.	Using FOCA / SearchDiggity tools, extract metadata and expanding the target list .	3
4.	Aggregates information from public databases using online free tools like Paterva's Maltego	4
5.	Information gathering using tools like Robtex.	4
6.	Scan the target using tools like Nessus.	4
7.	View and capture network traffic using Wireshark	4
8.	Automate dig for vulnerabilities and match exploits using Armitage	5

FOCA : http://www.informatica64.com/foca.aspx.

Nessus : http://www.tenable.com/products/nessus.

Wireshark : http://www.wireshark.org.

Armitage : http://www.fastandeasyhacking.com/.

Kali or Backtrack Linux, Metasploitable, Windows XP

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 60 Periods

List of Equipments: (for batch of 30 students)

1. Stand alone computers 30 nos.

Course Code	SOCIAL NETWORK SECURITY	L	T	P	C
22PCS36		2	0	2	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To develop semantic web related simple applications
2. To explain Privacy and Security issues in Social Networking
3. To explain the data extraction and mining of social networks
4. To discuss the prediction of human behavior in social communities
5. To describe the Access Control, Privacy and Security management of social networks.

Course Content:

UNIT I FUNDAMENTALS OF SOCIAL NETWORKING 6

Introduction to Semantic Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Social Network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis, Historical overview of privacy and security, Majorparadigms, for understanding privacy and security

UNIT II SECURITY ISSUES IN SOCIAL NETWORKS 6

The evolution of privacy and security concerns with networked technologies, Contextual influenceson privacy attitudes and behaviors, Anonymity in a networked world

UNIT III EXTRACTION AND MINING IN SOCIAL NETWORKING DATA 6

Extracting evolution of Web Community from a Series of Web Archive, Detecting communities in social networks, Definition of community, Evaluating communities, Methods for community detectionand mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Big data and Privacy

UNIT IV PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES 6

Understanding and predicting human behavior for social communities, User data Management, Inference and Distribution, Enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment, What is Neo4j, Nodes, Relationships,Properties

UNIT V ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT 6

Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Develop semantic web related simple applications

2. Address Privacy and Security issues in Social Networking
3. Explain the data extraction and mining of social networks
4. Discuss the prediction of human behavior in social communities
5. Describe the applications of social networks.

Text Book(s):

1. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
2. BorkoFurht, Handbook of Social Network Technologies and Application, First Edition,Springer, 2010.
3. Learning Neo4j 3.x Second Edition By Jérôme Baton, Rik Van Bruggen, Packt publishing
4. David Easley, Jon Kleinberg, Networks, Crowds, and Markets: Reasoning about a HighlyConnected World||, First Edition, Cambridge University Press, 2010

Reference Books:

1. Easley D. Kleinberg J., Networks, Crowds, and Markets – Reasoning about a Highly Connected World||, Cambridge University Press, 2010.
2. Jackson, Matthew O., Social and Economic Networks||, Princeton University Press, 2008.
3. GuandongXu ,Yanchun Zhang and Lin Li, —Web Mining and Social Networking – Techniques and applications||, First Edition, Springer, 2011

List of Experiments:

1.	Design own social media application	**5**
2.	Create a Network model using Neo4j	**5**
3.	Read and write Data from Graph Database	**5**
4.	Find "Friend of Friends" using Neo4j	**5**
5.	Implement secure search in social media	**5**
6.	Create a simple Security & Privacy detector	**5**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1.	Dream Weaver or Equivalent, MySQL or Equivalent, Apache Server, WAMP/XAMPP	30 nos
2.	Standalone desktops	30 nos

Course Code	MODERN CRYPTOGRAPHY	L	T	P	C
22PCS37		2	0	2	3

Pre-requisite Cryptography & Network Security **Syllabus Version** V 0.1

Course Objectives:

1. To learn about Modern Cryptography.
2. To focus on how cryptographic algorithms and protocols work and how to use them.
3. To build a Pseudorandom permutation.
4. To construct Basic cryptanalytic techniques.
5. To provide instruction on how to use the concepts of block ciphers and message authentication codes.

Course Content:

UNIT I INTRODUCTION 6

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations.

UNIT II FORMAL NOTIONS OF ATTACKS 6

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM-CPA and NMCCA2, Inter-relations among the attack model

UNIT III RANDOM ORACLES 6

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudorandom Functions (PRF)

UNIT IV BUILDING A PSEUDORANDOM PERMUTATION 6

The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction

UNIT V MESSAGE AUTHENTICATION CODES 6

Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes: One-way functions Imply Secure One-time Signatures. Shamir's Secret Sharing Scheme. Formally Analyzing Cryptographic Protocols. Zero Knowledge Proofs and Protocols.

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Interpret the basic principles of cryptography and general cryptanalysis.
2. Determine the concepts of symmetric encryption and authentication.
3. Identify the use of public key encryption, digital signatures, and key establishment.
4. Articulate the cryptographic algorithms to compose, build and analyze simple cryptographic solutions.
5. Express the use of Message Authentication Codes.

Text Book(s):

1. Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications, Springer Verlag.
2. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low Priced Edition)

Reference Books:

1. ShaffiGoldwasser and MihirBellare, Lecture Notes on Cryptography, Available at http://citeseerx.ist.psu.edu/.
2. OdedGoldreich, Foundations of Cryptography, CRC Press (Low Priced Edition Available), Part 1 and Part 23
3. William Stallings, "Cryptography and Network Security: Principles and Practice", PHI 3rd Edition, 2006.

List of Experiments:

1.	Implement Feige-Fiat-Shamir identification protocol	**3**
2.	Implement GQ identification protocol	**3**
3.	Implement Schnorr identification protocol.	**3**
4.	Implement Rabin one-time signature scheme.	**3**
5.	Implement Merkle one-time signature scheme	**3**
6.	Implement Authentication trees and one-time signatures	**3**
7.	Implement GMR one-time signature scheme	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1. Stand alone computers 30 nos.

Course Code	ENGINEERING SECURE SOFTWARE SYSTEMS	L	T	P	C
22PCS38		2	0	2	3

Pre-requisite Networking **Syllabus Version** V 0.1

Course Objectives:

1. Know the importance and need for software security.
2. Know about various attacks.
3. Learn about secure software design.
4. Understand risk management in secure software development.
5. Know the working of tools related to software security.

Course Content:

UNIT I NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS 6

Software Assurance and Software Security - Threats to software security - Sources of software insecurity - Benefits of Detecting Software Security - Properties of Secure Software – Memory- Based Attacks: Low-Level Attacks Against Heap and Stack - Defense Against Memory-Based Attacks

UNIT II SECURE SOFTWARE DESIGN 6

Requirements Engineering for secure software - SQUARE process Model - Requirements elicitation and prioritization- Isolating The Effects of Untrusted Executable Content - Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection - Session Hijacking. Secure Design - Threat Modeling and Security Design Principles

UNIT III SECURITY RISK MANAGEMENT 6

Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management

UNIT IV SECURITY TESTING 6

Traditional Software Testing – Comparison - Secure Software Development Life Cycle - Risk Based Security Testing – Prioritizing Security Testing With Threat Modeling – Penetration Testing – Planning and Scoping - Enumeration – Remote Exploitation – Web Application Exploitation - Exploits and Client Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection - Tools for Penetration Testing

UNIT V SECURE PROJECT MANAGEMENT 6

Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Identify various vulnerabilities related to memory attacks.
2. Apply security principles in software development.
3. Evaluate the extent of risks.
4. Involve selection of testing techniques related to software security in the testing phase of software development.

5. Use tools for securing software.

Text Book(s):

1. Julia H. Allen, “Software Security Engineering”, Pearson Education, 2008
2. Evan Wheeler, “Security Risk Management: Building an Information Security Risk Management Program from the Ground Up”, First edition, Syngress Publishing, 2011
3. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, “The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)”, Addison-Wesley Professional, 2006

Reference Books:

1. Robert C. Seacord, “Secure Coding in C and C++ (SEI Series in Software Engineering)”, Addison-Wesley Professional, 2005.
2. Jon Erickson, “Hacking: The Art of Exploitation”, 2nd Edition, No Starch Press, 2008.
3. Mike Shema, “Hacking Web Apps: Detecting and Preventing Web Application Security Problems”, First edition, Syngress Publishing, 2012
4. Bryan Sullivan and Vincent Liu, “Web Application Security, A Beginner's Guide”, Kindle Edition, McGraw Hill, 2012
5. Lee Allen, “Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)”, Kindle Edition, Packt Publishing,2012
6. Jason Grembi, “Developing Secure Software”

List of Experiments:

1.	Implement the SQL injection attack.	**3**
2.	Implement the Buffer Overflow attack.	**3**
3.	Implement Cross Site Scripting and Prevent XSS.	**3**
4.	Perform Penetration testing on a web application to gather information about the system, then initiate XSS and SQL injection attacks using tools like Kali Linux.	**3**
5.	Develop and test the secure test cases	**3**
6.	Penetration test using kali Linux	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1. Stand alone computers 30 nos.

Course Code	NETWORK SECURITY (NS)	L	T	P	C
22PCS39		2	0	2	3

Pre-requisite Networking **Syllabus Version** V 0.1

Course Objectives:

1. To learn the fundamentals of cryptography.
2. To learn the key management techniques and authentication approaches.
3. To explore the network and transport layer security techniques.
4. To understand the application layer security standards.
5. To learn the real time security practices.

Course Content:

UNIT I INTRODUCTION 6

Basics of cryptography, conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II KEY MANAGEMENT AND AUTHENTICATION 6

Key Management and Distribution: Symmetric Key Distribution, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure. User Authentication: Remote User-Authentication Principles, Remote User-Authentication Using Symmetric Encryption, Kerberos Systems, Remote User Authentication Using Asymmetric Encryption.

UNIT III ACCESS CONTROL AND SECURITY 6

Network Access Control: Network Access Control, Extensible Authentication Protocol, IEEE 802.1X Port-Based Network Access Control - IP Security - Internet Key Exchange (IKE). Transport-Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS standard, Secure Shell (SSH) application.

UNIT IV APPLICATION LAYER SECURITY 6

Electronic Mail Security: Pretty Good Privacy, S/MIME, DomainKeys Identified Mail. Wireless Network Security: Mobile Device Security

UNIT V SECURITY PRACTICES 6

Firewalls and Intrusion Detection Systems: Intrusion Detection Password Management, Firewall Characteristics Types of Firewalls, Firewall Basing, Firewall Location and Configurations. Blockchains, Cloud Security and IoT security

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Classify the encryption techniques
2. Illustrate the key management technique and authentication.
3. Evaluate the security techniques applied to network and transport layer
4. Discuss the application layer security standards.
5. Apply security practices for real time applications.

Text Book(s):

1. Cryptography and Network Security: Principles and Practice, 6th Edition, William Stallings, 2014, Pearson, ISBN 13:9780133354690.

Reference Books:

1. Network Security: Private Communications in a Public World, M. Speciner, R. Perlman, C. Kaufman, Prentice Hall, 2002.
2. Linux iptables Pocket Reference, Gregor N. Purdy, O'Reilly, 2004, ISBN-13: 978-0596005696.
3. Linux Firewalls, by Michael Rash, No Starch Press, October 2007, ISBN: 978-1-59327-141-1
4. Network Security, Firewalls And VPNs, J. Michael Stewart, Jones & Bartlett Learning, 2013,ISBN-10: 1284031675, ISBN-13: 978-1284031676.
5. The Network Security Test Lab: A Step-By-Step Guide, Michael Gregg, Dreamtech Press, 2015, ISBN-10:8126558148, ISBN-13: 978-8126558148.

List of Experiments:

1.	Implement symmetric key algorithms	**3**
2.	Implement asymmetric key algorithms and key exchange algorithms	**3**
3.	Implement digital signature schemes	**3**
4.	Installation of Wire shark, tcpdump and observe data transferred in client-server communication using UDP/TCP and identify the UDP/TCP datagram.	**3**
5.	Check message integrity and confidentiality using SSL	**3**
6.	Experiment Eavesdropping, Dictionary attacks, MITM attacks	**3**
7.	Experiment with Sniff Traffic using ARP Poisoning	**3**
8.	Demonstrate intrusion detection system using any tool.	**3**
9.	Explore network monitoring tools	**3**
10.	Study to configure Firewall, VPN	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipment: (for batch of 30 students)

1. Standalone computers 30 nos.

Course Code	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	L	T	P	C
22PCS40		2	0	2	3

Pre-requisite Basic computer networking **Syllabus Version** V 0.1

Course Objectives:

1. To understand the basics of Blockchain
2. To learn Different protocols and consensus algorithms in Blockchain
3. To learn the Blockchain implementation frameworks
4. To understand the Blockchain Applications
5. To experiment the Hyperledger Fabric, Ethereum networks

Course Content:

UNIT I INTRODUCTION TO BLOCKCHAIN 6

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 6

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 6

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 6

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

UNIT V BLOCKCHAIN APPLICATIONS 6

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 LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand emerging abstract models for Blockchain Technology
2. Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.
3. 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.
4. Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.

Text Book(s):

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

Reference Books:

1. Daniel Drescher, "Blockchain Basics", First Edition, Apress, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
3. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015
4. 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: 9780128198162, 2020.

List of Experiments:

1.	Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.	**5**
2.	Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.	5
3.	Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules.	5
4.	Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger fabric network.	
5.	Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabric to track and trace member rewards.	**5**
6.	Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chain code while storing results and data in the starter plan	**5**

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 60 Periods

List of Equipment: (for batch of 30 students)

1. Standalone computers 30 nos.

Course Code	DIGITAL AND MOBILE FORENSICS	L	T	P	C
22PCS41		2	0	2	3

Pre-requisite Software Engineering **Syllabus Version** V 0.1

Course Objectives:

1. To understand basic digital forensics and techniques.
2. To understand digital crime and investigation.
3. To understand how to be prepared for digital forensic readiness.
4. To understand and use forensics tools for iOS devices.
5. To understand and use forensics tools for Android devices.

Course Content:

UNIT I INTRODUCTION TO DIGITAL FORENSICS 6

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase

UNIT II DIGITAL CRIME AND INVESTIGATION 6

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

UNIT III DIGITAL FORENSIC READINESS 6

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics

UNIT IV iOS FORENSICS 6

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

UNIT V ANDROID FORENSICS 6

Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security –Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Have knowledge on digital forensics.
2. Know about digital crime and investigations.
3. Be forensic ready.
4. Investigate, identify and extract digital evidence from iOS devices.
5. Investigate, identify and extract digital evidence from Android devices.

Text Book(s):

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

Reference Books:

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

List of Experiments:

1.	Installation of Sleuth Kit on Linux. List all data blocks. Analyze allocated as well as unallocated blocks of a disk image.	3
2.	Data extraction from call logs using Sleuth Kit.	3
3.	Data extraction from SMS and contacts using Sleuth Kit.	4
4.	Install Mobile Verification Toolkit or MVT and decrypt encrypted iOS backups.	4
5.	Process and parse records from the iOS system.	4
6.	Extract installed applications from Android devices.	4
7.	Extract diagnostic information from Android devices through the adb protocol.	4
8.	Generate a unified chronological timeline of extracted records	4
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipment: (for batch of 30 students)

1. Standalone computers 30 nos.

Vertical List

22PCS42	KNOWLEDGE ENGINEERING	L T P C 2 0 2 3

Pre-requisite Python, pandas numpy **Syllabus Version** V 0.1

Course Objectives:

1. To understand the basics of Knowledge Engineering.
2. To discuss methodologies and modeling for Agent Design and Development.
3. To design and develop ontologies.
4. To apply reasoning with ontologies and rules.
5. To understand learning and rule learning

Course Content:

UNIT I REASONING UNDER UNCERTAINTY 6

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 6

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 6

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 6

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 6

Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definitionof Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning;

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the basics of Knowledge Engineering.
2. Apply methodologies and modelling for Agent Design and Development
3. Design and develop ontologies.
4. Apply reasoning with ontologies and rules.
5. Understand learning and rule learning

Text Book(s):

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016. (Unit 1 – Chapter 1 / Unit 2 – Chapter 3,4 / Unit 3 – Chapter 5, 6 / Unit 4- 7 , Unit 5 – Chapter 8, 9)

Reference Books:

1. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning,Morgan Kaufmann, 2004.
2. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.
3. John F. Sowa: Knowledge Representation: Logical, Philosophical, and ComputationalFoundations, Brooks/Cole, Thomson Learning, 2000.
4. King , Knowledge Management and Organizational Learning , Springer, 2009.
5. Jay Liebowitz, Knowledge Management Learning from Knowledge Engineering, 1st Edition,2001

List of Experiments:

1.	Perform operations with Evidence Based Reasoning.	**4**
2.	Perform Evidence based Analysis.	**5**
3.	Perform operations on Probability Based Reasoning.	**4**
4.	Perform Believability Analysis.	**4**
5.	Implement Rule Learning and refinement.	**5**
6.	Perform analysis based on learned patterns.	**4**
7.	Construction of Ontology for a given domain	**4**

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 60 Periods

List of Equipment: (for batch of 30 students)

1.	Python 3.9 or later, Anaconda Distribution	30 nos
2.	Systems with either Netbeans or Eclipse	30 nos

22PCS43	COMPUTER VISION	L	T	P	C
		2	0	2	3

Pre-requisite Python, pandas numpy **Syllabus Version** V 0.1

Course Objectives:

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

Course Content:

UNIT I INTRODUCTION TO IMAGE FORMATION AND PROCESSING 6

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

UNIT II FEATURE DETECTION, MATCHING AND SEGMENTATION 6

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

UNIT III FEATURE-BASED ALIGNMENT & MOTION ESTIMATION 6

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 - Layeredmotion.

UNIT IV 3D RECONSTRUCTION 6

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 6

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Categoryrecognition - Context and scene understanding- Recognition databases and test sets;

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. To understand basic knowledge, theories and methods in image processing and computervision.
2. To implement basic and some advanced image processing techniques in OpenCV.
3. To apply 2D a feature-based based image alignment, segmentation and motion estimations.
4. To apply 3D image reconstruction techniques
5. To design and develop innovative image processing and computer vision applications.

Text Book(s):

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

Reference Books:

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision,Second Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012

List of Experiments:

1.	OpenCV Installation and working with Python	**3**
2.	Basic Image Processing -	**3**
3.	a) Image Annotation – Drawing lines, text circle, rectangle, ellipse on images	**3**
4.	Image Enhancement - Understanding Color spaces, color space conversion, Histogramequialization, Convolution, Image smoothing, Gradients, Edge Detection	**3**
5.	Image Features and Image Alignment – Image transforms – Fourier, Hough, Extract ORBImage features, Feature matching, cloning, Feature matching based image alignment	**3**
6.	Image segmentation using Graphcut / Grabcut	**3**
7.	Camera Calibration with circular grid	**3**
8.	Pose Estimation	**3**
9.	3D Reconstruction – Creating Depth map from stereo images	**3**
10.	Object Detection and Tracking using Kalman Filter, Camshift	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipment: (for batch of 30 students)

1.	OpenCV computer vision Library for OpenCV in Python / PyCharm or C++ / Visual Studio or or equivalent	30 nos

Vertical III: Cloud Computing and Data center Technologies

22PCS44	**CLOUD COMPUTING**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

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

Course Content:

UNIT I INTRODUCTION 6

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

UNIT II CLOUD ENABLING TECHNOLOGIES 6

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

UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE 6

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

UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD 6

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods

– Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards

UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS 6

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

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Articulate the main concepts, key technologies, strengths and limitations of cloudcomputing.
2. Learn the key and enabling technologies that help in the development of cloud.
3. Develop the ability to understand and use the architecture of compute and storage cloud,service and delivery models.
4. Explain the core issues of cloud computing such as resource management and security.
5. Be able to install and use current cloud technologies.
6. Evaluate and choose the appropriate technologies, algorithms and approaches forimplementation and use of cloud

Text Book(s):

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. Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017

Reference Books:

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

List of Experiments:

1.	Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on topof windows7 or 8.	**3**
2.	Install a C compiler in the virtual machine created using virtual box and execute SimplePrograms.	**3**
3.	Install Google App Engine. Create *hello world* app and other simple web applications usingpython/java.	4
4.	Use GAE launcher to launch the web applications.	**3**
5.	Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is notpresent in CloudSim.	4
6.	Find a procedure to transfer the files from one virtual machine to another virtual machine.	**3**
7.	Find a procedure to launch virtual machine using trystack (Online Openstack DemoVersion).	**3**
8.	Install Hadoop single node cluster and run simple applications like wordcount..	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**

TOTAL LECTURE CUM PRACTICAL PERIODS 60 Periods

List of Equipments: (for batch of 30 students)

1.	PC with latest version	30 nos
2.	Cloud tools from free of open source like open nebula, open stack, Eucalyptus software	30 nos

22PCS45	VIRTUALIZATION	L	T	P	C
		2	0	2	3

Pre-requisite Python, pandas numpy **Syllabus Version** V 0.1

Course Objectives:

1. To Learn the basics and types of Virtualization
2. To understand the Hypervisors and its types
3. To Explore the Virtualization Solutions
4. To Experiment the virtualization platforms

Course Content:

UNIT I INTRODUCTION TO VIRTUALIZATION 6

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

UNIT II SERVER AND DESKTOP VIRTUALIZATION 6

Virtual machine basics- Types of virtual machines- Understanding Server Virtualization-types of server virtualization- Business Cases for Server Virtualization – Uses of Virtual Server Consolidation– Selecting Server Virtualization Platform-Desktop Virtualization-Types of Desktop Virtualization

UNIT III NETWORK VIRTUALIZATION 6

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

UNIT IV STORAGE VIRTUALIZATION 6

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

UNIT V VIRTUALIZATION TOOLS 6

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

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Analyse the virtualization concepts and Hypervisor
2. Apply the Virtualization for real-world applications
3. Install & Configure the different VM platforms
4. Experiment with the VM with various software.

Text Book(s):

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

Reference Books:

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

List of Experiments:

1.	Create type 2 virtualization in VMWARE or any equivalent Open Source Tool. Allocate memoryand storage space as per requirement. Install Guest OS on that VMWARE..	**4**
2.	a) Shrink and extend virtual disk b) Create, Manage, Configure and schedule snapshots c) Create Spanned, Mirrored and Striped volume d) Create RAID 5 volume .	**5**
3.	a) Desktop Virtualization using VNC b) Desktop Virtualization using Chrome Remote Desktop.	**4**
4.	Create type 2 virtualization on ESXI 6.5 server	**4**
5.	Create a VLAN in CISCO packet tracer	**5**
6.	Install KVM in Linux	**4**
7.	Create Nested Virtual Machine(VM under another VM)	**4**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipment: (for batch of 30 students)

1.	Python 3.9 or later, Anaconda Distribution	30 nos
2.	Systems with either Netbeans or Eclipse	30 nos

Vertical V: Creative Media

22PCS46	AUGMENTED REALITY/VIRTUAL REALITY	L	T	P	C
		2	0	2	3

Pre-requisite JAVA programming **Syllabus Version** V 0.1

Course Objectives:

1. To impart the fundamental aspects and principles of AR/VR technologies.
2. To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
3. To learn about the graphical processing units and their architectures.
4. To gain knowledge about AR/VR application development.
5. To know the technologies involved in the development of AR/VR based applications.

Course Content:

UNIT I INTRODUCTION 6

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System.

UNIT II VR MODELING 6

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

UNIT III VR PROGRAMMING 6

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

UNIT IV APPLICATIONS 6

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications– Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics– Information Visualization – VR in Business – VR in Entertainment – VR in Education.

UNIT V AUGMENTED REALITY 6

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

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the basic concepts of AR and VR
2. Understand the tools and technologies related to AR/VR
3. Know the working principle of AR/VR related Sensor devices
4. Design of various models using modeling techniques
5. Develop AR/VR applications in different domains

Text Book(s):

1. Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VR experiences for mobile", Packt Publisher, 2018.
2. Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles & Practice", Addison Wesley, 2016.
3. John Vince, "Introduction to Virtual Reality", Springer-Verlag, 2004.
4. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application, Design", Morgan Kaufmann, 2003.

Reference Books:

1.
2.

List of Experiments:

1.	Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.	**3**
2.	Use the primitive objects and apply various projection types by handling camera.	**3**
3.	Download objects from asset store and apply various lighting and shading effects.	**3**
4.	Model three dimensional objects using various modelling techniques and apply textures overthem.	**3**
5.	Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity	**3**
6.	Add audio and text special effects to the developed application.	**3**
7.	Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.	**3**
8.	Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places	**3**
9.	Develop AR enabled simple applications like human anatomy visualization, DNA/RNA structure visualization and surgery simulation.	**3**
10.	Develop simple MR enabled gaming applications.	**3**

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 60 Periods

List of Equipments: (for batch of 30 students)

1. Stand alone computers	30 nos.

22PCS47	MULTIMEDIA AND ANIMATION (MA)	L	T	P	C
		2	0	2	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To grasp the fundamental knowledge of Multimedia elements and systems
2. To get familiar with Multimedia file formats and standards
3. To learn the process of Authoring multimedia presentations
4. To learn the techniques of animation in 2D and 3D and for the mobile UI
5. To explore different popular applications of multimedia

Course Content:

UNIT I INTRODUCTION TO MULTIMEDIA 6

Definitions, Elements, Multimedia Hardware and Software, Distributed multimedia systems, challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata, Multimedia databases, Hypermedia, Multimedia Learning.

UNIT II MULTIMEDIA FILE FORMATS AND STANDARDS 6

File formats – Text, Image file formats, Graphic and animation file formats, Digital audio and Video file formats, Color in image and video, Color Models. Multimedia data and file formats for the web.

UNIT III MULTIMEDIA AUTHORING 6

Authoring metaphors, Tools Features and Types: Card and Page Based Tools, Icon and Object Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools, Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing Tools, audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning, simulations.

UNIT IV ANIMATION 6

Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation, Animation techniques: Keyframe, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, , Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.

UNIT V MULTIMEDIA APPLICATIONS 6

Multimedia Big data computing, social networks, smart phones, surveillance, Analytics, Multimedia Cloud Computing, Multimedia streaming cloud, media on demand, security and forensics, Online social networking, multimedia ontology, Content based retrieval from digital libraries.

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Get the bigger picture of the context of Multimedia and its applications
2. Use the different types of media elements of different formats on content pages
3. Author 2D and 3D creative and interactive presentations for different target multimedia applications.
4. Use different standard animation techniques for 2D, 21/2 D, 3D applications
5. Understand the complexity of multimedia applications in the context of cloud, security, bigdata streaming, social networking, CBIR etc.,

Text Book(s):

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of Multimedia", Third Edition, Springer Texts in Computer Science, 2021.

Reference Books:

1. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC press, 3rd Edition, 2016.
2. Gerald Friedland, Ramesh Jain, "Multimedia Computing", Cambridge University Press, 2018.
3. Prabhat K.Andleigh, Kiran Thakrar, "Multimedia System Design", Pearson Education, 1st Edition, 2015.
4. Mohsen Amini Salehi, Xiangbo Li, "Multimedia Cloud Computing Systems", Springer Nature,1st Edition, 2021.
5. Mark Gaimbruno, "3D Graphics and Animation", Second Edition, New Riders, 2002.
6. Rogers David, "Animation: Master – A Complete Guide (Graphics Series)", Charles River Media, 2006.
7. Rick parent, "Computer Animation: Algorithms and Techniques", Morgan Kauffman, 3rd Edition, 2012.
8. Emilio Rodriguez Martinez, Mireia Alegre Ruiz, "UI Animations with Lottie and After Effects:Create, render, and ship stunning After Effects animations natively on mobile with ReactNative", Packt Publishing, 2022.

List of Experiments:

Working with Image Editing tools:

Install tools like GIMP/ InkScape / Krita / Pencil and perform editing operations:

Ø Use different selection and transform tools to modify or improve an image

Ø Create logos and banners for home pages of websites.

Working with Audio Editing tools:

Ø Install tools like, Audacity / Ardour for audio editing, sound mixing and special effects like fade-in

or fade-out etc.,

Ø Perform audio compression by choosing a proper codec.

Working with Video Editing and conversion tools:

Install tools like OpenShot / Cinelerra / HandBrake for editing video content.

Ø Edit and mix video content, remove noise, create special effects, add captions.

Ø Compress and convert video file format to other popular formats.

Working with web/mobile authoring tools:

Adapt / KompoZer/ BlueGriffon / BlueFish / Aptana Studio/ NetBeans / WordPress /Expression Web:

Ø Design simple Home page with banners, logos, tables quick links etc
Ø Provide a search interface and simple navigation from the home page to the inside pages of the
website.
Ø Design Responsive web pages for use on both web and mobile interfaces.

Working with Animation tools:

Install tools like, Krita, Wick Editor, Blender:
Ø Perform a simple 2D animation with sprites
Ø Perform simple 3D animation with keyframes, kinematics
Working with Mobile UI animation tools: Origami studio / Lottie / Framer etc.,

Working with E-Learning authoring tools:

Install tools like EdApp / Moovly / CourseLab/ IsEazy and CamStudio/Ampache, VideoLAN:
Ø Demonstrate screen recording and further editing for e-learning content.
Ø Create a simple E-Learning module for a topic of your choice.
Creating VR and AR applications:
Ø Any affordable VR viewer like Google Cardboard and any development platform like Openspace 3D / ARCore etc.

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 60 Periods

List of Equipments: (for batch of 30 students)

1. Stand alone computers 30 nos.

22PCS48	VIDEO CREATION AND EDITING (VCE)	L	T	P	C
		2	0	2	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To introduce the broad perspective of linear and nonlinear editing concepts.
2. To understand the concept of Storytelling styles.
3. To be familiar with audio and video recording. To apply different media tools.
4. To learn and understand the concepts of AVID XPRESS DV 4.

Course Content:

UNIT I FUNDAMENTALS 6

Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression – risks associated with altering reality through editing.

UNIT II STORYTELLING 6

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - mechanics of digital editing - pointer files - media management.

UNIT III USING AUDIO AND VIDEO 6

Capturing digital and analog video importing audio putting video on exporting digital video to tape recording to CDs and VCDs.

UNIT IV WORKING WITH FINAL CUT PRO 6

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas – Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques – Working with Audio - Using Media Tools - Viewing and Setting Preferences.

UNIT V WORKING WITH AVID XPRESS DV 4 6

Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage -Using Timeline and Working in Trim Mode - Working with Audio - Output Options.

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Compare the strengths and limitations of Nonlinear editing.
2. Identify the infrastructure and significance of storytelling.
3. Apply suitable methods for recording to CDs and VCDs.
4. Address the core issues of advanced editing and training techniques.
5 Design and develop projects using AVID XPRESS DV 4

Text Book(s):

1. 3. Keith Underdahl, “Digital Video for Dummies”, Third Edition, Dummy Series, 2001.
2. 4. Robert M. Goodman and Partick McGarth, “Editing Digital Video: The Complete Creative and Technical Guide”, Digital Video and Audio, McGraw – Hill 2003.

Reference Books:

1. Avid Xpress DV 4 User Guide, 2007.
2. Final Cut Pro 6 User Manual, 2004.

List of Experiments:

1.	Write a Movie Synopsis (Individual/Team Writing)	**4**
2.	Present team stories in class	**4**
3.	Script/Storyboard Writing(Individual Assignment	**4**
4.	Pre-Production: Personnel, budgeting, scheduling, location scouting, casting, contracts & agreements	**5**
5.	Production: Single camera production personnel & equipment, Documentary Production	**4**
6.	Writing The Final Proposal: Overview, Media Treatments, Summary, Pitching	**5**
7.	Write Documentary & Animation Treatment	**4**
8.	Post-production: Editing, Sound design, Finishing	**4**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1. Stand alone computers 30 nos.

Course Code	DIGITAL MARKETING	L	T	P	C
22PCS49		2	0	2	3

Pre-requisite Data Analytics, basic social media process understanding **Syllabus Version** V 0.1

Course Objectives:

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

Course Content:

UNIT I INTRODUCTION TO ONLINE MARKET 6

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

UNIT II SEARCH ENGINE OPTIMISATION 6

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 6

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 6

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 6

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 LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. To examine and explore the role and importance of digital marketing in today's rapidly changing business environment..
2. To focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.
3. To know the key elements of a digital marketing strategy.
4. To study how the effectiveness of a digital marketing campaign can be measured

5. To demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs5. Develop AR/VR applications in different domains

Text Book(s):

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). ISBN10: 0199455449

Reference Books:

4. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition (April 2017); ISBN10: 9788126566938;ISBN 13: 9788126566938;ASIN: 8126566930.
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.

List of Experiments:

1.	Subscribe to a weekly/quarterly newsletter and analyze how its content and structure aids with the branding of the company and how it aids its potential customer segments.	**5**
2.	Perform keyword search for a skincare hospital website based on search volume and competition using Google keyword planner tool.	5
3.	Demonstrate how to use the Google WebMasters Indexing API	5
4.	Discuss an interesting case study regarding how an insurance company manages leads	5
5.	Discuss negative and positive impacts and ethical implications of using social media for political advertising.	5
6.	Discuss how Predictive analytics is impacting marketing automation	**5**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1. Stand alone computers 30 nos.

Course Code	MULTIMEDIA DATA COMPRESSION AND STORAGE	L	T	P	C
22PCS50		2	0	2	3

Pre-requisite Data processing, matrix, image processing **Syllabus Version** V 0.1

Course Objectives:

1. To understand the basics of compression techniques
2. To understand the categories of compression for text, image and video
3. To explore the modalities of text, image and video compression algorithms
4. To know about basics of consistency of data availability in storage devices
5. To understand the concepts of data streaming services.

Course Content:

UNIT I BASICS OF DATA COMPRESSION 6

Introduction —Lossless and Lossy Compression– Basics of Huffmann coding- Arithmetic coding Dictionary techniques- Context based compression – Applications

UNIT II IMAGE COMPRESSION 6

Lossless Image compression – JPEG-CALIC-JPEG LS-Prediction using conditional averages – Progressive Image Transmission – Lossless Image compression formats – Applications – Facsimile encoding

UNIT III VIDEO COMPRESSION 6

Introduction – Motion Compensation – Video Signal Representation – H.261 – MPEG-1-MPEG-2-H.263.

UNIT IV DATA PLACEMENT ON DISKS 6

Statistical placement on Disks – Striping on Disks – Replication Placement on Disks – Constraint allocation on Disks – Tertiary storage Devices – Continuous Placement on Hierarchical storage system – Statistical placement on Hierarchical storage systems – Constraint allocation on Hierarchical storage system

UNIT V DISK SCHEDULING METHODS 6

Scheduling methods for disk requests – Feasibility conditions of concurrent streams– Scheduling methods for request streams

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the basics of text, Image and Video compression
2. Understand the various compression algorithms for multimedia content
3. Explore the applications of various compression techniques
4. Explore knowledge on multimedia storage on disks
5. Understand scheduling methods for request streams

Text Book(s):

1. 1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Series in

Multimedia Information and Systems, 2018, 5th Edition.

2. 2. Philip K.C.Tse, Multimedia Information Storage and Retrieval: Techniques and Technologies, 2008

Reference Books:

1. David Salomon, A concise introduction to data compression, 2008.
2. Lenald Best, Best's Guide to Live Stream Video Broadcasting, BCB Live Teaching series, 2017.
3. Yun-Qing Shi, Image And Video Compression For Multimedia Engineering Fundamentals Algorithms And Standards, Taylor& Francis,2019
4. Irina Bocharova, Compression for Multimedia, Cambridge University Press; 1st edition, 2009

List of Experiments:

1.	Construct Huffman codes for given symbol probabilities	**3**
2.	Encode run lengths with fixed-length code.	**3**
3.	Lempel-Ziv algorithm for adaptive variable-length encoding	**3**
4.	Compress the given word using arithmetic coding based on the frequency of the letters.	**3**
5.	Write a shell script, which converts all images in the current directory in JPEG	**3**
6.	Write a program to split images from a video without using any primitives	**3**
7.	Create a photo album of a trip by applying appropriate image dimensions and format.	**3**
8.	Write the code for identifying the popularity of content retrieval from media server.	**3**
9.	Write the code for ensuring data availability in disks using strip based method.	**3**
10.	Program for scheduling requests for data streams.	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipment: (for batch of 30 students)

1. Standalone computers 30 nos.

Course Code	GAME DEVELOPMENT	L	T	P	C
22PCS51		2	0	2	3

Pre-requisite Basic programming knowledge, Python **Syllabus Version** V 0.1

Course Objectives:

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

Course Content:

UNIT I 3D GRAPHICS FOR GAME DESIGN 6

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 6

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 6

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 6

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

UNIT V GAME DEVELOPMENT USING PYGAME 6

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 LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1.Explain the concepts of 2D and 3d Graphics
2.Design game design documents.
3.Implementation of gaming engines.
4.Survey gaming environments and frameworks.
5.Implement a simple game in Pygame.

Text Book(s):

1.Sanjay Madhav, “Game Programming Algorithms and Techniques: A Platform Agnostic Approach”, Addison Wesley,2013.
2. Will McGugan, “Beginning Game Development with Python and Pygame: From Novice to Professional”, Apress,2007.

Reference Books:

1. Paul Craven, “Python Arcade games”, Apress Publishers,2016.
2. David H. Eberly, “3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics”, Second Edition, CRC Press,2006.
3. Jung Hyun Han, “3D Graphics for Game Programming”, Chapman and Hall/CRC, 2011.

List of Experiments:

1.	Installation of a game engine, e.g., Unity, Unreal Engine, familiarization of the GUI. Conceptualize the theme for a 2D game	**3**
2.	Character design, sprites, movement and character control	**3**
3.	Level design: design of the world in the form of tiles along with interactive and collectible objects.	**3**
4.	Design of interaction between the player and the world, optionally using the physics engine	**3**
5.	Developing a 2D interactive using Pygame	**3**
6.	Developing a Puzzle game	**3**
7.	Design of menus and user interaction in mobile platforms	**4**
8.	Developing a 3D Game using Unreal	**4**
9.	Developing a Multiplayer game using unity	**4**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipment: (for batch of 30 students)

1. Standalone computers 30 nos.

Course Code	VISUAL EFFECTS	L	T	P	C
22PCS52		2	0	2	3

Pre-requisite Photo/video editing basics **Syllabus Version** V 0.1

Course Objectives:

1. To get a basic idea on animation principles and techniques
2. To get exposure to CGI, color and light elements of VFX
3. To have a better understanding of basic special effects techniques
4. To have a knowledge of state of the art vfx techniques
5. To become familiar with popular compositing techniques

Course Content:

UNIT I ANIMATION BASICS 6

VFX production pipeline, Principles of animation, Techniques: Keyframe, kinematics, Full animation,limited animation, Rotoscoping, stop motion, object animation, pixilation, rigging, shape keys, motion paths.

UNIT II CGI, COLOR, LIGHT 6

CGI – virtual worlds, Photorealism, physical realism, function realism, 3D Modeling and Rendering: color - Color spaces, color depth, Color grading, color effects, HDRI, Light – Area and mesh lights, image based lights, PBR lights, photometric light, BRDF shading model

UNIT III SPECIAL EFFECTS 6

Special Effects – props, scaled models, animatronics, pyrotechniques, Schüfftan process, Particle effects – wind, rain, fog, fire

UNIT IV VISUAL EFFECTS TECHNIQUES 6

Motion Capture, Matt Painting, Rigging, Front Projection. Rotoscoping, Match Moving – Tracking, camera reconstruction, planar tracking, Calibration, Point Cloud Projection, Ground plane determination, 3D Match Moving

UNIT V COMPOSITING 6

Compositing – chroma key, blue screen/green screen, background projection, alpha compositing, deep image compositing, multiple exposure, matting, VFX tools - Blender, Natron, GIMP

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. To implement animation in 2D / 3D following the principles and techniques
2. To use CGI, color and light elements in VFX applications
3. To create special effects using any of the state of the art tools
4. To apply popular visual effects techniques using advanced tools
5. To use compositing tools for creating VFX for a variety of applications

Text Book(s):

1. Chris Roda, Real Time Visual Effects for the Technical Artist, CRC Press, 1st Edition,

2022.
2. Steve Wright, Digital Compositing for film and video, Routledge, 4th Edition, 2017.
3. John Gress, Digital Visual Effects and Compositing, New Riders Press, 1st Edition, 2014.

Reference Books:

1. Jon Gress, "Digital Visual Effects and Compositing", New Riders Press, 1st Edition, 2014.
2. Robin Brinkman, The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics", Morgan Kauffman, 2008.
3. Luiz Velho, Bruno Madeira, "Introduction to Visual Effects A Computational Approach", Routledge, 2023.
4. Jasmine Katatikarn, Michael Tanzillo, "Lighting for Animation: The art of visual storytelling , Routledge, 1st Edition, 2016.
5. Eran Dinur, "The Complete guide to Photorealism, for Visual Effects, Visualization
6. Jeffrey A. Okun, Susan Zwerman, Christopher McKittrick, " The VES Handbook of Visual Effects: Industry Standard VFX Practices and Procedures", Third Edition, 2020.and Games", Routledge, 1st Edition, 2022.
7. https://www.blender.org/features/vfx/
8. https://natrongithub.github.io/

List of Experiments:

Using Natron:

o Understanding Natron Environment:
o Working with color and using color grading
o using Channels
o Merging images
o Using Rotopaint
o performing Tracking and stabilizing
o Transforming elements
o Stereoscopic compositing

Using Blender:

Ø Motion Tracking – camera and object tracking
Ø Camera fx, color grading, vignettes
Ø Compositing images and video files
Ø Multilayer rendering

TOTAL PRACTICAL PERIODS	**30 Periods**
TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1. Stand alone computers	30 nos.

22PCS54	QUANTUM COMPUTING	L	T	P	C
		2	0	2	3

Pre-requisite Python, pandas numpy **Syllabus Version** V 0.1

Course Objectives:

1. To introduce students to the field of quantum computing and its potential applications
2. To provide students with knowledge of quantum information theory and quantum algorithms
3. To teach students about quantum hardware and its limitations
4. To cover quantum software and applications, as well as future directions in quantum computing

Course Content:

UNIT I INTRODUCTION TO QUANTUM COMPUTING 6

Overview of classical computing and its limitations-Introduction to quantum mechanics-Quantum bits (qubits) and quantum gates-Quantum circuits and quantum algorithms-Quantum complexity theory

UNIT II QUANTUM INFORMATION THEORY 6

Introduction to quantum information theory-Quantum entanglement and teleportation-Quantum error correction and fault tolerance-Quantum communication and cryptography-Quantum simulation

UNIT III QUANTUM HARDWARE 6

Introduction to quantum hardware-Superconducting qubits and circuits-Trapped ions and atoms-Topological quantum computing-Quantum annealing.

UNIT IV QUANTUM SOFTWARE AND APPLICATIONS 6

Quantum software tools and languages-Quantum machine learning and optimization-Quantum chemistry and materials science-Quantum finance and cryptography-Quantum artificial intelligence.

UNIT V FUTURE OF QUANTUM COMPUTING 6

Overview of current state of quantum computing technology-Challenges and opportunities for quantum computing-Quantum computing in industry and academia-Quantum computing and society-Future directions in quantum computing research

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the basic concepts of quantum mechanics and their implications for computing
2. Be able to design and implement quantum algorithms for various applications
3. Understand the limitations of quantum hardware and the challenges in building a scalable quantum computer

4. Be able to apply quantum computing principles to solve problems in various domains
5. Be able to critically evaluate the potential impact of quantum computing on society.

Text Book(s):

1. Quantum Computation and Quantum Information: 10th Anniversary Edition by Michael A. Nielsen and Isaac L. Chuang.
2. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci

Reference Books:

1. Quantum Computing: A Gentle Introduction by Eleanor G. Rieffel and Wolfgang H. Polak.
2. Quantum Computing Since Democritus by Scott Aaronson

List of Experiments:

1.	Quantum Teleportation: Students can implement a quantum teleportation experiment using a three-qubit circuit in Qiskit or Cirq. They can prepare an arbitrary qubit state and teleport it to a distant qubit using entanglement and classical communication.	**4**
2.	Quantum Gates: Students can implement different types of quantum gates such as the Hadamard gate, Pauli-X gate, and CNOT gate in Qiskit or Cirq. They can then run the circuits on a quantum simulator or a real quantum computer and observe the resulting quantum state.	**4**
3.	Quantum Error Correction: Students can study quantum error correction and implement simple error-correcting codes such as the bit-flip code or the phase-flip code in Qiskit or Cirq. They can then introduce errors in the qubits and study the effect of error correction on the fidelity of the quantum state.	**4**
4.	Grover's Algorithm: Students can implement Grover's algorithm in Qiskit or Cirq to search an unsorted database of N items with a quadratic speedup compared to classical algorithms. They can test the algorithm on a small database of 4 items and compare the results with the classical search algorithm.	**5**
5.	Shor's Algorithm: Students can implement Shor's algorithm in Qiskit or Cirq to factorize a small number such as 15 or 21 using a quantum computer. They can compare the running time with classical algorithms such as the Number Field Sieve	**4**
6.	Quantum Key Distribution: Students can implement quantum key distribution protocols such as BB84 or E91 in Qiskit or Cirq to distribute a secret key between two parties using entanglement and quantum measurement. They can test the security of the protocol against eavesdropping.	**5**
7.	Quantum Machine Learning: Students can explore the use of quantum computers for machine learning tasks such as classification, clustering, or dimensionality reduction. They can implement simple quantum machine learning algorithms such	**4**

as quantum k-means or quantum principal component analysis in Qiskit or Cirq

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 60 Periods

List of Equipment: (for batch of 30 students)

1. OpenCV computer vision Library for OpenCV in Python / PyCharm or C++ / Visual Studio or or equivalent — 30 nos

22PCS55	3D PRINTING AND DESIGN	L	T	P	C
		2	0	2	3

Pre-requisite Python, pandas numpy **Syllabus Version** V 0.1

Course Objectives:

1. To discuss on basics of 3D printing
2. To explain the principles of 3D printing technique
3. To explain and illustrate inkjet technology
4. To explain and illustrate laser technology
5. To discuss the applications of 3D printing

Course Content:

UNIT I INTRODUCTION 6

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

UNIT II PRINCIPLE 6

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 6

Printer - Working Principle, Positioning System, Print head, Print bed, Frames, Motion control; Printhead Considerations – Continuous Inkjet, Thermal Inkjet, Piezoelectric Drop-On-Demand; Material Formulation for jetting; Liquid based fabrication – Continous jet, Mulitjet; Powder based fabrication

Colourjet.

UNIT IV LASER TECHNOLOGY 6

Light Sources – Types, Characteristics; Optics – Deflection, Modulation; Material feeding and flow Liquid, powder; Printing machines – Types, Working Principle, Build Platform, Print bed Movement, Support structures

UNIT V INTRUSION PREVENTION 6

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

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Outline and examine the basic concepts of 3D printing technology
2. Outline 3D printing workflow`
3. Explain and categorise the concepts and working principles of 3D printing using inkjet

technique

4. Explain and categorise the working principles of 3D printing using laser technique
5. Explain various method for designing and modeling for industrial applications

Text Book(s):

1. Christopher Barnatt, 3D Printing: The Next Industrial Revolution, CreateSpace IndependentPublishing Platform, 2013.
2. Ian M. Hutchings, Graham D. Martin, Inkjet Technology for Digital Fabrication, John Wiley &Sons, 2013

Reference Books:

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

List of Experiments:

1. Study the interface and basic tools in the CAD software. **3**
2. Study 3D printer(s) including print heads, build envelope, materials used and relatedsupport removal system(s). **3**
3. Review of geometry terms of a 3D mesh.. **3**
4. Commands for moving from 2D to 3D **3**
5. Advanced CAD commands to navigate models in 3D space. **4**
6. Design any four everyday objects **4**

   Refer to web sites like Thingiverse, Shapeways and GitFab to design four everyday objectsthat utilize the advantages of 3D printing

   Choose four models from a sharing site like Thingiverse, Shapeways or Gitfab.

   - Improve upon a file and make it your own. Some ideas include: Redesign it with a specific user in mind
   - Redesign it for a slightly different purpose
   - Improve the look of the product
7. Use the CAM software to prepare files for 3D printing. **3**
8. Manipulate machine movement and material layering. **3**
9. Repair a 3D mesh using **4**

   a) Freeware utilities: Autodesk MeshMixer (http://goo.gl/x5nhYc), MeshLab (http://goo.gl/fgztLl) orNetfabb Basic or Cloud Service (http://goo.gl/Q1P47a)

   b) Freeware tool tutorials: Netfabb Basic or Cloud Service (http://goo.gl/Q1P47a), Netfabb andMeshLab (http://goo.gl/WPOVec)

   c) Professional tools: Magics or Netfabb

   Equipment : one 3D printer for every 10-15 students

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 60 Periods

List of Equipment: (for batch of 30 students)

1. Python 3.9 or later, Anaconda Distribution 30 nos
2. Systems with either Netbeans or Eclipse 30 nos

Open Elective List

Course Code	ADVANCED MANUFACTURING TECHNOLOGY	L	T	P	C
22OME02		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To provide students with a comprehensive understanding of advanced manufacturing technology and its applications in industry
2. To equip students with knowledge of the latest trends in manufacturing technology, including additive manufacturing, robotics, automation, and CAD/CAM
3. To develop students' ability to analyze and evaluate manufacturing processes and materials selection for advanced manufacturing
4. To prepare students to become leaders in the field of advanced manufacturing technology

Course Content:

UNIT I INTRODUCTION TO ADVANCED MANUFACTURING TECHNOLOGY **9**

Definition and overview of advanced manufacturing technology-Classification of advanced manufacturing technology-Comparison with traditional manufacturing technology.

UNIT II ADDITIVE MANUFACTURING **9**

Fundamentals of additive manufacturing-Types of additive manufacturing processes-Applications of additive manufacturing-Advantages and limitations of additive manufacturing.

UNIT III ROBOTICS AND AUTOMATION **9**

Overview of robotics and automation-Types of robots-Components of a robot system-Robot programming-Applications of robotics and automation in manufacturing.

UNIT IV COMPUTER-AIDED DESIGN AND MANUFACTURING **9**

Introduction to CAD/CAM systems-CAD/CAM software-Advantages of CAD/CAM-Applications of CAD/CAM in manufacturing.

UNIT V MATERIALS AND MANUFACTURING PROCESSES **9**

Overview of materials science and engineering-Properties of materials-Classification of manufacturing processes-Materials selection for advanced manufacturing

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Students will be able to describe the fundamental principles and key concepts of advanced manufacturing technology.
2. Students will be able to analyze and evaluate manufacturing processes and materials selection for advanced manufacturing.
3. Students will be able to use CAD/CAM software to design and manufacture products.
4. Students will be able to identify the potential applications of robotics and automation

in manufacturing.

5. Students will be able to develop innovative solutions for advanced manufacturing challenges.

Text Book(s):

1. Principles of CAD/CAM/CAE Systems, by Kunwoo Lee
2. Industrial Robotics: Technology, Programming, and Applications, by Mikell P. Groover, Mitchell Weiss, and Roger N. Nagel

Reference Books:

1. Advanced Manufacturing: An ICT and Systems Perspective, by Marco Taisch, Dimitris Kiritsis, and Gunther Reinhart
2. Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, by Ian Gibson, David W. Rosen, and Brent Stucker.

22OCS04	COGNITIVE COMPUTING	L	T	P	C
		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. The objective of this course is to provide students with a comprehensive understanding of the principles and applications of cognitive computing, including artificial intelligence, machine learning, natural language processing, computer vision, and other related technologies.

2. Upon completion of this course, students should be able to design, implement, and evaluate cognitive computing systems for various applications..

Course Content:

UNIT I INTRODUCTION TO COGNITIVE COMPUTING 9

Definition and characteristics of cognitive computing-Cognitive computing systems and architectures-Comparison with traditional computing approaches-Applications of cognitive computing in various domains

UNIT II ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING 9

Fundamentals of artificial intelligence and machine learning-Neural networks and deep learning-Supervised and unsupervised learning techniques-Reinforcement learning.

UNIT III NATURAL LANGUAGE PROCESSING 9

Language models and linguistic processing-Text classification and sentiment analysis-Information extraction and retrieval

Chatbots and conversational interfaces.

UNIT IV COMPUTER VISION AND IMAGE PROCESSING 9

Fundamentals of computer vision and image processing-Object recognition and tracking-Image segmentation and feature extraction-Face recognition and emotion detection.

UNIT V COGNITIVE COMPUTING APPLICATIONS AND TOOLS 9

Case studies and real-world examples of cognitive computing applications-Cognitive computing tools and frameworks (IBM Watson, Google Cloud AI, Microsoft Cognitive Services, etc.)-Ethical considerations and challenges of cognitive computing-Future directions and trends in cognitive computing

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the fundamental concepts and principles of cognitive computing and its various subfields such as artificial intelligence, machine learning, natural language processing, and computer vision.

2. Develop skills in designing, implementing, and evaluating cognitive computing systems for various applications such as chatbots, recommendation systems, and image recognition systems.

3. Learn how to use cognitive computing tools and frameworks such as IBM Watson, Google Cloud AI, and Microsoft Cognitive Services.

4. Gain practical experience in developing cognitive computing applications through hands-on exercises, projects, and case studies.

5. Explore the ethical considerations and challenges associated with cognitive computing and understand how to develop responsible and ethical cognitive computing systems.

Text Book(s):

1. Data Mining: Concepts and Techniques by Jiawei Han, Micheline Kamber, and Jian Pei, Morgan Kaufmann Publishers, 3rd Edition, 2011.

2. Introduction to Data Mining by Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, Pearson, 2nd Edition, 2018

Reference Books:

1. Data Mining for Business Analytics: Concepts, Techniques, and Applications with JMP Pro by Galit Shmueli, Peter C. Bruce, Mia L. Stephens, Nitin R. Patel, and David A. Dickey, Wiley, 3rd Edition, 2020.

2. Practical Machine Learning for Computer Vision by Martin Görner, Ryan Gillard, Valliappa Lakshmanan, and Ryan Gillard, O'Reilly Media, 2020.

Course Code	COMPUTATIONAL FINANCE	L	T	P	C
22OCS05		3	0	0	3

Pre-requisite Basic knowledge on Finance **Syllabus Version** V 0.1

Course Objectives:

1. To provide an understanding of the principles of computational finance and their applications in the financial industry.
2. To introduce students to popular numerical and computational methods used in finance.
3. To develop programming skills for financial analysis and modeling using Python.
4. To provide practical knowledge for solving real-world financial problems using computational finance techniques.

Course Content:

UNIT I FINANCIAL MARKETS AND TIME VALUE OF MONEY 9

Overview of financial markets and financial instruments-Time value of money and its applications-Discounted cash flow analysis-Bond valuation

UNIT II ASSET PRICING AND PORTFOLIO OPTIMIZATION 9

Capital Asset Pricing Model (CAPM)-Arbitrage Pricing Theory (APT)-Markowitz portfolio theory and efficient frontier-Black-Litterman model and portfolio optimization.

UNIT III OPTION PRICING AND RISK MANAGEMENT 9

Basics of options and option pricing models-Black-Scholes-Merton option pricing model-Greeks and sensitivity analysis-Value at Risk (VaR) and Conditional Value at Risk (CVaR).

UNIT IV MONTE CARLO SIMULATIONS AND FINANCIAL DERIVATIVES 9

Monte Carlo simulations and its applications in finance-Pricing and hedging of financial derivatives using Monte Carlo simulations Binomial and trinomial trees for option pricing-Finite difference methods for option pricing.

UNIT V HIGH-FREQUENCY TRADING AND MACHINE LEARNING 9

Overview of high-frequency trading-Machine learning applications in finance-Reinforcement learning in trading-Deep learning in finance

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the fundamentals of financial markets and financial instruments.
2. Develop an understanding of time value of money and its applications in finance.
3. Apply quantitative and computational methods to asset pricing and portfolio optimization problems.
4. Apply computational finance techniques to risk management and option pricing problems.
5. Develop programming skills in Python for financial analysis and modeling.

Text Book(s):

1. Computational Finance: An Introductory Course with R by Argimiro Arratia
2. Options, Futures, and Other Derivatives by John C. Hull

Reference Books:

1. Quantitative Finance: A Simulation-Based Introduction Using Excel by Matt Davison
2. Numerical Methods in Finance and Economics: A MATLAB-Based Introduction by Paolo Brandimarte.

Course Code	COMPUTATIONAL LINGUISTICS	L	T	P	C
22OCS06		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To provide an overview of the field of computational linguistics and its applications
2. To teach fundamental concepts and techniques in natural language processing
3. To introduce machine learning methods and their applications in language processing
4. To cover advanced topics in computational linguistics, including language generation and speech processing

Course Content:

UNIT I INTRODUCTION TO COMPUTATIONAL LINGUISTICS 9

Overview of the field-Basic concepts and terminology-Applications of computational linguistics-Tools and resources for computational linguistics

UNIT II NATURAL LANGUAGE PROCESSING 9

Text pre-processing-Part-of-speech tagging-Parsing and syntax analysis-Named entity recognition-Sentiment analysis

UNIT III MACHINE LEARNING FOR LANGUAGE PROCESSING 9

Supervised and unsupervised learning-Feature selection and extraction-Classification and regression models-Neural networks for language processing.

UNIT IV LANGUAGE GENERATION 9

Text generation using templates-Text generation using probabilistic models-Neural language generation models.

UNIT V ADVANCED TOPICS IN COMPUTATIONAL LINGUISTICS 9

Discourse analysis-Dialogue systems-Machine translation-Speech recognition and synthesis

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the basic concepts and terminology of computational linguistics
2. Be able to perform common natural language processing tasks such as part-of-speech tagging and parsing
3. Be able to apply machine learning techniques to natural language processing tasks
4. Understand advanced topics in computational linguistics such as language generation and speech processing.

Text Book(s):

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition by Daniel Jurafsky and James H. Martin.
2. Foundations of Statistical Natural Language Processing by Christopher Manning and Hinrich Schütze

Reference Books:

1. Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit by Steven Bird, Ewan Klein, and Edward Loper.
2. Handbook of Natural Language Processing edited by Nitin Indurkhya and Fred J. Damerau.

Course Code	COMPUTATIONAL NEUROSCIENCE	L	T	P	C
22OBM07		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To introduce students to the field of computational neuroscience and its applications in neuroscience research
2. To provide students with knowledge of neural data analysis techniques
3. To teach students about neural network models and their applications
4. To cover sensory and motor systems, as well as higher cognitive functions.

Course Content:

UNIT I INTRODUCTION TO COMPUTATIONAL NEUROSCIENCE 9

Overview of the field of computational neuroscience-Basic neuroscience concepts and terminology-The role of computational modeling in neuroscience-Types of neurons and neural circuits-Neural coding and information representation-Overview of neural systems and behavior

UNIT II NEURAL DATA ANALYSIS 9

Techniques for acquiring and analyzing neural data-Time-series analysis-Spectral analysis-Spike train analysis-Machine learning approaches to neural data analysis.

UNIT III NEURAL NETWORK MODELS 9

Introduction to neural network models-Single-neuron models-Population models-Recurrent neural networks-Feedforward neural networks-Deep learning architectures.

UNIT IV SENSORY AND MOTOR SYSTEMS 9

Visual system-Auditory system-Somatosensory system-Motor system-Sensorimotor integration.

UNIT V HIGHER COGNITIVE FUNCTIONS 9

Memory and learning-Decision making and control-Emotion and motivation-Attention and consciousness-Neural correlates of mental disorders

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the basic concepts and terminology in computational neuroscience
2. Be able to analyze neural data using appropriate techniques
3. Be able to design and implement neural network models for various applications
4. Understand the neural mechanisms underlying sensory and motor systems, as well as higher cognitive functions
5. Be able to apply computational neuroscience principles to solve problems in various domains

Text Book(s):

1. Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems by Peter Dayan and L.F. Abbott.
2. An Introduction to Neural Information Processing by James A. Anderson

Reference Books:

1. Principles of Neural Design by Peter Sterling and Simon Laughlin.
2. Handbook of Brain Theory and Neural Networks, Second Edition by Michael A. Arbib.

Course Code	COMPUTER AIDED DESIGN AND MANUFACTURING	L	T	P	C
22OME05		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To provide students with a comprehensive understanding of CAD/CAM systems and their applications.
2. To teach students the principles and techniques of computer-aided design (CAD) and computer-aided manufacturing (CAM).
3. To introduce students to the integration of CAD and CAM and their role in modern manufacturing.
4. To cover advanced topics in CAD/CAM, including rapid prototyping, virtual reality, and Industry 4.0.

Course Content:

UNIT I INTRODUCTION TO CAD/CAM 9

Overview of CAD/CAM-Historical development of CAD/CAM-Basic concepts of CAD/CAM systems-Types of CAD/CAM systems-Applications of CAD/CAM in different fields.

UNIT II COMPUTER AIDED DESIGN 9

Introduction to computer-aided design (CAD)-CAD system architecture and components-CAD file formats and data exchange-2D and 3D modeling techniques-Parametric and feature-based modeling.

UNIT III COMPUTER AIDED MANUFACTURING 9

Introduction to computer-aided manufacturing (CAM)-CAM system architecture and components-CAM file formats and data exchange-Tool path generation and simulation-CNC machining and other CAM processes.

UNIT IV INTEGRATION OF CAD AND CAM 9

CAD/CAM integration and interoperability-Design for manufacturability and assembly (DFMA)-CAM-driven design and reverse engineering-Collaborative design and manufacturing.

UNIT V ADVANCED TOPICS IN CAD/CAM 9

Rapid prototyping and 3D printing-Virtual reality and augmented reality in CAD/CAM-Cloud-based CAD/CAM and mobile apps-Industry 4.0 and smart manufacturing-Future trends and challenges in CAD/CAM

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the basic concepts and principles of CAD/CAM.
2. Be able to use CAD software to create 2D and 3D models.
3. Be able to use CAM software to generate tool paths and simulate machining processes.
4. Understand the integration of CAD and CAM and their role in modern manufacturing.

5. Be able to critically evaluate advanced topics in CAD/CAM and their potential impact on manufacturing.

Text Book(s):

1. CAD/CAM: Principles and Applications by P.N. Rao.
2. Computer-Aided Manufacturing by Tien-Chien Chang and Richard A. Wysk

Reference Books:

1. Computer-Aided Design and Manufacturing by M. Groover and E. Zimmers.
2. CAD/CAM: Concepts and Applications by Alavala Chennakesava Reddy and Sreekanth Mallampalli.

Course Code	COMPUTER FORENSICS AND INCIDENT RESPONSE	L	T	P	C
22OCS07		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To introduce students to the field of computer forensics and incident response
2. To provide students with knowledge of digital evidence collection, preservation, and analysis
3. To teach students techniques for network forensics and malware analysis
4. To cover advanced topics in computer forensics and incident response, including cloud forensics and mobile device forensics.

Course Content:

UNIT I INTRODUCTION TO COMPUTER FORENSICS AND INCIDENT RESPONSE **9**

Overview of the field-Legal and ethical considerations-Incident response process-Forensic tools and techniques.

UNIT II DIGITAL EVIDENCE COLLECTION AND PRESERVATION **9**

Types of digital evidence-Evidence collection and documentation-Chain of custody-Tools and techniques for evidence preservation.

UNIT III DATA RECOVERY AND ANALYSIS **9**

Data recovery techniques-File system analysis-Registry analysis-Timeline analysis.

UNIT IV NETWORK FORENSICS AND MALWARE ANALYSIS **9**

Network traffic analysis-Malware analysis techniques-Memory analysis-Reverse engineering.

UNIT V ADVANCED TOPICS IN COMPUTER FORENSICS AND INCIDENT RESPONSE **9**

Cloud forensics-Mobile device forensics-Incident response team management-Emerging trends and challenges

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the legal and ethical considerations of computer forensics and incident response
2. Be able to collect and preserve digital evidence
3. Be able to analyze digital evidence using appropriate tools and techniques
4. Understand network forensics and malware analysis techniques
5. Be familiar with advanced topics in computer forensics and incident response.

Text Book(s):

1. Computer Forensics and Incident Response: Fundamentals by EC-Council.
2. Incident Response and Computer Forensics, Third Edition by Jason Luttgens, Matthew Pepe, and Kevin Mandia.

Reference Books:

1. Digital Forensics with Open Source Tools by Cory Altheide and Harlan Carvey.
2. Malware Analyst's Cookbook and DVD: Tools and Techniques for Fighting Malicious Code by Michael Ligh, Steven Adair, Blake Hartstein, and Matthew Richard.

Course Code	COMPUTER GRAPHICS AND MULTIMEDIA	L	T	P	C
22OCS08		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To introduce students to the field of computer graphics and multimedia
2. To provide students with knowledge of graphics programming using OpenGL
3. To teach students about multimedia and hypermedia systems
4. To cover advanced topics in computer graphics and multimedia, including virtual reality and augmented reality.

Course Content:

UNIT I INTRODUCTION TO COMPUTER GRAPHICS 9

Overview of the field of computer graphics-Graphics hardware and software-2D and 3D graphics-Geometric transformations and viewing-Graphics primitives and coordinate systems-Graphics pipeline and rendering techniques-Introduction to shading and lighting

UNIT II GRAPHICS PROGRAMMING 9

Graphics programming using OpenGL-Creating 2D and 3D graphics using OpenGL-Color and lighting in OpenGL-Texture mapping-Creating animations and simulations using OpenGL.

UNIT III MULTIMEDIA AND HYPERMEDIA 9

Multimedia systems architecture-Digital audio and video formats-Interactive multimedia authoring-Introduction to multimedia networking-Hypermedia and hypertext-Multimedia storage and retrieval-Compression techniques for multimedia

UNIT IV VIRTUAL REALITY AND AUGMENTED REALITY 9

Virtual reality systems and technologies-Augmented reality systems and technologies-Human perception and cognition in VR/AR-VR/AR hardware and software-Applications of VR/AR in various domains.

UNIT V ADVANCED TOPICS IN COMPUTER GRAPHICS AND MULTIMEDIA 9

3D modeling and rendering techniques-Image processing and computer vision-Computer animation and visual effects-Emerging trends and challenges in computer graphics and multimedia

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the fundamentals of computer graphics and multimedia systems
2. Be able to program graphics using OpenGL
3. Be able to create multimedia applications and interactive hypermedia systems
4. Understand advanced topics in computer graphics and multimedia, including virtual reality and augmented reality
5. Be able to apply computer graphics and multimedia principles to solve problems in

various domains.

Text Book(s):

1. Computer Graphics with OpenGL by Donald Hearn and M. Pauline Baker.
2. Multimedia: Making It Work, Ninth Edition by Tay Vaughan.

Reference Books:

1. Computer Graphics: Principles and Practice, Third Edition by James D. Foley, Andries van Dam, Steven K. Feiner, and John F. Hughes.
2. Computer Vision: Algorithms and Applications by Richard Szeliski.

Course Code	CYBER CRIME AND DIGITAL FORENSICS	L	T	P	C
22OCS10		3	0	0	3

Pre-requisite Computer Networking **Syllabus Version** V 0.1

Course Objectives:

1. To provide students with an understanding of the concepts and techniques of cybercrime investigation and digital forensics.
2. To equip students with the knowledge and skills necessary to investigate and analyze digital evidence.
3. To develop the students' understanding of the legal and ethical issues surrounding cybercrime investigation and digital forensics.
4. To provide students with an insight into the future trends and emerging technologies in the field of cybercrime and digital forensics.

Course Content:

UNIT I INTRODUCTION TO CYBER CRIME AND DIGITAL FORENSICS 9

Overview of cybercrime and digital forensics-Types of cybercrime-Incident response process-Digital forensics tools and techniques.

UNIT II INVESTIGATING CYBER CRIMES 9

Investigating network intrusions and attacks-Investigating cyber espionage and cyber terrorism-Investigating financial cybercrime-Investigating online fraud and scams.

UNIT III DIGITAL FORENSICS ANALYSIS 9

Digital evidence and forensic analysis-Disk imaging and analysis-File system analysis-Network forensics analysis.

UNIT IV LEGAL AND ETHICAL ISSUES 9

Legal aspects of cybercrime and digital forensics-Digital evidence admissibility-Ethics in digital forensics-Chain of custody and-preservation of digital evidence.

UNIT V CASE STUDIES AND FUTURE TRENDS 9

Case studies of cybercrime investigations and digital forensics-Emerging trends in cybercrime and digital forensics-Digital forensics in the cloud and mobile environment-Cybercrime prevention and future challenges

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Ability to identify different types of cybercrime and understand the incident response process.
2. Ability to investigate and analyze digital evidence using various digital forensic tools and techniques.
3. Understanding of legal and ethical issues surrounding cybercrime investigation and digital forensics.
4. Knowledge of emerging trends and future challenges in the field of cybercrime and

digital forensics.

5. Ability to work effectively in teams and communicate findings to technical and non-technical audiences.

Text Book(s):

1. Computer Forensics and Cyber Crime: An Introduction, 3rd Edition by Marjie T. Britz
2. Digital Forensics and Cyber Crime: An Introduction, 4th Edition by Ian Walden

Reference Books:

1. Cybercrime and Digital Forensics: An Introduction, 2nd Edition by Thomas J. Holt
2. Investigating Cyber Crime: A Complete Guide for Beginners by Andrew Jones.

Course Code	CYBER DEFENSE AND INFORMATION ASSURANCE	L	T	P	C
22OCS11		3	0	0	3

Pre-requisite Computer networking **Syllabus Version** V 0.1

Course Objectives:

1. Understand fundamental principles of cybersecurity and the importance of securing information systems.
2. Acquire knowledge of cryptographic techniques and methods for data protection.
3. Develop skills in risk management, incident response planning, and security operations.
4. Gain knowledge of security technologies and tools for securing information systems.

Course Content:

UNIT I CYBERSECURITY FUNDAMENTALS 9

Cybersecurity overview and principles-Security threats and vulnerabilities-Access control and authentication Network security.

UNIT II CRYPTOGRAPHY AND DATA PROTECTION 9

Cryptography basics-Symmetric and asymmetric encryption-Digital signatures and certificates-Key management.

UNIT III CYBERSECURITY RISK MANAGEMENT 9

Risk management concepts-Threat modeling-Vulnerability assessment and penetration testing-Incident response planning.

UNIT IV SECURITY OPERATIONS AND MAINTENANCE 9

Security monitoring and analysis-Security policies and procedures-Security awareness and training-Security testing and evaluation.

UNIT V CYBERSECURITY TECHNOLOGIES 9

Firewalls, intrusion detection/prevention systems-Virtual private networks (VPNs)-Malware analysis and defense Cloud security

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Ability to identify cybersecurity threats and vulnerabilities and implement appropriate security controls.
2. Ability to develop and implement security policies and procedures.
3. Ability to design and implement secure information systems.
4. Ability to perform risk assessments and develop incident response plans.
5. Ability to use security technologies and tools effectively.

Text Book(s):

1. "Introduction to Computer Security" by Michael T. Goodrich and Roberto Tamassia
2. "Computer Security: Principles and Practice" by William Stallings and Lawrie Brown

Reference Books:

1. "Applied Cybersecurity and Threat Intelligence" by Eric Cole
2. "Cybersecurity and Cyberwar: What Everyone Needs to Know" by P.W. Singer and Allan Friedman.

22OCS12	CYBER-PHYSICAL SYSTEMS	L	T	P	C
		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To provide students with a comprehensive understanding of cyber-physical systems and their applications in various domains.
2. To develop students' skills in designing and implementing cyber-physical systems using real-time embedded systems, control theory, and cybersecurity.
3. To expose students to current research and emerging trends in cyber-physical systems.
4. To promote ethical and responsible practices in the design and implementation of cyber-physical systems.

Course Content:

UNIT I INTRODUCTION TO CYBER-PHYSICAL SYSTEMS 9

Definition and characteristics of cyber-physical systems-Components and architecture of cyber-physical systems-Key applications of cyber-physical systems in various domains-Challenges and opportunities in cyber-physical systems.

UNIT II REAL-TIME EMBEDDED SYSTEMS 9

Fundamentals of real-time embedded systems-Hardware and software components of real-time embedded systems-Real-time operating systems and scheduling algorithms-Programming languages and tools for real-time embedded systems.

UNIT III CYBERSECURITY FOR CYBER-PHYSICAL SYSTEMS 9

Threats and vulnerabilities of cyber-physical systems-Security requirements and challenges for cyber-physical systems-Security mechanisms and protocols for cyber-physical systems-Risk management and assessment for cyber-physical systems.

UNIT IV CONTROL THEORY AND CYBER-PHYSICAL SYSTEMS 9

Introduction to control theory-Modeling and simulation of cyber-physical systems-Feedback control and optimal control for cyber-physical systems-Stability and performance analysis of cyber-physical systems.

UNIT V APPLICATIONS OF CYBER-PHYSICAL SYSTEMS 9

Case studies and real-world examples of cyber-physical systems-Cyber-physical systems for smart cities, transportation, healthcare, and other domains-Emerging trends and future directions in cyber-physical systems-Ethical considerations and societal impact of cyber-physical systems

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the fundamental concepts and principles of cyber-physical systems and their components.
2. Develop skills in designing and implementing real-time embedded systems for cyber-physical systems.
3. Gain knowledge of cybersecurity threats, vulnerabilities, and mitigation techniques for cyber-physical systems.
4. Learn the principles of control theory and their applications in modeling and analyzing cyber-physical systems.
5. Develop ethical and responsible practices in the design and implementation of cyber-physical systems.

Text Book(s):

1. Real-Time Embedded Systems: Optimization, Synthesis, and Networking by Albert M.K. Cheng, Springer, 2016.
2. Cybersecurity for Industrial Control Systems: SCADA, DCS, PLC, HMI, and SIS by Tyson Macaulay and Bryan Singer, CRC Press, 2012.

Reference Books:

1. Cyber-Physical Systems: From Theory to Practice edited by Danda B. Rawat, Joel J.P.C. Rodrigues, and Ivan Stojmenovic, CRC Press, 2015.
2. Cyber-Physical Systems: A Computational Perspective edited by Tapio Heikkilä, Wenbing Zhao, and Song Han, CRC Press, 2018

Course Code	DIGITAL SIGNAL PROCESSING	L	T	P	C
22OEC04		3	0	0	3

Pre-requisite Linear Algebra, signals and Systems **Syllabus Version** V 0.1

Course Objectives:

1. To learn discrete fourier transform, properties of DFT and its application to linear filtering
2. To understand the characteristics of digital filters, design digital IIR and FIR filters and apply these filters to filter undesirable signals in various frequency bands
3. To understand the effects of finite precision representation on digital filters
4. To understand the fundamental concepts of multi rate signal processing and its applications
5. To introduce the concepts of adaptive filters and its application to communication engineering

Course Content:

UNIT I DISCRETE FOURIER TRANSFORM 9

Sampling Theorem, concept of frequency in discrete-time signals, summary of analysis & synthesis equations for FT & DTFT, frequency domain sampling, Discrete Fourier transform (DFT) - deriving DFT from DTFT, properties of DFT - periodicity, symmetry, circular convolution. Linear filtering using DFT. Filtering long data sequences - overlap save and overlap add method. Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT). Linear filtering using FFT.

UNIT II INFINITE IMPULSE RESPONSE FILTERS 9

Characteristics of practical frequency selective filters. characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.

UNIT III FINITE IMPULSE RESPONSE FILTERS 9

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations

UNIT IV FINITE WORD LENGTH EFFECTS 9

Fixed point and floating-point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

UNIT V DSP APPLICATIONS **9**

Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor – Adaptive Filters: Introduction, Applications of adaptive filtering to equalization-DSP Architecture, Fixed and Floating-point architecture principles

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Apply DFT for the analysis of digital signals and systems
2. Design IIR and FIR filters
3. Characterize the effects of finite precision representation on digital filters
4. Design multirate filters
5. Apply adaptive filters appropriately in communication systems

Text Book(s):

1. John G. Proakis and Dimitris G.Manolakis, Digital Signal Processing – Principles, Algorithms and Applications, Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. A. V. Oppenheim, R.W. Schafer and J.R. Buck, —Discrete-Time Signal Processing", 8th Indian Reprint, Pearson, 2004.

Reference Books:

1. Emmanuel C. Ifeachor& Barrie. W. Jervis, "Digital Signal Processing", Second Edition, Pearson Education / Prentice Hall, 2002.
2. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata Mc Graw Hill, 2007.
3. Andreas Antoniou, "Digital Signal Processing", Tata Mc Graw Hill, 2006.

Course Code	ENERGY CONVERSION AND MANAGEMENT	L	T	P	C
22OAG05		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To provide a comprehensive understanding of energy conversion technologies and their environmental impacts
2. To develop knowledge of energy efficiency measures and their implementation in buildings, transportation, and industry
3. To introduce renewable energy sources and their conversion technologies
4. To provide an overview of energy management strategies and tools.

Course Content:

UNIT I INTRODUCTION **9**

Overview of energy and its importance-Types of energy sources-Energy conversion technologies-Environmental impacts of energy use.

UNIT II ENERGY EFFICIENCY **9**

Definition and importance of energy efficiency-Energy efficiency measures in buildings, transportation, and industry-Barriers to energy efficiency-Policies and programs to promote energy efficiency

UNIT III FOSSIL FUEL-BASED ENERGY CONVERSION **9**

Fossil fuel-based energy conversion technologies (combustion, gasification, liquefaction)-Thermal power plants and their components-Energy efficiency and emissions control in fossil fuel-based energy conversion.

UNIT IV RENEWABLE ENERGY CONVERSION **9**

Overview of renewable energy sources (solar, wind, hydro, geothermal, biomass)-Renewable energy conversion technologies-Energy storage and grid integration for renewable energy-Environmental and social impacts of renewable energy.

UNIT V ENERGY MANAGEMENT **9**

Energy management systems and tools-Energy audits and benchmarking-Energy management strategies for buildings, transportation, and industry-Case studies of successful energy management

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the different types of energy sources and their conversion technologies
2. Apply energy efficiency measures in various sectors
3. Evaluate the potential of renewable energy sources for electricity and heat generation
4. Implement energy management strategies in buildings, transportation, and industry
5. Assess the environmental and social impacts of energy conversion and management practices.

Text Book(s):

1. "Energy Management Handbook" by Wayne Turner, Steve Doty and Wayne C. Turner
2. "Renewable Energy Systems: A Smart Energy Systems Approach to the Choice and Modeling of 100% Renewable Solutions" by Henrik Lund

Reference Books:

1. "Energy Conversion" by Kenneth C. Weston and Sarma Mulukutla
2. "Energy and the Environment" by Robert A. Ristinen and Jack P. Kraushaar.

Course Code	FOOD PROCESSING AND PRESERVATION	L	T	P	C
22OBT02		3	0	0	3

Pre-requisite - **Syllabus Version** V 0.1

Course Objectives:

1. Apply the principles and methods involved in the processing of different foods and discuss the processing of cereals and pulses.
2. Compare various millet processing techniques.
3. Discuss pulse processing and preservation techniques.
4. Identify oil seed processing and preservation.
5. Explain spice processing and preservation techniques.

Course Content:

UNIT I PROCESSING THE FOOD **9**

Primary, secondary and tertiary processing, historical perspective, traditional technologies used in food processing. Effects of processing on components, properties and nutritional value of foods.

UNIT II CEREALS AND PULSES **9**

Milling of wheat - extraction of flour, refined wheat flour and pasta products Milling of rice – parboiled rice, rice based instant food Processing of corn, barley and millets – pearling, flaking and puffing, corn starch products, Malting-Pulses – Red gram, Bengal gram, black gram, green gram, soy-based products, Decortication and dhal milling, elimination of toxic factors, fermentation and germination

UNIT III MILK AND MILK PRODUCTS **9**

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations

UNIT IV FRUITS AND VEGETABLES **9**

Harvesting, physiological and bio chemical changes during ripening, handling and storage, general methods of processing – extraction and pulping, raw material and product specifications and standards.

UNIT V MEAT, POULTRY, FISH AND EGG **9**

Ageing and tenderizing, curing, smoking and freezing of meat, fresh storage of meat. Meat based products: sausages, salami, bacon. Fish: Dry fish - Tuna Fish Canning - Fish processing and storage, pickling. Egg: storage, frozen egg, dehydrated egg powder.

TOTAL LECTURE PERIODS **45 Periods**

Expected Course Outcome: On completion of the course, the student is expected to

1. Understanding of the various principles and methods used in the processing of cereals and pulses, including cleaning, milling, soaking, and cooking.
2. Knowledge of the different millet processing techniques, including dehulling, milling, and polishing, and their respective advantages and disadvantages.
3. Understanding of the various pulse processing and preservation techniques, including soaking, cooking, canning, and freezing, and their effects on the nutritional value of the pulses.
4. Knowledge of the various oilseed processing and preservation techniques, including extraction, refining, and packaging, and their importance in ensuring the quality and safety of the oil.
5. Understanding of the various spice processing and preservation techniques, including drying, grinding, and packaging, and their effects on the flavor and aroma of the spices.

Text Book(s):

1. Desrosier N W and Desrosier J N (1987) The Technology of Food Preservation, 4thEdition, CBS, New Delhi.
2. Fellows P J (2000) Food Processing Technology: Principles and Practice 2nd edition CRC Woodhead Publishing Ltd., Cambridge.

Reference Books:

1. KhetarpaulNeelam (2005) Food Processing and Preservation, Daya Publications, New Delhi.
2. Salunke D K and Kadam S (1995) Hand book of Food Science and Technology - production, composition, storage and processing, Marcel Dekker INC, New York.

Course Code	GAME DESIGN AND DEVELOPMENT	L	T	P	C
22OCS16		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

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

Course Content:

UNIT I 3D GRAPHICS FOR GAME DESIGN 9

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation – Controller Based Animation.

UNIT II GAME DESIGN PRINCIPLES 9

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.

UNIT III GAME ENGINE DESIGN 9

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Pathfinding.

UNIT IV OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS 9

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

UNIT V GAME DEVELOPMENT USING PYGAME 9

Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based arcade Games– Puzzle Games

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Explain the concepts of 2D and 3d Graphics
2. Design game design documents.
3. Implementation of gaming engines.
4 Survey gaming environments and frameworks.
5. Implement a simple game in Pygame.

Text Book(s):

1. Sanjay Madhav, “Game Programming Algorithms and Techniques: A Platform AgnosticApproach”, Addison Wesley,2013.
2. Will McGugan, “Beginning Game Development with Python and Pygame: From Novice toProfessional”, Apress,2007

Reference Books:

1. Paul Craven, “Python Arcade games”, Apress Publishers,2016.
2. David H. Eberly, “3D Game Engine Design: A Practical Approach to Real-Time ComputerGraphics”, Second Edition, CRC Press,2006.
3. Jung Hyun Han, “3D Graphics for Game Programming”, Chapman and Hall/CRC, 2011

Course Code	HIGH-PERFORMANCE COMPUTING	L	T	P	C
22OCS17		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To introduce students to parallel computing and high-performance computing architectures
2. To provide students with a comprehensive understanding of parallel programming techniques and programming models for high-performance computing
3. To enable students to write and optimize high-performance computing applications using MPI and OpenMP
4. To familiarize students with real-world applications of high-performance computing in various domains.

Course Content:

UNIT I INTRODUCTION TO HIGH-PERFORMANCE COMPUTING 9

Introduction to parallelism and distributed systems-Classification of parallel computers-High-performance computing architectures-Programming models for high-performance computing.

UNIT II PARALLEL PROGRAMMING TECHNIQUES 9

Parallel algorithms and data structures-Synchronization and communication techniques-Performance tuning and optimization.

UNIT III MESSAGE PASSING INTERFACE (MPI) 9

MPI concepts and programming model-MPI communication functions and topologies-MPI collective operations-Advanced MPI concepts and features.

UNIT IV OPENMP PROGRAMMING 9

OpenMP architecture and programming model-OpenMP memory model and synchronization-OpenMP work-sharing constructs and scheduling-Performance tuning and optimization with OpenMP.

UNIT V HIGH-PERFORMANCE COMPUTING APPLICATIONS 9

Scientific and engineering applications of high-performance computing-Parallel and distributed computing in data science and machine learning-Case studies of high-performance computing in industry and research

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Students will be able to design and implement parallel algorithms and data structures for high-performance computing
2. Students will be able to write and optimize high-performance computing applications using MPI and OpenMP
3. Students will gain hands-on experience with high-performance computing systems

and tools

4. Students will be able to analyze and evaluate the performance of high-performance computing applications
5. Students will be able to apply high-performance computing techniques to solve real-world problems in science, engineering, and other domains

Text Book(s):

1. "High Performance Computing", Charles Severance and Kevin Dowd, O'Reilly Media, Inc., 2018.

Reference Books:

1. "Parallel Programming in C with MPI and OpenMP", Michael J. Quinn, McGraw-Hill Education, 2018.

Course Code	HUMAN-COMPUTER INTERACTION	L	T	P	C
22OCS18		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To introduce students to the field of human-computer interaction
2. To provide students with knowledge of user research and usability testing techniques
3. To teach students how to design interactive systems using user-centered design principles
4. To cover advanced topics in HCI, including social computing, augmented and virtual reality, and ethics and privacy.

Course Content:

UNIT I INTRODUCTION TO HUMAN-COMPUTER INTERACTION 9

Overview of the field-Historical development of HCI-Design principles and guidelines-User-centered design.

UNIT II USER RESEARCH AND USABILITY TESTING 9

User research methods-Usability testing techniques-Metrics for evaluating usability-Accessibility considerations.

UNIT III DESIGNING INTERACTIVE SYSTEMS 9

Designing for different platforms-Interaction design principles-Information architecture-Prototyping and iterative design.

UNIT IV HUMAN FACTORS AND ERGONOMICS 9

Cognitive processes and perception-Attention and memory-Task analysis and modeling-Anthropometry and physical ergonomics.

UNIT V ADVANCED TOPICS IN HCI 9

Social computing-Augmented and virtual reality-Natural user interfaces-Ethics and privacy in HCI

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the history and principles of human-computer interaction
2. Be able to conduct user research and usability testing
3. Be able to design interactive systems using user-centered design principles
4. Understand advanced topics in HCI and their implications for design and ethics
5. Apply HCI principles to the design of interactive systems in various contexts

Text Book(s):

1. The Design of Everyday Things by Don Norman.

2. About Face 3: The Essentials of Interaction Design by Alan Cooper, Robert Reimann, and David Cronin

Reference Books:

1. Human-Computer Interaction: An Empirical Research Perspective by I. Scott MacKenzie and Philip Kortum.
2. Handbook of Usability Testing: How to Plan, Design, and Conduct Effective Tests by Jeffrey Rubin and Dana Chisnell

Course Code	INFORMATION RETRIEVAL	L	T	P	C
22OCS19		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. Learn the information retrieval models.
2. Be familiar with Web Search Engine.
3. Be exposed to Link Analysis.
4. Understand Hadoop and Map Reduce.
5. Learn document text mining techniques

Course Content:

UNIT I INTRODUCTION 9

Introduction -History of IR- Components of IR - Issues –Open source Search engine Frameworks - The impact of the web on IR - The role of artificial intelligence (AI) in IR – IR Versus Web Search - Components of a Search engine- Characterizing the web.

UNIT II INFORMATION RETRIEVAL 9

Boolean and vector-space retrieval models- Term weighting - TF-IDF weighting- cosine similarity – Preprocessing - Inverted indices - efficient processing with sparse vectors – Language Model based IR - Probabilistic IR –Latent Semantic Indexing - Relevance feedback and query expansion

UNIT III WEB SEARCH ENGINE – INTRODUCTION AND CRAWLING 9

Web search overview, web structure, the user, paid placement, search engine optimization/ spam. Web size measurement - search engine optimization/spam – Web Search Architectures - crawling - meta-crawlers- Focused Crawling - web indexes –- Near-duplicate detection - Index Compression - XML retrieval.

UNIT IV WEB SEARCH – LINK ANALYSIS AND SPECIALIZED SEARCH 9

Link Analysis –hubs and authorities – Page Rank and HITS algorithms -Searching and Ranking – Relevance Scoring and ranking for Web – Similarity - Hadoop & Map Reduce - Evaluation - Personalized search - Collaborative filtering and content-based recommendation of documents and products – handling “invisible” Web - Snippet generation, Summarization, Question Answering, Cross- Lingual Retrieval..

UNIT V DOCUMENT TEXT MINING 9

Information filtering; organization and relevance feedback – Text Mining -Text classification and clustering - Categorization algorithms: naive Bayes; decision trees; and nearest neighbor - Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM).

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Apply information retrieval models.

2. Design Web Search Engine.
3. Use Link Analysis.
4. Use Hadoop and Map Reduce.
5. Apply document text mining techniques.

Text Book(s):

1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval , Cambridge University Press, 2008.
2. Ricardo Baeza -Yates and Berthier Ribeiro - Neto, Modern Information Retrieval: The Concepts and Technology behind Search 2nd Edition, ACM Press Books 2011.
3. Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, 1st Edition Addison Wesley, 2009.
4. Mark Levene, An Introduction to Search Engines and Web Navigation, 2nd Edition Wiley, 2010.

Reference Books:

1. Stefan Buettcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.
2. Ophir Frieder “Information Retrieval: Algorithms and Heuristics: The Information Retrieval Series “, 2nd Edition, Springer, 2004.

Course Code	INFORMATION SECURITY MANAGEMENT	L	T	P	C
22OCS20		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. Understand the fundamental concepts and principles of Information Security Management.
2. Develop skills to assess risks, design and implement Information Security Management System.
3. Understand the legal, regulatory and ethical issues related to Information Security.
4. Gain awareness of emerging trends and technologies in the field of Information Security Management.

Course Content:

UNIT I INTRODUCTION TO INFORMATION SECURITY MANAGEMENT 9

Definition of Information Security Management-Overview of Information Security Management System (ISMS)-Principles of Information Security.

UNIT II RISK MANAGEMENT AND CONTROL 9

Risk Management Concepts and Methodologies-Threats and Vulnerabilities-Risk Assessment and Treatment-Control Implementation and Monitoring.

UNIT III IMPLEMENTATION OF ISMS 9

ISMS Planning and Implementation-Management Responsibility-Resource Management-Operation Management.

UNIT IV COMPLIANCE AND AUDIT 9

Laws and Regulations related to Information Security-Compliance Management-Audit Planning and Conducting-Corrective Actions and Continuous Improvement

UNIT V EMERGING TRENDS AND TECHNOLOGIES 9

Emerging Trends in Information Security-Emerging Technologies and Information Security-Privacy and Data Protection

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Develop a comprehensive understanding of Information Security Management principles, concepts and methodologies.
2. Demonstrate ability to identify and assess risks and design and implement appropriate controls to mitigate them.
3. Develop an understanding of legal, regulatory and ethical issues related to Information Security and demonstrate ability to comply with the applicable laws and regulations.
4. Gain awareness of emerging trends and technologies in the field of Information Security Management and their implications for organizations.

5. Demonstrate ability to apply Information Security Management principles in practical scenarios.

Text Book(s):

1. Information Security Management: Concepts and Practice by Bel G. Raggad and Ravi S. Sharma.
2. Managing Risk and Information Security: Protect to Enable by Malcolm W. Harkins

Reference Books:

1. Information Security Management Principles, Second edition by David Alexander, Amanda Finch, and David Sutton.
2. CISSP (ISC)2 Certified Information Systems Security Professional Official Study Guide, Eighth Edition by Mike Chapple, James Michael Stewart, and Darril Gibson.

Course Code	INTELLIGENT TRANSPORTATION SYSTEMS	L	T	P	C
22OCS21		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To provide students with an understanding of the challenges and opportunities in transportation systems.
2. To teach students about the principles and components of ITS.
3. To cover specific applications of ITS, including traffic management and control systems, vehicle technologies and communication systems, and transportation planning and optimization.
4. To introduce students to emerging trends and future directions in ITS.

Course Content:

UNIT I INTRODUCTION TO INTELLIGENT TRANSPORTATION SYSTEMS 9

Overview of transportation systems and their challenges-Introduction to Intelligent Transportation Systems (ITS)-ITS architectures and components-ITS applications and services-ITS standards and regulations.

UNIT II TRAFFIC MANAGEMENT AND CONTROL SYSTEMS 9

Introduction to traffic management and control systems-Traffic flow modeling and prediction-Traffic signal control systems-Incident management systems-Adaptive traffic control systems.

UNIT III VEHICLE TECHNOLOGIES AND COMMUNICATION SYSTEMS 9

Introduction to vehicle technologies and communication systems-Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication Connected and autonomous vehicles (CAVs)-Advanced driver assistance systems (ADAS)-Intelligent transportation sensors and data collection.

UNIT IV TRANSPORTATION PLANNING AND OPTIMIZATION 9

Introduction to transportation planning and optimization-Traffic demand forecasting-Route planning and optimization-Transit planning and optimization-Freight transportation planning and optimization.

UNIT V EMERGING TRENDS AND FUTURE DIRECTIONS 9

Overview of emerging trends and future directions in ITS-Big data analytics and machine learning in ITS-Cybersecurity and privacy in ITS-Sustainability and social impact of ITS-Future research directions in ITS

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the principles and components of Intelligent Transportation Systems.
2. Be able to design and implement ITS applications and services.
3. Understand the challenges and limitations of ITS technologies.

4. Be able to analyze and evaluate transportation systems using ITS tools and techniques.
5. Be able to critically evaluate the potential impact of ITS on society.

Text Book(s):

1. Intelligent Transportation Systems: Smart and Green Infrastructure Design, Second Edition by Sumit Ghosh and Tony S. Lee.
2. Intelligent Transport Systems: Technologies and Applications by Asier Perallos and Alexander H. Vo

Reference Books:

1. Introduction to Intelligent Transportation Systems by Francesco Viti and Matteo Sacco.
2. Handbook of Intelligent Transport Systems by K. Ganesh and David Boyce.

Course Code	IRRIGATION AND DRAINAGE ENGINEERING	L	T	P	C
22OAG12		3	0	0	3

Pre-requisite - **Syllabus Version** V 0.1

Course Objectives:

1. Inculcate water resources development and various parameters required for irrigation scheduling and its Requirement
2. Understand different kinds of irrigation system and choose appropriate system for a given environment.
3. Introduce different types of water control and diversion structures for planning the irrigation system.
4. Understand canal, tank irrigation and command area development.
5. Understand the basic concepts for planning, design and management of land drainage works in field areas

Course Content:

UNIT I WATER RESOURCES AND IRRIGATION REQUIREMENT 9

Water Resources- River basins-Development and Utilization in India and Tamil Nadu-Irrigation – duty and delta - Rooting characteristics - Moisture use of crop, Evapotranspiration - ET plot - Crop water requirement - Effective rainfall - Scheduling - Irrigation requirement - Irrigation frequency, Irrigation efficiencies.

UNIT II METHODS OF IRRIGATION 9

Methods of Irrigation – Surface and Subsurface methods – Drip and Sprinkler - Hydraulics and design - Erodible and non-erodible, Kennedy‟s and Lacey‟s theories, Materials for lining water courses and field channel, Water control and diversion structure - Underground pipeline irrigation system.

UNIT III DIVERSION AND IMPOUNDING STRUCTURES 9

Head works –Weirs and Barrage –Types of impounding structures - Factors affecting, location of dams -Forces on a dam -Design of Gravity dams- Earth dams, Arch dams – Spillways -Energy dissipaters.

UNIT IV CANAL IRRIGATION AND COMMAND AREA DEVELOPMENT 9

Classification of canals- Alignment of canals – Design of irrigation canals– Regime theories - Canal Head works – Canal regulators - Canal drops – Cross drainage works – Canal Outlet, Escapes –Lining and maintenance of canals - Excess irrigation and waterlogging problem - Command area - Concept, Components of CADP - On Farm Development works, Farmer‟s committee - its role for water distribution and system operation - rotational irrigation system.

UNIT V AGRICULTURAL DRAINAGE 9

Agricultural drainage - Drainage coefficient; principles of flow through soils, Darcy‟s law – infiltration theory, Surface drainage systems - Subsurface drainage - Design of subsurface drainage - Pipe materials - mole drains, drainage wells, Leaching requirements - irrigation and drainage water quality - recycling of drainage water for irrigation.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. The students will have knowledge and skills on Planning, design, operation and management of Water Resources and Irrigation Requirement.
2. The student will gain knowledge on different methods of irrigation including canal irrigation.
3. Obtain knowledge on different types Diversion and Impounding Structures
4. Understand the concept Canal Irrigation and Command Area Development
5. Understand the concept recycling of drainage water for irrigation.

Text Book(s):

1. Dilip Kumar Majumdar., "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2008.
2. Michael, A.M., "Irrigation Engineering", Vikas Publishers, New Delhi, 2008.
3. Garg, S.K., "Irrigation Engineering," Laxmi Publications, New Delhi, 2008.
4. Ritzema, H.P., "Drainage Principles and Applications", Publication No. 16, International Institute of Land Reclamation and Improvement, Netherlands, 1994.

Reference Books:

1. Basak, N.N., "Irrigation Engineering", Tata McGraw-Hill Publishing Co, New Delhi, 2008.
2. Murthy, V.V.N. Land and water management, Kalyani publishing, New Delhi, 1998.
3. Bhattacharya, A.K., and Michael, A.M., "Land Drainage – Principles, Methods and Applications", Konark Publishers Pvt. Ltd., New Delhi, 2003.
4. Irrigation water Management, Training Manual No 6, Drainage of Irrigated Lands, Food and Agriculture Organisation, Rome 1996
5. Kessler, J., "Drainage Principles and Applications", Vol. II and IV, International Institute of Land Reclamation and Improvement, Netherlands, 1979.

Course Code	MECHATRONICS AND CONTROL SYSTEMS	L	T	P	C
22OEC14		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To provide a comprehensive understanding of mechatronics and control systems
2. To develop skills in designing and implementing mechatronic systems
3. To introduce programming and microcontroller interfacing for mechatronic systems
4. To develop knowledge of control systems design and their applications.

Course Content:

UNIT I INTRODUCTION 9

Definition and concept of mechatronics-Overview of control systems-Types of sensors and actuators-Mechatronics design process

UNIT II Mechanical Systems and Electronics 9

Kinematics and dynamics of mechanical systems-Analog and digital electronics-Interfacing sensors and actuators with electronics-Electronic control systems.

UNIT III Programming and Microcontrollers 9

Programming languages for mechatronics-Introduction to microcontrollers-Microcontroller programming and interfacing-Real-time operating systems.

UNIT IV Control Systems Design 9

Classical and modern control systems-PID control and tuning methods-State-space control systems-Robust control systems.

UNIT V Applications of Mechatronics and Control Systems 9

Mechatronic systems in automotive, aerospace, and manufacturing industries-Robotics and automation-Smart systems and IoT applications- Control systems for renewable energy systems

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the design process of mechatronic systems and their components
2. Apply electronic control systems and programming for mechatronic systems
3. Implement control systems for mechatronic systems
4. Design and implement control systems for different mechatronic applications
5. Evaluate the performance and efficiency of mechatronic systems.

Text Book(s):

1. "Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering" by W. Bolton

2. "Introduction to Mechatronics and Measurement Systems" by David G. Alciatore and Michael B. Histand

Reference Books:

1. "Mechatronics: Principles and Applications" by Godfrey C. Onwubolu
2. "Control Systems Engineering" by Norman S. Nise

Course Code	MICRO AND NANO ELECTRONICS	L	T	P	C
22OEC15		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To introduce the fundamental concepts and principles of nanotechnology, molecular nanotechnology, and nanomaterials.
2. To provide an overview of the fundamentals of nanoelectronics, including logic devices, quantum computing, and ultimate computation.
3. To explore the properties and applications of carbon nanotubes.
4. To examine the principles and applications of molecular electronics.
5. To identify the potential applications of nanotechnology in various fields, including MEMS, robots, and memory storage devices.

Course Content:

UNIT I INTRODUCTION TO MICRO AND NANO ELECTRONICS 9

Introduction to Micro and Nano Electronics-Historical development of Micro and Nano Electronics-Overview of the course-Advantages and-challenges of Micro and Nano Electronics-Basic concepts in Micro and Nano Electronics-Scaling laws and limitations-Overview of micro and-nanofabrication techniques;

UNIT II SEMICONDUCTOR PHYSICS 9

Review of Quantum Mechanics-Crystal structures and lattice vibrations-Energy bands and bandgap engineering-Charge carriers in semiconductors-Carrier transport and mobility-Doping and carrier concentration-PN Junctions-Metal-semiconductor junctions-MOS Capacitors

UNIT III MICRO AND NANO FABRICATION TECHNIQUES 9

Photolithography-Etching Techniques-Deposition Techniques-Oxidation and Diffusion-Ion Implantation-Chemical-Mechanical Planarization-Nanoimprint Lithography-Electron-Beam Lithography-Scanning Probe Lithography

UNIT IV MICRO AND NANO DEVICES 9

MOS Transistors-CMOS Logic Gates-Memories-Optoelectronic Devices-MEMS and NEMS-Bio-electronics-Power Electronics.

UNIT V CHARACTERIZATION TECHNIQUES 9

Electrical Characterization-Optical Characterization-Scanning Probe Microscopy-X-ray Diffraction-Secondary Ion Mass Spectrometry-Transmission Electron Microscopy-Atomic Force Microscopy-Ellipsometry

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Students will be able to explain the basic principles and concepts of nanotechnology and its various types and nanomachines.
2. Students will be able to describe the atomic and molecular structures of materials and their behavior at the nanoscale.
3. Students will be able to analyze the performance and limitations of various nanoelectronic devices, including logic gates, quantum computing, and single electron devices.
4. Students will be able to evaluate the properties and potential applications of carbon nanotubes in nanoelectronics and memory storage.
5. Students will be able to apply the principles of molecular electronics to design and fabricate electronic devices and circuits.

Text Book(s):

1. Michael Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons and Burkhard
2. Raguse, Nanotechnology: Basic Science and Emerging Technologies, Chapman & Hall / CRC, 2002

Reference Books:

1. T. Pradeep, NANO: The Essentials – Understanding Nanoscience and Nanotechnology, TMH, 2007
2. Rainer Waser (Ed.), Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices, Wiley-VCH, 2003

Course Code	OPTICAL COMMUNICATION AND NETWORKS	L	T	P	C
22OEC19		3	0	0	3

Pre-requisite Communication & networks **Syllabus Version** V 0.1

Course Objectives:

1. To study about the various optical fiber modes, configuration and transmission characteristics of optical fibers
2. To learn about the various optical sources, detectors and transmission techniques
3. To explore various idea about optical fiber measurements and various coupling techniques
4. To enrich the knowledge about optical communication systems and networks

Course Content:

UNIT I INTRODUCTION TO OPTICAL FIBERS 9

Evolution of fiber optic system- Element of an Optical Fiber Transmission link– Total internal reflection-Acceptance angle –Numerical aperture – Skew rays Ray Optics-Optical Fiber Modes and Configurations -Mode theory of Circular Wave guides- Overview of Modes-Key Modal concepts- Linearly Polarized Modes -Single Mode Fibers-Graded Index fiber structure.

UNIT II SIGNAL DEGRADATION OPTICAL FIBERS 9

Attenuation – Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides-Information Capacity determination -Group Delay-Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers-Mode Coupling -Design Optimization of SM fibers-RI profile and cut-off wavelength.

UNIT III FIBER OPTICAL SOURCES AND COUPLING 9

Direct and indirect Band gap materials-LED structures -Light source materials -Quantum efficiency and LED power, Modulation of a LED, lasers Diodes-Modes and Threshold condition -Rate equations -External Quantum efficiency -Resonant frequencies -Laser Diodes, Temperature effects, Introduction to Quantum laser, Fiber amplifiers- Power Launching and coupling, Lencing schemes, Fiber -to- Fiber joints, Fiber splicing-Signal to Noise ratio , Detector response time.

UNIT IV FIBER OPTIC RECEIVER AND MEASUREMENTS 9

Fundamental receiver operation, Pre amplifiers, Error sources – Receiver Configuration– Probability of Error – Quantum limit.Fiber Attenuation measurements- Dispersion measurements – Fiber Refractive index profile measurements – Fiber cut- off Wave length Measurements – Fiber Numerical Aperture Measurements – Fiber diameter measurements.

UNIT V OPTICAL NETWORKS AND SYSTEM TRANSMISSION 9

Basic Networks – SONET / SDH – Broadcast – and –select WDM Networks –Wavelength Routed Networks – Non linear effects on Network performance –-Link Power budget -Rise time budget- Noise Effects on System Performance-Operational Principles of WDM Performance of WDM + EDFA system – Solutions – Optical CDMA – Ultra High Capacity Networks.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Realize basic elements in optical fibers, different modes and configurations.
2. Analyze the transmission characteristics associated with dispersion and polarization techniques.
3. Design optical sources and detectors with their use in optical communication system.
4. Construct fiber optic receiver systems, measurements and coupling techniques.
5. Design optical communication systems and its networks.

Text Book(s):

1. P Chakrabarti, "Optical Fiber Communication‖, McGraw Hill Education (India)Private Limited, 2016 (UNIT I, II, III)

2. Gred Keiser,"Optical Fiber Communication‖, McGraw Hill Education (India) Private Limited. Fifth Edition, Reprint 2013. (UNIT I, IV, V)

Reference Books:

1. John M.Senior, —Optical fiber communication‖, Pearson Education, second edition.2007.

2. Rajiv Ramaswami, —Optical Networks — Second Edition, Elsevier , 2004.

3. J.Gower, —Optical Communication System‖, Prentice Hall of India, 2001.

4. Govind P. Agrawal, —Fiber-optic communication systems‖, third edition, John Wiley & sons, 2004.

Course Code	QUANTUM COMPUTING	L	T	P	C
22OCS25		3	0	0	3

Pre-requisite Digital logic **Syllabus Version** V 0.1

Course Objectives:

1. To introduce students to the field of quantum computing and its potential applications
2. To provide students with knowledge of quantum information theory and quantum algorithms
3. To teach students about quantum hardware and its limitations
4. To cover quantum software and applications, as well as future directions in quantum computing.

Course Content:

UNIT I INTRODUCTION TO QUANTUM COMPUTING 9

Overview of classical computing and its limitations-Introduction to quantum mechanics-Quantum bits (qubits) and quantum gates-Quantum circuits and quantum algorithms-Quantum complexity theory

UNIT II QUANTUM INFORMATION THEORY 9

Introduction to quantum information theory-Quantum entanglement and teleportation-Quantum error correction and fault tolerance-Quantum communication and cryptography-Quantum simulation

UNIT III QUANTUM HARDWARE 9

Introduction to quantum hardware-Superconducting qubits and circuits-Trapped ions and atoms-Topological quantum computing-Quantum annealing.

UNIT IV QUANTUM SOFTWARE AND APPLICATIONS 9

Quantum software tools and languages-Quantum machine learning and optimization-Quantum chemistry and materials science-Quantum finance and cryptography-Quantum artificial intelligence.

UNIT V FUTURE OF QUANTUM COMPUTING 9

Overview of current state of quantum computing technology-Challenges and opportunities for quantum computing-Quantum computing in industry and academia-Quantum computing and society-Future directions in quantum computing research

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the basic concepts of quantum mechanics and their implications for computing
2. Be able to design and implement quantum algorithms for various applications
3. Understand the limitations of quantum hardware and the challenges in building a scalable quantum computer

4. Be able to apply quantum computing principles to solve problems in various domains
5. Be able to critically evaluate the potential impact of quantum computing on society.

Text Book(s):

1. Quantum Computation and Quantum Information: 10th Anniversary Edition by Michael A. Nielsen and Isaac L. Chuang.
2. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci

Reference Books:

1. Quantum Computing: A Gentle Introduction by Eleanor G. Rieffel and Wolfgang H. Polak.
2. Quantum Computing Since Democritus by Scott Aaronson.

Course Code	RADAR AND NAVIGATION SYSTEM	L	T	P	C
22OEC20		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

The objective of this course is to provide students with a comprehensive understanding of radar systems, including the fundamental principles of radar operation, radar equations, various types of radar systems, and the detection of radar signals in noise.

Course Content:

UNIT I BASICS OF RADAR **9**

Introduction, Maximum Unambiguous Range, Simple form of Radar Equation, Radar Block Diagram and Operation - Radar Frequencies and Applications, Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise - Modified Radar Range Equation, Illustrative Problems.

UNIT II CW AND FREQUENCY MODULATED RADAR **9**

Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver - Receiver Bandwidth Requirements, Applications of CW radar, Illustrative Problems - FM-CW Radar, Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), FM-CW altimeter.

UNIT III MTI AND PULSE DOPPLER RADAR **9**

Introduction, Principle, MTI Radar with – Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, And Staggered PRFs, Range Gated Doppler Filters, MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler radar.

UNIT IV DETECTION OF RADAR SIGNALS IN NOISE **9**

Introduction, Matched Filter Receiver – Response Characteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise, Radar Receivers: Noise Figure and Noise Temperature, Displays – types.

UNIT V TRACKING RADAR **9**

Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one- and two- coordinates), Phase Comparison Monopulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers, Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Series versus Parallel Feeds, Applications, Advantages and Limitations

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Students will gain knowledge of the fundamental principles of radar operation, radar equations, and the types of radar systems used in different applications.
2. Students will develop problem-solving skills in the prediction of range performance, minimum detectable signal, receiver noise, and modified radar range equation.
3. Students will be able to design and analyze radar systems, including CW and frequency modulated radar, MTI and pulse Doppler radar, and tracking radar.
4. Students will be able to analyze radar signals in noise, including the use of matched filter receivers and correlation functions.
5. Students will learn about the applications of radar systems in different fields, such as defense, aviation, meteorology, and navigation.

Text Book(s):

1. Radar Principles for the Non-Specialist by John C. Toomay

Reference Books:

1. Introduction to Radar Systems by Merrill Skolnik.
2. Principles of Modern Radar: Basic Principles by Mark A. Richards, James A. Scheer, and William A. Holm.
3. Radar Handbook by Merrill Skolnik.

Course Code	REFRIGERATION AND AIR CONDITIONING	L	T	P	C
22OME29		3	0	0	3

Pre-requisite NiL **Syllabus Version** V 0.1

Course Objectives:

1. To introduce the underlying principles of operations in different Refrigeration & Air conditioning systems and components.
2. To provide knowledge on design aspects of Refrigeration & Air conditioning systems.
3. To study the Vapour absorption and air refrigeration systems.
4. To learn the psychrometric properties and processes.
5. To study the air conditioning systems and load estimation.

Course Content:

UNIT I INTRODUCTION 9

Introduction to Refrigeration - Unit of Refrigeration and C.O.P.– Ideal cycles- Refrigerants Desirable properties – Classification - Nomenclature - ODP & GWP.

UNIT II VAPOUR COMPRESSION REFRIGERATION SYSTEM 9

Vapor compression cycle: p-h and T-s diagrams - deviations from theoretical cycle – subcooling and super heating- effects of condenser and evaporator pressure on COP- multi pressure system -low temperature refrigeration - Cascade systems – problems. Equipment: Type of Compressors, Condensers, Expansion devices, Evaporators.

UNIT III OTHER REFRIGERATION SYSTEMS 9

Working principles of Vapour absorption systems and adsorption cooling systems – Steam jet refrigeration- Ejector refrigeration systems- Thermoelectric refrigeration- Air refrigeration – Magnetic Vortex and Pulse tube refrigeration systems.

UNIT IV PSYCHROMETRIC PROPERTIES AND PROCESSES 9

Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temperature Thermodynamic wet bulb temperature, Psychrometric chart; Psychrometric of air-conditioning processes, mixing of air streams.

UNIT V AIR CONDITIONING SYSTEMS AND LOAD ESTIMATION 9

Air conditioning loads: Outside and inside design conditions; Heat transfer through structure, Solar radiation, Electrical appliances, Infiltration and ventilation, internal heat load; Apparatus selection; fresh air load, human comfort & IAQ principles, effective temperature & chart, calculation of summer & winter air conditioning load; Classifications, Layout of plants; Air distribution system; Filters; Air Conditioning Systems with Controls: Temperature, Pressure and Humidity sensors, Actuators & Safety controls.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Explain the basic concepts of Refrigeration
2. Explain the Vapor compression Refrigeration system
3. Discuss the various types of Refrigeration systems
4. Calculate the Psychrometric properties and its use in psychrometric processes
5. Explain the concepts of Air conditioning and to solve problems.

Text Book(s):

1. Arora, C.P., "Refrigeration and Air Conditioning", 3rd edition, McGraw Hill, New Delhi, 2010
2. Textbook of Refrigeration And Air-Conditioning (M.E.) by R.S. Khurmi | 10 February 2019

Reference Books:

1. ASHRAE Hand book, Fundamentals, 2010
2. JonesW.P., "Air conditioning engineering", 5th edition, Elsevier Butterworth-Heinemann, 2007
3. Roy J. Dossat, "Principles of Refrigeration", 4th edition, Pearson Education Asia, 2009.
4. Stoecker,W.F. and Jones J.W., "Refrigeration and Air Conditioning", McGraw Hill, New Delhi,1986.
5. A Textbook of Refrigeration and Air-Conditioning by R.K. Rajput | 1 January 2013

Course Code	ROBOTICS AND AUTOMATION	L	T	P	C
22OME32		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To understand the basic concepts associated with the design, functioning, applications and social aspects of robots
2. To study about the electrical drive systems and sensors used in robotics for various applications
3. To learn about analyzing robot kinematics, dynamics through different methodologies and study various design aspects of robot arm manipulator and end-effector
4. To learn about various motion planning techniques and the associated control architecture
5. To understand the implications of AI and other trending concepts of robotics

Course Content:

UNIT I FOUNDATION FOR BEGINNERS 9

Introduction -- brief history, definition, anatomy, types, classification, specification and need based applications; role and need of robots for the immediate problems of the society, future of mankind and automation-ethical issues; industrial scenario local and global, case studies on mobile robot research platform and industrial serial arm manipulator.

UNIT II BUILDING BLOCKS OF A ROBOT 9

Types of electric motors - DC, Servo, Stepper; specification, drives for motors - speed & direction control and circuitry, Selection criterion for actuators, direct drives, non-traditional actuators; Sensors for localization, navigation, obstacle avoidance and path planning in known and unknown environments – optical, inertial, thermal, chemical, biosensor, other common sensors; Case study on choice of sensors and actuators for maze solving robot and self driving cars.

UNIT III KINEMATICS, DYNAMICS AND DESIGN OF ROBOTS & END-EFFECTORS 9

Robot kinematics - Geometric approach for 2R, 3R manipulators, homogenous transformation using D-H representation, kinematics of WMR, Lagrangian formulation for 2R robot dynamics; Mechanical design aspects of a 2R manipulator, WMR; End-effector - common types and design case study..

UNIT IV NAVIGATION, PATH PLANNING AND CONTROL ARCHITECTURE 9

Mapping & Navigation – SLAM, Path planning for serial manipulators; types of control architectures - Cartesian control, Force control and hybrid position/force control, Behaviour based control, application of Neural network, fuzzy logic, optimization algorithms for navigation problems, programming methodologies of a robot

UNIT V AI AND OTHER RESEARCH TRENDS IN ROBOTICS 9

Application of Machine learning - AI, Expert systems; Tele-robotics and Virtual Reality, Micro & Nanorobots, Unmanned vehicles, Cognitive robotics, Evolutionary robotics, Humanoids

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Explain the concepts of industrial robots in terms of classification, specifications and coordinate systems, along with the need and application of robots & automation
2. Examine different sensors and actuators for applications like maze solving and self driving cars.
3. Design a 2R robot & an end-effector and solve the kinematics and dynamics of motion for robots.
4. Explain navigation and path planning techniques along with the control architectures adopted for robot motion planning.
5. Describe the impact and progress in AI and other research trends in the field of robotics

Text Book(s):

1. Saeed. B. Niku, Introduction to Robotics, Analysis, system, Applications, Pearson educations, 2002
2. Roland Siegwart, Illah Reza Nourbakhsh, Introduction to Autonomous Mobile Robots, MIT Press, 2011

Reference Books:

1. Richard David Klafter, Thomas A. Chmielewski, Michael Negin, Robotic engineering: an integrated approach, Prentice Hall, 1989
2. Craig, J. J., Introduction to Robotics: Mechanics and Control, 2nd Edition, Addison-Wesley, 1989.
3. K.S. Fu, R.C. Gonzalez and C.S.G. Lee, Robotics: Control, Sensing, Vision and Intelligence, McGraw-Hill, 1987.
4. Wesley E Snyder R, Industrial Robots, Computer Interfacing and Control, Prentice Hall International Edition, 1988.
5. Robin Murphy, Introduction to AI Robotics, MIT Press, 2000

Course Code	SOCIAL NETWORK ANALYSIS	L	T	P	C
22OCS26		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

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

Course Content:

UNIT I INTRODUCTION **9**

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

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

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

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

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.

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

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

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

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation -

Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Develop semantic web related applications.
2. Represent knowledge using ontology.
3. Predict human behaviour in social web and related communities.
4. Visualize social networks.

Text Book(s):

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

Reference Books:

1. Guandong Xu ,Yanchun Zhang and Lin Li, —Web Mining and Social Networking – Techniques and applications‖, First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo, —Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively‖, IGI Global Snippet, 2008.

Course Code	WIRELESS COMMUNICATION AND NETWORKS	L	T	P	C
22OEC26		3	0	0	3

Pre-requisite Communication & networks **Syllabus Version** V 0.1

Course Objectives:

1. To study and understand the concepts and design of a Cellular System.
2. To Study And Understand Mobile Radio Propagation And Various Digital Modulation Techniques.
3. To Understand The Concepts Of Multiple Access Techniques And Wireless Networks

Course Content:

UNIT I THE CELLULAR CONCEPT-SYSTEM DESIGN FUNDAMENTALS 9

Evolution of fiber optic system- Element of an Optical Fiber Transmission link– Total internal reflection-Acceptance angle –Numerical aperture – Skew rays Ray Optics-Optical Fiber Modes and Configurations -Mode theory of Circular Wave guides- Overview of Modes-Key Modal concepts- Linearly Polarized Modes -Single Mode Fibers-Graded Index fiber structure.

UNIT II MOBILE RADIO PROPAGATION 9

Large Scale Path Loss: Introduction To Radio Wave Propagation - Free Space Propagation Model – Three Basic Propagation Mechanism: Reflection – Brewster Angle- Diffraction Scattering .Small Scale Fading And Multipath: Small Scale Multipath Propagation, Factors, Influencing Small-Scale Fading, Doppler Shift, Coherence Bandwidth, Doppler Spread And Coherence Time. Types Of Small- Scale Fading: Fading Effects Due To Multipath Time Delay, Spread, Fading Effects Due To Doppler Spread.

UNIT III MODULATION TECHNIQUES AND EQUALIZATION &DIVERSITY 9

Digital Modulation – An Overview: Factors That Influence The Choice Of Digital Modulation, Linear Modulation Techniques: Minimum Shift Keying (MSK), Gaussian Minimum Shift, Keying(GMSK), Spread Spectrum Modulation Techniques: Pseudo- Noise (PN) Sequences, Direct Sequence Spread Spectrum (DS-SS)- Modulation Performance In Fading And Multipath, Channels- Equalization, Diversity And Channel Coding: Introduction- Fundamentals Of, Equalization- Diversity Techniques: Practical Space Diversity Considerations, Polarization Diversity, Frequency Diversity, Time Diversity.

UNIT IV MULTIPLE ACCESS TECHNIQUES 9

Introduction: Introduction To Multiple Access- Frequency Division Multiple Access(FDMA)- Time, Division Multiple Access(TDMA)- Spread Spectrum Multiple Access-Code Division Multiple, Access(CDMA)- Space Division Multiple Access(SDMA)- Capacity Of Cellular Systems: Capacity, Of Cellular CDMA, Capacity Of CDMA With Multiple Cells.

UNIT V WIRELESS NETWORKING 9

Introduction: Difference Between Wireless And Fixed Telephone Networks, The Public

Switched Telephone Network(PSTN), Development Of Wireless Networks: First Generation Wireless Networks, Second Generation Wireless Networks, Third Generation Wireless Networks, Fixed Network Transmission Hierarchy, TrafficRouting In Wireless Networks: Circuit Switching, Packet Switching- Personal Communication Services/ Networks(PCS/PCNs):Packet Vs Circuit Switching For PCN, Cellular Packet- Switched Architecture- Packet Reservation Multiple Access(PRMA)- Network Databases: Distributed Database For Mobility Management- Universal Mobile Telecommunication Systems(UMTS).

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the Concept and Design of A Cellular System.
2. Understand Mobile Radio Propagation and Various Digital Modulation Techniques.
3. Understand the Concepts of Multiple Access Techniques And Wireless Networks
4. Characterize a wireless channel and evolve the system design specifications
5. Design a cellular system based on resource availability and traffic demands.

Text Book(s):

1. Rappaport,T.S.,-Wireless communications", Pearson Education, Second Edition, 2010.

Reference Books:

1. Wireless Communication –Andrea Goldsmith, Cambridge University Press, 2011
2. Van Nee, R. and Ramji Prasad, —OFDM for wireless multimedia communications, Artech House, 2000
3. David Tse and Pramod Viswanath, —Fundamentals of Wireless Communication, Cambridge University Press, 2005.